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Development of Integrated Physics Learning Videos for Tsunami Disaster Education to Increase Awareness and Preparedness of High School Students in Coastal Areas of Kulon Progo Regency

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Abstract: Students' awareness and preparedness for tsunami disasters are two very important things to minimize the impact of disasters, especially for those who live in coastal areas. This study aims to produce video media for learning physics that is integrated with tsunami disaster education that is suitable for use in helping students understand physics material while increasing awareness and preparedness of students in the coastal areas of Kulon Progo Regency against the tsunami disaster. The method used in this study is research and development with a 4D model (Define, Design, Develop, and Disseminate). At the define stage, defining and determining the needs in making learning videos; then in the design stage the initial product design of video media and learning tools is carried out, the develop stage is carried out by validating video media by expert and practitioner validators as well as product trials on high school students in the coastal area of Kulon Progo district; and finally, the disseminate stage is the dissemination of the final product to the internet network and to the school where the research is being carried out. The resulting physics learning video media is integrated with tsunami disaster education which is suitable for use in physics learning and can help understand business and energy material while increasing students' awareness and preparedness for tsunami disasters.

Keywords: Learning Video; Tsunami; Disaster Education; Research and Development.

Introduction

Physics is a branch of natural science that underlies the development of science and technology. Therefore, the application of physics can be found in almost every sector of human life, such as natural phenomena observed by the five senses, and technology built by humans, most of which can be explained using physical theories and concepts. Physics also provides good lessons for humans to live in harmony based on various phenomena that occur in nature.

In the Content Standards for elementary and secondary education units, it is explained that physics is related to how to find out about natural phenomena systematically so that physics is not only the mastery of a collection of knowledge in the form of facts, concepts, or principles but is also a discovery process. In this regard, physics learning is carried out using scientific inquiry to develop the ability to think, work behave scientifically and communicate as an important aspect of life skills (Soehendro, 2006). Thus, in its application to life, physics can be used as a scientific basis for discovering the secrets of natural phenomena that often occur. One natural phenomenon that often occurs in Indonesia is natural disasters.

Indonesia is an area prone to natural disasters, such as earthquakes, tsunamis, floods, landslides, and volcanic eruptions. This is due to the location of Indonesia's territory at the meeting point of the Eurasian plate, the Indo-Australian plate, and the Pacific plate. These plates are always moving because of convection currents in the Earth's mantle layer. If there is a collision or fault due to the movement of these plates, it will cause an

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earthquake. Furthermore, if a plate fracture occurs vertically and occurs suddenly on the seabed, it could potentially cause another disaster that is more destructive in coastal areas, namely a tsunami disaster.

A tsunami is a high sea wave that is even higher than a storm wave. The tsunami waves that occurred in Indonesia reached 26 meters (Istiyanto et al., 2003). A tsunami is a tidal wave caused by the seabed experiencing sudden vertical deformation (change in shape) which causes displacement of the surface of the sea water above it. The tsunami was not felt in the deep sea and on the contrary, its effect was very powerful on the coast. In Indonesia, tsunamis often occur in certain areas, such as the west coast of Sumatra, the east coast of Kalimantan, the south coast of Java, Nusa Tenggara, the north coast of Papua, and so on. Based on the 1629-2002 earthquake catalog released by BMKG, tsunamis occurred 109 times in Indonesia, namely 1 time due to landslides, 9 times due to volcanoes, and 98 times due to tectonic earthquakes. A map of tsunami-prone areas in Indonesia is shown in Figure 1.

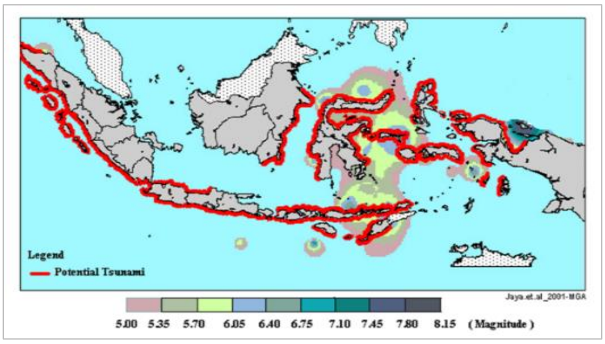

Figure 1. The red line on the map shows tsunami-prone areas in Indonesia (Jaya et al., 2001).

Kulon Progo Regency is one of the five regencies/cities in the Special Region of Yogyakarta Province which is located in the west. Based on geographic location, the southern region of Kulon Progo Regency is on the southern coast of Java Island which is directly opposite the subduction zone between the two Eurasian and Indo-Australian tectonic plates. In this subduction zone, tectonic earthquakes often occur due to the shift of the two plates at the convergent boundary which move towards each other (one slip beneath another). If the shift of the two plates that are moving over each other occurs suddenly, it can trigger the formation of tsunami waves in the subduction zone (Amri et al., 2016). This happened in 2006, when a tsunami hit the South Coast of Java, including Kulon Progo Regency. The tsunami occurred as a result of the collision of the Indo-Australian oceanic plate approaching the Eurasian plate, reaching an average of 7 cm, producing an earthquake with a magnitude of 6.8. The plate shift resulted in deformation of the seabed which resulted in tsunami waves forming and spreading to the South Coast of Java (BMKG, 2006).

Kulon Progo Regency has a varied topography with a height of between 0 - 1000 meters above sea level, which is divided into 3 regions, namely the northern, central, and southern regions. The northern part is the Menoreh plateau/hills with a height of between 500-1000 meters above sea level. The middle part is a hilly area with a height of between 100-500 meters above sea level. Meanwhile, the southern part is a low area with a height of 0-100 meters above sea level. The southern part of Kulon Progo Regency is a coastal area covering the districts of Temon, Wates, Panjatan, Galur, and parts of Lendah. Based on its slope, this coastal area has a slope of 0-2% and is a 24.9 km long coastal area (Bappeda, Kulon Progo Regency, 2020).

Based on the explanation above, the coastal area or southern part of Kulon Progo Regency is an area that is vulnerable to tsunami natural disasters. Therefore, people need to be equipped with various self-saving techniques which are part of preparedness. Through appropriate self-rescue techniques, it is hoped that people can avoid the risk of becoming victims if a tsunami suddenly occurs. Strategic steps that can be taken are to develop tsunami preparedness materials and provide training to educational institutions, especially school communities.

The coastal area or generally the southern part of Kulon Progo Regency consists of the sub-districts of Temon, Wates, Panjatan, Galur, and parts of Lendah in which there are SMA/MA communities including SMA Negeri 1 Galur, MA Muh DU Galur, SMA Muhammadiyah Galur, SMA Negeri 1 Lendah, SMA Negeri 1 Temon, SMA Negeri 1 Wates, SMA Negeri 2 Wates, SMA BOPKRI Wates SMA Ma'arif Wates, SMA Muhammadiyah Wates, MAN 1 Wates, and MAN 2 Wates. Of all the high schools in the southern region of Kulon Progo Regency, most are within a radius of 10 km from the coastline which is a zone prone to the impact of tsunami disasters. Based on these conditions, the provision of disaster education for high school communities in areas prone to tsunami disasters must be provided to increase student preparedness.

The Indonesian government has adopted the concept of disaster risk reduction which includes prevention, mitigation, and preparedness efforts, and

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integrated them into development and decision-making processes. Apart from that, the government also enacted Law Number 24 of 2007 concerning Disaster Management which was passed on March 29 2007 mandating activities for implementing development policies, disaster prevention activities, emergency response, and rehabilitation. However, so far disaster education and training in school communities has only been short-term. It is very important to integrate disaster material into education as a systematic and sustainable effort to pass on knowledge to the next generation (Mukhlis et al., 2009).

Physics is one of the subjects that are relevant to disaster education. This is because of the causes, processes, and impacts of disasters, some of which can be explained in physics subjects in a simple and interesting way. Through the integration of tsunami disaster education into physics subjects, students can learn the signs of a tsunami and how to reduce the risk of tsunami danger. Apart from that, it is also hoped that it can make students aware that they live in an area prone to tsunami disasters so that in the future students can increase their preparedness if a tsunami occurs in the area where they live.

Learning media are channels or intermediaries used to convey messages or teaching materials. Media is very necessary in learning as a means of conveying information and messages from teachers to students (Arsyad, 2004). Good and smooth learning requires good learning media that is appropriate to class conditions. In integrated physics learning, tsunami disaster education, which is productive/practical learning, requires media that can not only display information verbally or statically, but media that can contain both and contain elements of movement. Therefore, learning videos are a suitable medium for use in integrated physics learning in tsunami disaster education. Learning videos can show the process and early signs of a tsunami disaster. Apart from that, this learning video can also show the stages of mitigating a tsunami disaster in detail and in detail.

Learning video media is media or teaching aids in the form of audio-visual media or a type of viewing-listening media that displays information in the form of moving images (Seels and Richey, 1994). Video as an audio-visual medium and has elements of movement will be able to attract students' attention and motivation in carrying out learning activities. According to the Big Indonesian Dictionary (2018), video is defined as 1) the part that transmits images on a television set; and 2) the recording of live images for broadcast on television sets. Video is able to summarize many events over a long period of time in a shorter and clearer manner, accompanied by images and sounds that can be repeated over and over again during thae process of use. Videos have the advantage of being able to help understand learning messages more meaningfully without being bound by other teaching materials. With the elements of movement and animation that videos have, videos are able to attract students' attention longer when compared to other learning media. Based on the explanation of the background above, the author conducted research on the development of physics learning video media that is integrated with tsunami disaster education to increase student preparedness in high school communities in the coastal area of Kulon Progo district.

Methode

This development research was carried out with the aim of producing learning video media based on findings from a series of validations and trials carried out in field trials. Then, based on the findings obtained, revisions are carried out and so on to obtain results in the form of learning video media that are adequate or suitable for use in integrated physics learning in tsunami disaster education. Considering that the research aims to increase the preparedness of high school students in the coastal areas of Kulon Progo Regency in general, the subjects of this research are class and 1 class from SMA Negeri 1 Galur.

This research is a type of Research and Development (R&D) research using the 4-D research design by Thiagarajan and Semmel (1974). This development model consists of 4 main stages, namely: Define, Design, Develop, Disseminate.

The define stage aims to define and determine learning needs. In this research, the KI and KD of high school physics subjects were identified which have the potential to be integrated with tsunami disaster education.

The Design stage aims to obtain an initial draft of learning video media with supporting learning tools (syllabus, lesson plans and worksheets) on one of the materials according to KI and KD with the potential to be integrated into the tsunami disaster education being developed. Develaop learning tools and data collection instruments.

The develop stage aims to learning media and learning tools developed are validated by expert validators (media and material expert lecturers) and practitioner validators (high school physics

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teachers). Then proceed with revisions based on suggestions, comments and assessments from validators. Next, they conducted trials on learning devices and media in 3 high schools in the coastal area of Kulonprogo Regency, namely SMA Negeri 1 Galur, SMA 2 Wates and SMA 1 Lendah. Then further revisions are made based on the results of the trials that have been carried out. The trial of the learning media developed was carried out in two trial stages. Trial 1 was carried out on class XI Science students at SMA Negeri 1 Galur. Meanwhile, trial 2 was carried out on class XI Science students at SMA Negeri 2 Wates and SMA Negeri 1 Lendah.

The aim of the dessemination stage is the dissemination or publication and use of integrated physics learning tools and media for tsunami disaster education which have undergone the development stage. This dissemination stage will be carried out practically by distributing learning video media developed in the school community where the research was conducted in the form of DVD cassettes and uploading them to the YouTube video streaming site channel (http:// www.youtube.com).

The data obtained from the research is in the form of qualitative and quantitative data. The qualitative data obtained includes Comments and suggestions from validators for the tools and media being developed; as well as suggestions and input from (student) responses to the media being developed. Meanwhile, the quantitative data obtained includes Data from student awareness and preparedness questionnaires for the tsunami disaster before and after learning; Media assessment score data and learning tools developed from validators; Data on student response scores to the media and learning tools developed; and Data on mastery of integrated Physics material in tsunami disaster education.

The research instruments used to collect the data described above include (1) a product validation questionnaire (expert and practitioner validation); (2) a questionnaire on awareness and preparedness for the tsunami disaster; (3) a student response questionnaire to learning video media; (4) RPP implementation observation sheet; and (5) Questions of material mastery. The validation questionnaire is used to collect assessment data and suggestions from expert validators and practitioner validators regarding the suitability of the learning tools and media being developed. The data and suggestions obtained were used as a basis for revising the initial product draft. Observation of the implementation of lesson plans is used to collect data on the implementation of activities in the implementation of the learning process in the classroom. The tsunami awareness and preparedness questionnaire was used to collect data on students' awareness and preparedness for the dangers of the tsunami disaster before and after learning activities. The student response questionnaire was used to collect data on student responses to the integrated physics learning video media for tsunami disaster education that was developed. The material mastery test is used to collect data on students' material values of effort and energy.

The feasibility of the learning video media developed was analyzed descriptively and qualitatively. Data in the form of validator suggestions and results of development observations during trials are used to revise the learning media being developed. Analysis of the average score for each item obtained when filling out the learning media suitability validation questionnaire was carried out by changing the raw scores into standard scale scores. The benchmark used to create a basis for assessment is based on the equation of ideal assessment criteria according to Sukardjo (2006) which is shown in the equation below.

$$X_i(Mean\ Ideal) = \frac{1}{2}(highest\ score + lowest\ score)$$

$$SB_i(SD\ Ideal) = \left(\frac{1}{3}\right)\left(\frac{1}{2}\right)(highest\ score - lowest\ score)$$

Based on the similarity of assessment criteria according to Sukardjo (2006) above, the ideal assessment range on a scale of 1-5 for media validation is as shown in Table 1.

Table 1. Ideal Assessment Criteria Scale Range 1-5.

Score Range	Quality Criteria
$\mathbf{4,21 < X}$	Very good
$\mathbf{3,40 < X < 4,21}$	Good
$\mathbf{2,60 < X < 3,40}$	Enough
$\mathbf{1,79 < X < 2,60}$	Not enough
$\mathbf{X < 1,79}$	Very less

The Gain value is used to determine increased awareness and preparedness for tsunami disasters by calculating the gain based on initial and final data. What is calculated is the absolute value of gain and standard gain. Absolute gain is used to determine how high the percentage increase in aspects of awareness and preparedness is, while standard gain is used to determine the quality of increased student awareness and preparedness. The increasing awareness of students living in areas prone to tsunami disaster risk is one illustration of the success of integrated learning in tsunami disaster education.

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The absolute gain is calculated based on the results of the initial questionnaire and the results of the final questionnaire, while to calculate the standard gain, use the following equation.

$$\text{Standard gain } \langle g \rangle = \frac{\bar{X}_{Post} - \bar{X}_{Pre}}{\bar{X}_{max} - \bar{X}_{Pre}}$$

Information:
$\bar{X}_{post}$ = mean questionnaire score after learning
$\bar{X}_{Pre}$ = mean questionnaire score before learning
$\bar{X}_{max}$ = maximum score

The standard gain value is interpreted based on the qualifications made by Hake (1999) as shown in Table 2 below.

Table 2. Interpretation of Standard Gain

Standard Gain Value <g>	Interpretation
$0,7 \leq (g)$	Hight
$0,3 \leq (g) < 0,7$	Medium
$(g) < 0,3$	Low

Result and Discussion

The development of integrated learning video media for tsunami disaster education for high school physics subjects was carried out through 4 stages, namely through the defining, designing, developing and disseminating stages. The results of the research carried out in accordance with the stages above will be presented based on the data that has been obtained during this research process. This data is in the form of qualitative and quantitative data. The results and discussion of the research for each of the stages mentioned above can be explained as follows.

Define

The definition stage is the initial stage carried out in the process of developing integrated physics learning video media with tsunami disaster education to increase preparedness. This stage begins with identifying Core Competencies (KI) and Basic Competencies (KD) for high school physics subjects in the 2013 curriculum which have the potential to be integrated into tsunami disaster education. From the identification results, for class Meanwhile, for class From the identification and by adjusting the research implementation schedule, the focus is again on the KD and KI which will be used as the basis for developing learning video media, namely the potential KI and KD that apply to class XI.

As for this development research, the KI and KD in class In this regard, according to the guidelines for designing and implementing learning for the 2013 curriculum, it should start from KI.3 to KI.4. Skills can only be built with good results through knowledge. In the process of acquiring knowledge and skills, attitudes are integrated so that the subject matter of business and energy is oriented to contribute to the formation of spiritual and social attitudes. Thus, the design of the learning process in the classroom uses a flow starting from KD.3.3 to KD.4.3 and then having an impact on the formation of KD.1.1, KD.1.2, KD.2.1, and KD.2.2.

Design

The initial draft or integrated physics learning video media for disaster education was made based on a video script written from researchers' ideas and ideas for business and energy material integrated into tsunami disaster education. This video script is then consulted with the supervisor to get suggestions and improvements before finally the script is ready to be implemented in shooting for video making material. In general, the process of creating an initial draft of integrated learning media for tsunami disaster education is carried out through several stages, namely concept, design, collecting materials, and assembly (Rahmawati and Wiyatmo, 2018).

At the concept stage, indicators are formulated that will be achieved after the teaching material is delivered. This indicator is formulated based on the Core Competencies and Basic Competencies that have been determined at the initial definition stage. At the concept stage, the scope of physics subject matter and the scope of disaster education material that will be included in learning video media are also determined.

At the design stage, the learning video media being developed is designed. Activities carried out in the design process include collecting references, making video scripts and supporting learning tools, as well as selecting the software used in making the initial draft of integrated physics learning video media for tsunami disaster education.

At the collecting materials stage, teaching materials are collected which will be included in the learning video. The material collected includes material on business and energy, information on the geographical conditions of the coastal areas of Kulon Progo Regency, a

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simulation of the process of a tsunami disaster, and interviews with expert sources regarding material on tsunami disaster preparedness and mitigation.

At the assembly stage, the initial draft of learning tools, research instruments and learning video media is carried out. What is done in making learning videos includes taking pictures or recording, installing material content, and video editing. The video product created at this stage is based on a script (script/storyboard).

The results of this design stage are initial products of learning video media, learning tools and data collection which include:

1). The initial learning video media product includes an integrated physics learning video on tsunami disaster education which is divided into five subchapters, a synopsis and an initial video script.
2). Learning tools (lesson plan).
3). Tsunami disaster awareness and preparedness questionnaire.
4). Student response questionnaire to video media.
5). Learning video media validation sheet

Develop

This stage is the stage where the initial learning video media product is validated by validators consisting of material expert validators, media experts and practitioners. After validation, revisions are made based on suggestions from the validator. The results of the product revision were then used in trial 1. After trial 1, product revisions were carried out based on suggestions and the results of the first trial. The product resulting from revisions after trial 1 was then used for trial 2. After trial 2, revisions were made to the product again based on suggestions and the results of the last trial. Trial 1 in this research was carried out at SMA Negeri 2 Wates, while trial 2 was carried out at SMA Negeri 1 Lendah and SMA Negeri 1 Galur.

The initial design of the media and learning tools produced at the design stage is then validated with the aim of determining the validity and feasibility of the initial design before being used in trials 1. Validation is carried out by lecturers who are media experts and material experts as well as physics practitioners or teachers. Validation of expert lecturers was carried out by FMIPA UNY lecturers, while practitioner validation was carried out by physics teachers at SMA Negeri 2 Wates, SMA Negeri 1 Lendah, and SMA Negeri 1 Galur. The names of validators can be seen in Table 3. Because this research is focused on developing video media, video validation is carried out in several aspects. The validation of aspects in the video carried out by validators includes: (1) validation of aspects of the video display; (2) validation of aspects of the play program; (3) validation of media competency aspects; (4) validation of language/readability aspects; and (5) validation of material aspects.

Table 3. Names of Reviewers in The Validation Stage

Name	Position	Validator
Dr.Yusman Wiyatmo, M.Si.	UNY Physics Education Lecturer	Materials Expert
Dr. Sabar Nurohman, S.Pd., Si., M.Pd.	UNY Physics Education Lecturer	Media Expert
Basuki Joko Purwono, S.Pd.	Teacher at SMAN 2 Wates	Practitioner 1
Zoewono, S.Pd.Si.	Teacher at SMAN 1 Lendah	Practitioner 1
Nur Zuniasih, S.Pd.	Teacher at SMAN 1 Galur	Practitioner 1

The results of the validation of integrated physics learning video media for tsunami disaster education by material expert validators, media expert validators, and practitioner validators for each aspect can be seen in Table 4, Table 5, Table 6, Table 7; and Table 8.

Table 4. Validation Results of the Display Aspects of Learning Video Media

Display Aspect Criteria	Score
Display the chapter introduction section	4,00
Interesting introduction section	3,75
Selection of typeface	3,75
Selecting font size	4,00
Division of video section duration	3,5
Background sound selection	3,75
Image display quality	4,50
Lighting quality and video contrast	4,00
Clarity of flow	3,50
Selection of video settings	3,50
Quality animation and graphic effects	4,00
The quality of the narrator's voice	3,50
Average Score	**3,81**

Based on Table 4, aspects of the integrated learning video media display on disaster education validated by media expert validators and practitioners have an average score of 3.81. After the final average score is entered into Table 1, the

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display aspect of the learning video media is in the good quality category.

Table 5. Validation Results of Aspects of the Play Learning Video Media Program

Program Aspect Criteria	Score
Convenience	4,25
Division of video parts	3,50
Text efficiency	3,50
Content flexibility	3,50
Average Score	**3,68**

Based on the scores given by validators, media experts and practitioners, the average score for the play program aspect is 3.68. After this average score is entered into Table 1, the learning video media program aspect has a good quality category.

Table 6. Validation results of Competency Aspects of Learning Video Media.

Aspects of Media Competence	Score
Insertion of character and religious values	4,20
Giving apperception to the material	4,20
Providing motivation for the material	4,20
Clarity of target	4,40
Consistency of content with competency standards	4,20
Use of logic	4,00
Providing learning feedback using media	3,80
Maximizing the learning process	3,60
Increasing tsunami preparedness and awareness	4,40
Average Score	**4,12**

Based on Table 6, the average score for the learning video media competency aspect given by validators is 4.12. After this average score is entered into Table 1, the competency aspect of the learning video media is in the good quality category.

Table 7. Validation Results of Language Aspects of Learning Video Media

Language/Readability Aspects	Score
Use of spelling in standard and correct language	4,00
Use effective sentences in the material	4,00
Using idea development patterns in conveying physics concepts.	4,00
Suitability of the use of terms with the concepts in the material	4,20
Suitability of language to students' developmental stages	4,20
Using rules for writing variables, symbols and units in writing equations for physical quantities	3,60
Clarity of pronunciation by the narrator	4,20
Intonation of the video's narrator and cast	3,80
Average Score	**4,00**

Based on Table 7, the average score for the language/readability aspect of the learning video media given by the validator is 4.00. After the average score is entered into Table 1, the language/readability aspect of the learning video media is in the good quality category.

Table 8. Validation Results of Learning Video Media Material Aspects.

Aspects of Video Media Material	Score
Accuracy in selecting discussion topics	4,20
Selection of sources	4,40
Clarity of data sources	4,20
Integrating physics material and disaster education	4,20
Providing practice questions	4,00
Clarity of discussion of practice questions	4,00
Simulation of tsunami disaster management	4,20
Segmentation/division of subchapters	4,00
Explanation and analysis of physical formulations	3,60
Percentage of disaster material	4,00
Percentage of physics material	4,20
Average Score	**4,09**

Based on Table 8, the average score for the learning video media material aspect given by the validator is 4.09. After this average score is entered into Table 1, the learning video media material aspect is in the good quality category.

Apart from categorizing the validation results of learning video media, to determine the consistency of each validator's assessment of the learning video media being developed, a reliability test analysis was carried out by calculating the Percentage of Agreement (PA) or agreement according to the Borich method. The results of the reliability test on learning video media for each assessment aspect item were carried out by comparing the average score from expert validators $\overline{(VA)}$ with the average score from practitioner validators $\overline{(VP)}$. From the results of this comparison, it was found that all questions or aspects assessed from the learning video media were classified as reliable because the PA value of all questions was greater than 75%. Overall, the assessment of learning video media has a PA value of 94.21. This shows that all aspects of the assessment of learning video media on the instruments used are reliable.

From the validation results of learning video media, it was found that the display aspect had an average score of 3.81, the media program play aspect had an average score of 3.68, the media competency aspect had an average score of 4.00, the language/

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Media readability has an average score of 4.00, and media material aspects have an average score of 4.09. Based on the scores obtained, all aspects assessed in the learning video media are in the good quality category. Thus, the results of the validation carried out by all 5 validators provide the conclusion that learning video media is worth testing with revisions based on comments and suggestions.

Based on the suggestions given by expert validators and practitioners on integrated physics learning video media for tsunami disaster education, revisions were made to the initial draft of the video that had been created and validated. The revisions or improvements made include:

1). Correct writing errors in the video which include writing regional names; writing physical quantity symbols (Figure 2).

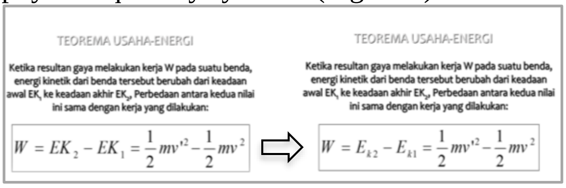

Figure 2. Differences in writing equation symbols before and after revision.

2). Replace words and sentences with standard forms according to EYD.

3). Added several more practice questions and solutions for each subchapter.

4). Add introductory text quoted from the Koran which is relevant to the tsunami disaster material to provide religious value content in the video at the beginning and content of the video (Figure 3).

Figure 4. Differences in Video Parts Added with Religious Value Before and After Revision.

5). Remove unnecessary and noisy parts of the video and improve and increase the gain of the narrator's voice in the video.

6). Add an animated UNY logo to the video introduction section (Figure 4).

Figure 4. Differences in the Introduction Video Section Before and After Revision.

7). Increase the length of time that text or subtitles appear in videos.

8). Eliminate unnecessary instructional sounds in video content.

9). Added sound containing an explanation from the narrator in the sub-chapter regarding the relationship between work and kinetic energy which feels quiet.

10). Added an illustration of 'changes in kinetic energy due to external work, which is demonstrated by a bicycle starting from rest (when v = 0 m/s).

11). Add a closing segment at the end in the form of a closing video featuring the crew and parties who took part in the development of the video.

In trial 1, the integrated physics learning video media for tsunami disaster education which had been validated and revised was tested on 27 students in class XI Science 4 of SMA Negeri 2 Wates. This limited trial was carried out over 4 meetings. From the first trial carried out based on awareness and preparedness questionnaire data given before (pretest) and after (posttest) the learning process using learning video media obtained the absolute gain value shown in Figure 6.

Figure 5. Diagram of Increasing Awareness (Left) and Preparedness (Right) for the Tsunami Disaster at SMA N 2 Wates.

In Figure 6 above, it can be seen that there is an increase in the awareness aspect of students living in areas prone to tsunami disasters by 13.08% for SMA N 2 Wates with a standard gain of 0.53. So it can be said that for SMA N 2 Wates the awareness of students living in disaster-prone areas has a relatively moderate increase in quality. Furthermore, in Figure 6 it can be seen that there is an increase in student preparedness for tsunami disasters by 18.31% for SMA N 2 Wates with a standard gain of 0.37. So it can be said that for SMA N 2 Wates, students' preparedness for the tsunami disaster has a moderate quality of improvement.

In trial 1, after learning using integrated physics learning video media for tsunami disaster education, students were given a response questionnaire to obtain responses and suggestions from students regarding the video media developed. The average score of student responses to learning video media was 3.34. This score was then compared with Table 1 and it was found that students' responses to the integrated physics learning video media for disaster education were in the good category. The revisions made based on suggestion data from the response questionnaire include: (1) increasing the duration of the text appearing on the video; (2) Addition of competency test questions for power material; and (3) adding video clips simulating tsunami propagation from deep sea to shallow sea.

In trial 2 the learning video media which had been revised based on student responses during trial 1 was then tested on 23 students of XI Science 2 SMA Negeri 1 Lendah and 22 students of class XI Science 1 SMA N 1 Galur. This wider trial was carried out during 4 meetings for SMA N 1 Lendah and 2 meetings for SMA N 1 Galur. The increase (gain) for SMA N 1 Lendah and SMA N 1 Galur students after learning using video media developed based on pretest and posttest data is shown respectively in Figure 7 and Figure 8.

In Figure 7 above, it can be seen that there is an increase in awareness of students living in disaster-prone areas by 11.30% for SMA N 1 Lendah with a standard gain of 0.36. So it can be said that for SMA N 1 Lendah the awareness of students living in disaster-prone areas has improved quality which is in the medium category. Furthermore, from Figure 7 it can also be seen that there was an increase in student preparedness for the tsunami disaster by 12.3% for SMA N 1 Lendah with a standard gain of 0.18. Thus, it can be said that for SMA N 1 Lendah the preparedness of students living in disaster-prone areas has increased with low quality.

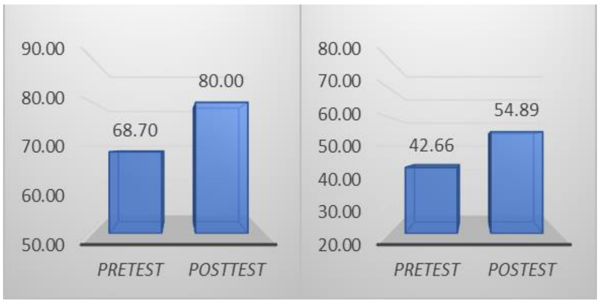

Figure 6. Diagram of Increasing Awareness (Left) and Preparedness (Right) for the Tsunami Disaster at SMA N 1 Lendah.

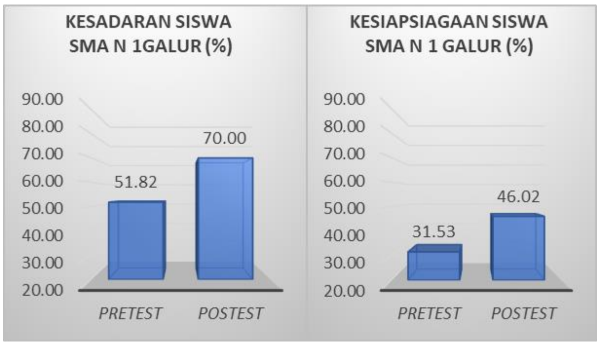

Figure 7. Diagram of Increasing Awareness (Left) and Preparedness (Right) for the Tsunami Disaster at SMA N 1 Galur.

In Figure 8 it can be seen that there is an increase in awareness of students living in disaster-prone areas by 18.18% for SMA N 1 Galur with a standard gain of 0.38. So it can be said that for SMA N 1 Galur awareness of living in a tsunami-prone area, students have improved quality which is in the medium category. Next, from Figure 8, it can also be seen that there was an increase in preparedness for the tsunami disaster by 14.26% for SMA N 1 Galur with a standard gain of 0.19. Thus, for SMA N 1 Galur, students' preparedness for the tsunami disaster also increased with low quality.

Based on data analysis of student responses to learning video media in the trial, the average score of SMA N 1 Lendah and SMA N 1 Galur was 3.10. The average score of students' responses in the second trial was compared with Table 1 and it was found that students' responses to the integrated physics learning video media for disaster education were in the good category.

Next, based on the suggestions obtained from the student response questionnaire in trial 2, efforts were then made to revise the learning video media. Revisions made to the learning video media used include: (1) speeding up the duration of the video chapter opening animation; (2) replacing text or animation that takes up a large amount of space in the video so that it is easy to read; and (3) increase the gain of the narrator's voice and background sound in the video. This final video media resulting from the latest revision is the final product of developing video media for integrated physics learning in tsunami disaster education that is suitable for use. The learning video media will continue to be distributed during further development.

Disseminate

The dissemination stage is the final stage of developing high school physics learning video media integrated with tsunami disaster education to increase the preparedness of high school students in the coastal areas of Kulon Progo Regency. At this stage, the final product of integrated learning video media for tsunami disaster education was distributed to the three schools where the research was conducted, namely SMA N 2 Wates, SMA N 1 Lendah, and SMA N 1 Galur. The final product of the learning video media was disseminated by giving it to physics subject teachers in the three schools in the form of a soft file on a DVD. Apart from being distributed to test sites, physics learning video media on business and energy topics integrated with tsunami disaster education are also distributed via the researcher's YouTube channel which can be accessed via the address URL: https://www.youtube.com/watch?v=nrTCtzasz-w&t=1050s.

Conclusion

Based on the results of research and development using the 4D model that has been carried out, several conclusions can be drawn, including: (1) in the 2013 curriculum which applies to class XI, there are 4 Core Competencies (KI) and 12 Basic Competencies (KD) which have the potential to be integrated into tsunami disaster education; (2) from the results of data analysis and discussion, it was found that the integrated learning video media for tsunami disaster education produced through research and development with 4D design was in the good category and suitable for use in physics learning; and (3) based on the results of trials of integrated physics learning video media for tsunami disaster education, the results of the development can increase the awareness and preparedness of class XI students at 3 high schools in the coastal area of Kulon Progo Regency.

References

Amri, M.R, Yulianti, G., Yunus, R., Wiguna, S., Adi, A.W., Ichwana, A.N., Randongkir, R.E., & Septian, R.T. (2016). *RBI: Resiko Bencana Indonesia*. Jakarta: BNPB.

Anggraini, S. D., Wahyuni, S., & Aristaya, P. (2017). Pengembangan Modul Fisika Materi Gelombang Berbasis Kebencanaan Alam di SMA. *Jurnal Edukasi*, 4(1), 20-23. Doi: https://doi.org/10.19184/jukasi.v4i1.5085

Arsyad, Azhar. (2004). *Media Pembelajaran.* Jakarta: PT. Raja Grafindo Persada.

Bappeda Kabupaten Kulon Progo. (2020). *Kondisi Umum.* Retrieved From: https://kulonprogokab.go.id/v31/detil/7672/kondisi-umum.

BMKG. (2006). *Gempa Bumi dan Tsunami Jawa 2006.* Retrieved From: https://www.bmkg.go.id/tsunami/.

Hake, R. R. (1999). analyzing change/gain scores. American Educational Research Association. Retrieved from: http://www.physics.indiana.edu/~sdi/AnalyzingChange-Gain.pdf.

Istiyanto, Dinar Catur. Sutikno, Pramono, Hadi (Ed.). (2003). *Panduan Mitigasi Bencana Alam Tsunami.* Yogyakarta: Badan Koordinasi Survey dan Pemetaan Nasional, Projek Penelitian dan Pengembangan Teknologi Survei dan Pemetaan dan Pusat Studi Bencana Universitas Gadjah mada.

Jaya, dkk. (2001). *Peta Gempa Berpotensi Tsunami.* Jakarta: BMKG.

KBBI. (2023). Kamus Besar Bahasa Indinesia (KBBI). Retrieved From: https://kbbi.kemdikbud.go.id/.

Mukhlis, dkk. (2009). *Buku Integrasi Materi Kebencanaan ke Dalam Mata Pelajaran di Sekolah Dasar dan Madrasah Ibtidaiyah*. Banda Aceh: Dinas Pendidikan Aceh dan ADEF.

Prihatin, R.B. (2018). Masyarakat Sadar Bencana: Pembelajaran Dari Karo, Banjarnegara, dan Jepang. *Aspirasi: Jurnal Masalah-Masalah Sosial*, 9(2), 221-239. https://doi.org/10.46807/aspirasi.v9i2.1106

Rahmawati, L. dan Wiyatmo, Y. (2018). Keefektifan Pembelajaran Fisika SMA Terintegrasi

Pendidikan Kebencanaan Letusan Gunung Api Ditinjau Dari Penguasaan Materi dan Kesiapsiagaan Bencana Alam. *Jurnal Pendidikan Fisika,* 7(1), 74-82. Retrieved From: https://journal.student.uny.ac.id/ojs/index.php/pfisika/article/view/10482

Richey, R. C., & Seels, B. (1994). Defining a Field: A Case Study of the Development of the 1994 Definition of Instructional Technology. *Educational media and technology yearbook,* 20, 2-17. Retrieved From: https://eric.ed.gov/?id=EJ491599

Soehendro, B. (2006). *Standar Isi untuk Satuan Pendidikan Dasar dan Menengah.* Jakarta: Badan Standar Nasional Pendidikan (BSNP).

Sudrajad, B. (2015). *Pengembangan Media Video Pembelajaran Fisika Terintegrasi dengan Pendidikan Kebencanaan Tsunami untuk Meningkatkan Kesiapsiagaan Siswa SMA di Kawasan Pesisir Kabupaten Kulon Progo.* Tidak diterbitkan Skripsi. Daerah Istimewa Yogyakarta: Fakultas MIPA Universitas Negeri Yogyakarta.

Sukardjo. (2006). *Kumpulan Materi Evaluasi Pembelajaran.* Yogyakarta: Program Pascasarjana Universitas Negeri Yogyakarta.

Thiagarajan dan Semmel. (1974). *Instructional Development for Training Teacher of Exceptional Children A Source Book*. Indiana: ERIC.

Widjanarko, M., & Minnafiah, U. (2018). Pengaruh Pendidikan Bencana Pada Perilaku Kesiapsiagaan Siswa. *Jurnal Ecopsy, [S.l.],* 5(1), 1-7. Doi: 10.20527/ecopsy.v5i1.4878