Development Of Website-Based Learning Media Combined With Geogebra On Pythagoras Materials For VIII-Class Students Of Smp Negeri 1 Pasawahan, Kuningan District

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ABSTRACT

This study aims to develop a website-based learning media on Pythagorean material. This study uses a development research method with the Research and Development (R&D) method with a 4D model (Define, Design, Development, and Dissemination. The research was carried out at SMP Negeri 1 Pasawahan Kuningan Regency by dividing into two trials, namely 5 students for small class trials and 26 students for a large class trial. Instruments of the assessment used a questionnaire assessment of material experts, media experts and student responses. The results in this study were from material experts with an average of 3.71 categorized as very valid, from media experts with an average of 3.63 categorized as very valid and student responses in the interesting category with an average percentage of 77.23% so that the website-based learning media with Pythagorean material that the researcher developed is feasible to use in the learning process.
Keywords : Mathematics Learning Media, Website, Geogebra, Google Sites.

ABSTRAK

Penelitian ini bertujuan untuk mengembangkan media pembelajaran berbasis website pada materi Pythagoras. Penelitian ini menggunakan metode penelitian pengembangan dengan metode *Research and Development* (R&D) dengan model 4D (*Define, Design, Development*, dan *Dissemination*. Penelitian dilaksanakan di SMP Negeri 1 Pasawahan Kabupaten Kuningan dengan membagi dua uji coba yaitu 5 peserta didi untuk uji coba kelas kecil dan 24 siswa untuk uji coba kelas besar. Instrumen dalam pengambilan penilaian menggunakan angket penilaian ahli materi, ahli media dan respon peserta didik. Hasil dalam penelitian ini dari ahli materi dengan rata-rat a 3,71 dikategorika sangat valid, dari ahli media dalam kategori sangat valid dengan rata-rata 3,63 dan respon peserta didik dalam kategori menarik dengan rata-rata persentase 76,5% sehingga media pembelajaran berbasis website dengan materi Pythagoras yang peneliti kembangkan ini layak digunakan dalam proses pembelajaran.
Kata kunci: Media Pembelajaran Matematika, Website, Geogebra, Google Sites.

PRELIMINARY

As technology develops in everyday life, technology in learning emerges as a medium to help students. In the past, learning was only done face-to-face in the classroom, but due to advances in technology, learning can be done remotely using smartphone or computer technology. Even now, educational institutions are competing to provide facilities that support student education at school. According to Gafar (2017) educational technology in general can be interpreted as a medium that was born from technological changes, namely the use of computers and programmatic teaching.

Learning media is a tool used to assist the learning process so that the meaning of the message given becomes more clearly understood and learning objectives can be fulfilled effectively and efficiently (Nuritta, 2018). The existence of learning media which is a tool in the learning process, educators improve the process of interaction between teachers-students and interaction between students in the learning environment (Karo-karo and Rohmani, 2018).

The development of web-based learning media can be used in learning systems because it can involve various media (multimedia) such as text, images, audio, animated videos, and digital e-books (Januarysman and Ghufron, 2016). In simple terms, a learning activity that utilizes internet technology can also be referred to as web-based learning (Uno, 2016). In addition, the benefits of developing web-based interactive multimedia according to Santoso, et al (2020) are that it can increase students' interest, motivation, and enthusiasm in learning. The benefits in developing web-based learning media can be used as an alternative media that can support the mathematics learning process and assist students in understanding the abstract nature of mathematics (Santoso, et al: 2020).

One of the innovations used to help students love mathematics is to use the GeoGebra application. One way is to provide visualization of images that add to the attractiveness of students and are easily understood by students, especially in geometry material (Permatasari, et al; 2016). Apart from using the web as a medium that helps support online learning, the web can also be combined with other software such as GeoGebra. It is said that according to Saputro, et al (2015) geogebra is specifically designed for educational purposes. GeoGebra software according to Hall & Chamblee in Waluyo (2016) states that this software combines geometry abilities, algebraic computer systems, and practice questions. The equations used in this software are applied in geometric shapes. Therefore this makes GeoGebra software an ideal learning medium for learning mathematics. According to Suryawan and Permana (2020) the use of Geogebra

software is closely related to the 2013 curriculum which consists of 5M, namely: (1) Observing, (2) Asking questions, (3) Gathering information, (4) Associating, and (5) Communicating.

The website that is used to combine material from YouTube and GeoGebra is to use Google Sites. Google sites are a product from Google as a tool or media to make it easier to create websites for ordinary users (Harsanto, 2017). So that everyone can use Google sites, especially for educators who, during a pandemic like today, are conducting online-based distance learning activities (Jubaidah & Zulkarnain, 2020). One can collaborate on sites and add files from other Google applications such as Google Docs, Google Calendar, Picasa, Youtube and others. To make your site easy to edit, Site owners can control and edit documents who have access (Suryanto, 2018)

Based on the results of an interview on October 1, 2021 which was conducted at Negeri 1 Pasawahan Middle School, Kuningan Regency, information was obtained that one of the materials in mathematics that students at Pasawahan 1 Public Middle School lacked mastery was Pythagorean material. One of the less mastered Pythagorean material units for students is identifying the slanted side of a triangle and also finding its length. The learning process that was carried out at SMP Negeri 1 Pasawahan, Kuningan Regency was carried out online during the pandemic through the whatsapp group. One of the difficulties encountered is the lack of reciprocity between the teacher and students in the learning process, because the whatsapp group is loaded in admin mode so that students cannot freely ask questions through the group. During online learning activities the teacher has used other alternatives (besides WhatsApp) that are appropriate to the circumstances and abilities of students so that students do not feel burdened. Learning media used such as Google form and YouTube as online learning media.

The use of YouTube videos is still not optimal, it can be seen from the videos used that there are still minimal animations that are useful in visualizing material. Therefore the development of web-based learning media combined with GeoGebra comes as a solution because of its ability to provide material simulations that are useful in helping students understand the material. Also, its features that are able to interact with students add value to the benefits of GeoGebra media in interacting with users.

In addition, the development of web media combined with GeoGebra is an effort to provide solutions to students' difficulties in understanding Pythagorean material. Of the many Basic Competencies that must be mastered by students at the junior high school level. In this study using KD (3.6) Explaining and proving the Pythagorean theorem and

Pythagorean triples and (4.6) Solving problems related to the Pythagorean theorem and Pythagorean triples. In the class VIII semester 2 SMP/MTs book, it states that the Pythagorean theory is that the square of the hypotenuse of a right triangle is equal to the sum of the other sides. This theory was expressed by Pythagoras (582 BC – 496 BC), he was born on the island of Samos, in the Ionia region, Southern Greece. The product resulting from this research is a website that has experienced development by providing additional references for student learning in understanding the material and solving various sample questions. so that it can be accessed by students in class and outside the classroom using computers or smartphones. This research was conducted on class VIII students of SMP Negeri 1 Pasawahan, Kuningan Regency.

METHODS

This research is a Research and Development (R&D) with a 4D model. Research and Development (R&D) is a research activity that begins with research and continues with development. Initial research activities were carried out to obtain information related to user needs, while development was carried out to produce learning tools (Prasetyo, 2012). The 4D model stands for Define, Design, Development and Dissemination which was developed by Thiagarajan (1974). The product of this research is a web-based media based on the Pythagorean theorem. One of the advantages of the 4D model according to (Arywiantari, Agung, & Tastra; 2015) is that this model is more appropriate for developing learning tools rather than for developing learning systems.

The steps taken in developing website-based learning media based on the 4D model are (1) Define, according to Tambunan (2021) at this stage the process of collecting various information related to the product to be developed is carried out. The Define stage consists of several stages, namely initial analysis, student analysis and task analysis. This stage aims as a reference in the development of website-based learning media. (2) Design, the first step at this stage is to design a learning media framework, prepare a systematic presentation of material, and prepare learning media assessment instruments including assessment questionnaires for media experts and material experts, and student response questionnaires. (3) Development, at this stage researchers realizing all the designs of learning media that have been prepared at the design stage and validating learning media with material experts and media experts to be given an assessment and advice regarding the websites that have been made, then the media is repaired according to the suggestions that have been given. (4) Disseminate, at this stage, the small class trial was carried out

consisting of 5 students from VIII-A class at SMP Negeri 1 Pasawahan Kuningan Regency by filling out the Google form provided via the WhatsApp group. After that, the researcher conducted a large class trial of 26 students from VIII-A class at SMP Negeri 1 Pasawahan 1, Kuningan Regency. Data analysis was carried out to obtain information about student responses to the developed website-based learning media.

Assessment questionnaire by material experts and media experts

Instruments that have been filled out by experts are then analyzed using the following equation.

$$VR = \frac{\sum_{i=1}^{n} \bar{V}_1}{n}$$

VR : average of validity

$\bar{V}_1$: The average score of each validator

n : number of validators

Table 1. Criteria for Categorizing Validity by Experts

VR Range	Interpretation Criteria
$3 \leq VR \leq 4$	Very Valid
$2 \leq VR < 3$	Valid
$1 \leq VR < 2$	Less Valid
$0 \leq VR < 1$	Invalid

(Source: Riyani, Maizora, & Hanifah, 2017)

Student response assessment questionnaire

Response questionnaires that have been filled in by students are then analyzed using the following equation.

$$P = \frac{F}{N} \times 100\%$$

P = percentage of data from the questionnaire

F = the total score obtained

N = maximum score

Table 2. Percentage of Student Trials

P Range	Interpretation Criteria
$81\% \leq P \leq 100\%$	Very interesting
$61\% \leq P < 81\%$	Interesting
$41\% \leq P < 61\%$	Quite interesting
$21\% \leq P < 41\%$	Less interesting
$0\% \leq P < 21\%$	Very uninteresting

(Source: Septina, Farida & Komarudin, 2018)

Web media is categorized as feasible for use in learning if the criteria for interpreting the results of the validation questionnaire analysis and the minimum response questionnaire show valid and interesting.

RESULTS AND DISCUSSION

This research produces a website-based learning media product on Pythagorean material which can be accessed online on the page https://sites.google.com/webmail.uad.ac.id/pythagoras. Product development begins with creating a storyline containing Pythagorean materials that will be placed on the website. In addition to written material, geogebra files, images that support the material, and also discussion questions files which will later be integrated into the website. The results of the development are as follows.

On this website-based learning media, it starts with the main page display which consists of an opening sentence regarding Pythagorean, KI and KD material, concept maps, learning video buttons and several buttons at the top.

Figure 1. Website Home Page

Figure 2. Menu Selection Button

On the second page displays four learning videos, including video tutorials on using website-based learning media, videos on learning Pythagorean theorem material, video learning material on special triangles, and video learning material on using the Pythagorean theorem.

Figure 3. Learning Video Start Page

The third page on this website provides some material that will be studied, including the history of Pythagoras, the Pythagorean theorem, special triangles and the uses of the Pythagorean theorem. But there is also sub material from the Pythagorean theorem, namely the concept of the Pythagorean theorem, the opposite of the Pythagorean theorem and Pythagorean triples.

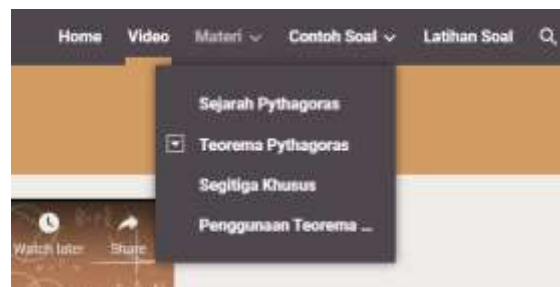**Figure 4. Display On The Page Of Pythagorean Historical Materials**

Figure 5. Menu Selection Button On The Material Section

Figure 6. The Menu Selection Button In The Pythagorean Theorem Section

Figure 7. The Menu Selection Button In The Pythagorean Theorem Section

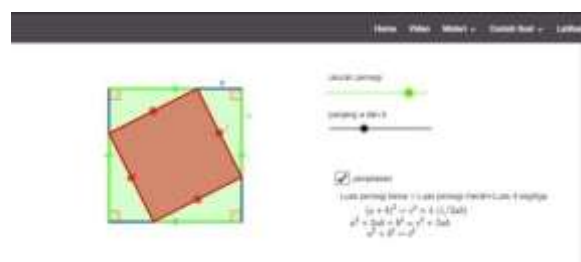**Figure 8. Display On The Start Page Of The Pythagorean Theorem Material**

Figure 9. Geogebra Media On The Submaterial Of Proving The Pythagorean Theorem

On the sample question menu page, three examples of questions using GeoGebra are given. Students can type answers to the sample questions that have been given and will find out if the answer is right or wrong through the geogebra page.
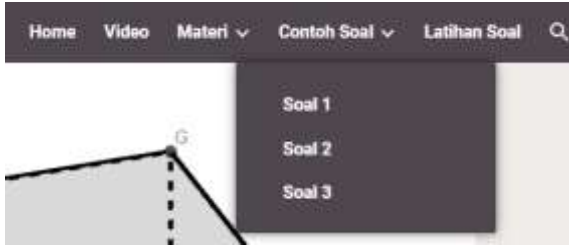
Figure 10. Button Display On Sample Questions

Figure 11. Display Geogebra Media On The Sample Question Page

The last page that students can visit is on the practice questions menu consisting of 10 questions via Google form and there is an answer file for discussing the practice questions which is given after the Google form page is submitted.

Figure 12. Display The Practice Questions Page

Figure 13. Display Of The Practice Questions Page After Submission The Answers

After the product has been developed, product validation is then carried out by material experts and media experts with the aim of getting advice from the validator. The results of the assessment of material experts and media experts can be seen in the following table.

Table 3. Material Expert Validation Data For Each Aspect

Validator	Learning Media Assessment Score		
	Content Material	**Presentation**	**Language**
1st Material Expert	34	24	20
2nd Material Expert	34	22	22
Total Score	68	46	42
Mean	3,78	3,83	3,5
Criteria	Very Valid	Very Valid	Very Valid

Based on the table 3 above, it can be concluded that the content aspect has an average validation of 3.78, the presentation aspect has an average validation of 3.83 and the language aspect has an average validity of 3.5. So it can be seen that the results of the material assessment by the first and second material experts obtained an average validity of 3.71. So that it can be seen that these results indicate that website-based learning media based on aspects of material feasibility are included in the very valid category.

Table 4. Media Expert Validation Data For Each Aspect

Validator	Learning Media Assessment Score		
	Content Material	Presentation	Visual
1st Media Expert	12	15	44
2nd Media Expert	12	13	49
Total Score	24	28	93
Mean	4	3,5	3,6
Criteria	Very Valid	Very Valid	Very Valid

Based on table 4 above, it can be concluded that the content feasibility aspect gets an average validation of 4, the presentation feasibility aspect gets an average validation of 3.5 and the visual aspect gets an average validity of 3.6. So that it can be seen that the results of the material assessment by the first and second media experts obtained an average validity of 3.63 indicating that website-based learning media based on aspects of media feasibility are included in the very valid category.

In addition to providing assessments, media experts and material experts also provide suggestions for the developed website-based learning media. Suggestions from experts can be seen in the table below.

Table 5. Table Of Suggestions From Material Experts

No.	Aspect	Suggestions
A	Content feasibility	1) KI and KD have not been seen raised 2) The answer key to the exercise needs to be shown to check the suitability of the questions and answers 3) The suitability of the questions and answer choices needs to be checked again, there are questions that have no answers.
B	Presentation feasibility	-
C	Language feasibility	1) Some of the writing still has typo 2) Writing units should be placed in the conclusion

Table 6. Table Of Suggestions From Media Experts

No.	Aspect	Suggestions
A	Content feasibility	-
B	Presentation feasibility	-
C	Visual	1) The background for each material needs to be distinguished from the background for the initial appearance.
		2) Videos on youtube need to be added thumbnails
		3) The learning videos are too fast
		4) Video layout needs work
		5) Set the maximum number in geogebra so that the image is seen as a whole
		6) Adding tools to the Pythagorean theorem material
		7) Removing the Google toolbar on learning videos

In the desseminate stage, the researcher disseminated learning media products to be tested on students of SMP Negeri 1 Pasawahan, Kuningan Regency. In the initial stages, the trial was carried out with small classes consisting of 5 students of VIII-A class at SMP Negeri 1 Pasawahan, Kuningan Regency on June 16, 2022. In the implementation of the small class trials, it was carried out online via WhatsApp group, then students are asked to access the website link that the researcher has shared.

Table 7. The Results Of The Questionnaire Score Of The Small Class Pilot Test For Each Aspect

Validator	Learning Media Assessment Score		
	Easiness	Presentation	Content Material
Siswa kelas VIII A	153	219	182
Total score	437	438	455
Mean	87,4%	87,6%	91%
Criteria	Very interesting	Very interesting	Very interesting

Table 8. The Score Of The Results Of The Small Class Trial

Respondent	Total	Percentage	Criteria
5 students of VIII-A class SMPN 1 Pasawahan, Kuningan Regency	554	88,64 %	Very interesting

Based on the table above, it can be seen that the percentage for the ease of using the website is 87.4%, the website display aspect is 87.6%, and the ease for understanding the material is 91%. It can be concluded that the results of the calculation of the student response questionnaire in the small class trial followed by 5 students obtained a result of 88.64% with a very interesting category.

After conducting a small class trial, the next step is to conduct a large class trial on June 18, 2022 for VIII-A class at SMP Negeri 1 Pasawahan, Kuningan Regency. Then after the trial implementation was complete, each student was asked to fill out a student response questionnaire to the website-based learning media that had been developed through the questionnaire sheets that had been distributed. The results of the student response questionnaire can be seen in the table below.

Table 9. The Results Of The Questionnaire Score Of The Large Class Pilot Test For Each Aspect

Validator	Learning Media Assessment Score		
	Easiness	**Presentation**	**Content Material**
Students of VIII-A class	667	1012	821
Total score	677	1021	821
Mean	73,3%	77,25%	78,3%
Criteria	Interesting	Interesting	Interesting

Based on the table above, it can be seen that the percentage for the ease of using the website is 73.3%, the website display aspect is 77.25%, and the ease for understanding the material is 78.3%. So according to tables 9 and 10 it can be concluded that the results of calculating student response questionnaires in the large class trial which were attended by 26 students obtained a result of 76.5% with an interesting category.

Table 10. The Score Of The Results Of The Large Class Trial

Respondent	Total	Percentage	Criteria
Students of VIII-A class	2510	76,5%	Interesting

Based on the results of the assessment of media experts, material experts and the results of student response questionnaires, it can be concluded that website-based learning media is valid and interesting. So that the website-based learning media with Pythagorean material that the researchers developed is suitable for use in the learning process.
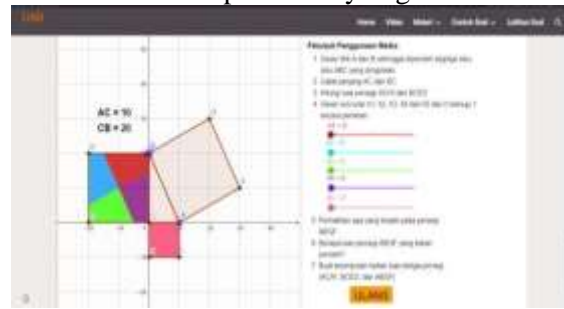
DISCUSSION

The characteristics of valid and interesting website-based learning media are summarized in the table below.

Table 11. Characteristics Of Website-Based Learning Media

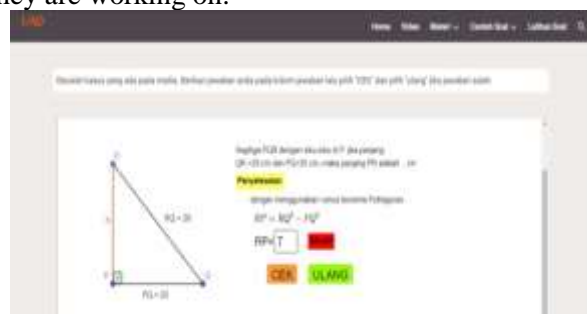| No.	Characteristics	Explanation
1.	The material presented in learning media is in accordance with Kompetensi Inti (KI) and Kompetensi Dasar (KD)	The material is prepared according to KI and KD of Kurikulum 2013.
2.	Learning media contains apperception	Apperception serves to remind students of the material that has been studied.
3.	Geogebra animation can help students to understand the material, and also the material is packaged in an attractive way	In the Pythagorean material students need animation to help visualize the material.
4.	The Pythagorean material on the website is presented coherently	In learning media, material is presented sequentially to make it easier for students to learn it.
5.	Website-based learning media uses communicative language	The media uses communicative language, so that it is easy for users to understand.
6.	Learning videos on the website help clarify the material	Learning videos contained in website-based learning media help students better understand how to use the website and also help understand the material provided.

| 7.	Learning media can illustrate the material	Illustration of the contents of the material on the proof of the Pythagorean theorem serves to understand the concept of the Pythagorean theorem.
8.	Learning media has a color display and an attractive choice of background images	Learning media with attractive appearance and colors can increase the user's desire to use learning media.
9.	Diversity in the presentation of examples of questions can clarify the material.	Example questions serve to train students' understanding of the material and information about "true" and "wrong" so that students know the answers they are working on.
10.	The answer key to the questions given is correct	The answer key consists of 10 answers to practice questions which are given at the end of the page after students submit.
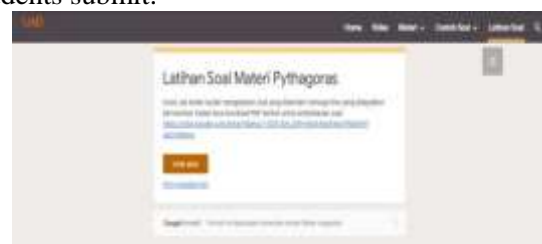
The table above shows that this website-based learning media is interesting. This shows that the results of developing learning media are useful for communicating mathematical ideas, through solving problems in practice questions and examples of questions given. In addition, geogebra animation can be used by students to explore material independently with the aim of visualizing Pythagorean material.

Based on the assessment of the material expert questionnaire, an average of 3.71 was obtained so that it was included in the very valid category and for the media expert questionnaire assessment, an average of 3.63 was obtained so that it was included in the very valid category. In addition to assessments from media experts and material experts, there were also assessments from student responses that obtained an average percentage of 77.23% so that they were included in the interesting category. So it can be seen that website-based mathematics learning media combined with geogebra on Pythagorean material is categorized as valid and interesting.

Based on the scores and categories obtained from the results of the assessment of media experts, material experts and students' responses to this website-based learning media, there are several indicators that show the highest scores, namely the feasibility of the material content in accordance with KI and KD, the combination of websites with geogebra on Pythagorean material, the suitability of the geogebra animation with the material provided, the selection and arrangement of sentences used in website-based learning media using communicative language, the simplicity of the website display and the selection of colors used make the website more attractive.

Some of these indicators show the main characteristics of the development of website-based learning media are the novelty of this research. This is evidenced by the results of the development carried out by Jubaidah and Zulkarnain (2020) that the learning media developed only presents learning videos and the material is provided in the form of a syllabus. Meanwhile, based on this research, the developed media provides animation using GeoGebra media and also gets a good category on the GeoGebra illustration component. Likewise with the results of research by Setyadi and Qohar (2017) that aspects of language and the effectiveness of the sentences used are still lacking, whereas based on this research in table 3 the aspects of language and sentence construction produce an average validation of 3.5 which is categorized as very valid.

CONCLUSION

Based on the results of the assessment carried out by mathematics learning material experts, an average of 3.71 was obtained and the assessment of mathematics learning media experts obtained an average of 3.63 so that it can be seen that the website-based mathematics learning media developed is categorized as very valid. In addition to the results of the student response assessment, an average percentage of 76.5% was obtained so that it can be seen that the website-based mathematics learning media that has been

developed is categorized as attractive. In conclusion, website-based learning media on Pythagorean material is declared feasible to be used in the learning process, because it meets valid and interesting criteria.

It is hoped that website-based learning media combined with GeoGebra can be utilized in the process of learning mathematics on Pythagorean material, so that this learning video can help students understand the material. This learning media can be used as a scientific reference in conducting similar development research in the future. The hope is that further products will be developed with similar materials and with even better results.

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