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THE DEVELOPMENT GEMATIKA AS A WEBSITE-BASED MATHEMATICS LEARNING MEDIA ON COMPARISON MATERIALS

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Abstract

Technology-based *learning media in the learning process must be applied in today's digital era. GEMATIKA* as *website-based mathematics learning media was developed to support students' mathematics learning, especially Comparative material. This study aims to determine the process of developing learning media based on the GEMATIKA website that meets valid and practical criteria. This type of research is development research using the ADDIE development model. Data was collected using material and media expert validation sheets and student response questionnaires to the GEMATIKA website learning media. The subjects of this study consisted of 28 students from class VII. The results showed that the results of media validation by material experts and media experts were 4.13 and 4.29. The average percentage of student response questionnaire results is 80.82%. It means that students respond positively after using the GEMATIKA learning media. The positive responses indicate that students support, feel happy, and are interested in using the GEMATIKA website learning media in the mathematics learning process at home or in class. Based on the results of the validation sheet and student response questionnaires, it can be concluded that the GEMATIKA website learning media meets the valid and practical criteria.*

***Keywords**: Comparison materials, mathematics learning media, website-based learning*

Abstrak

Penggunaan media pembelajaran berbasis teknologi dalam proses pembelajaran penting untuk diterapkan di era digital sekarang ini. GEMATIKA sebagai media pembelajaran matematika berbasis website dikembangkan untuk menunjang pembelajaran matematika siswa, khususnya materi Perbandingan. Penelitian ini bertujuan untuk mengetahui proses pengembangan media pembelajaran berbasis website GEMATIKA yang memenuhi kriteria valid dan praktis. Jenis penelitian ini merupakan penelitian pengembangan dengan menggunakan model pengembangan ADDIE. Pengumpulan data dilakukan dengan menggunakan lembar validasi ahli materi dan media serta angket respons siswa terhadap media pembelajaran website GEMATIKA. Subjek penelitian ini terdiri dari 28 siswa kelas VII. Hasil penelitian menunjukkan bahwa hasil validasi media oleh ahli materi dan ahli media secara berturut-turut sebesar 4,13 dan 4,29 dan rata-rata hasil persentase angket respons peserta didik adalah 80,82%, hal ini berarti siswa memberikan respon positif setelah menggunakan media pembelajaran GEMATIKA. Respon positif yang diberikan siswa menunjukkan bahwa siswa mendukung, merasa senang, dan tertarik menggunakan media pembelajaran website GEMATIKA dalam proses pembelajaran matematika baik di rumah ataupun di kelas. Berdasarkan hasil lembar validasi dan angket respon peserta didik dapat dikatakan media pembelajaran website GEMATIKA memenuhi kriteria valid dan praktis.

Kata kunci: Materi perbandingan; media pembelajaran, pembelajaran berbasis website

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INTRODUCTION

The development of technology today has been felt in all aspects of life, including the field of education. Coinciding with the occurrence of the Covid-19 pandemic in recent years, which has made Indonesia and even the world experience accelerated adaptation to the use of technology. The COVID-19 pandemic has accelerated the use of technology, such as the internet and electronic devices, in the education sector. Teachers and students also feel the transformation of learning from face-to-face to online. Changing the process and assessment methods in education so that current and future learning differs from past learning Engelbrecht, Llinares, & Borba (2020).

Digital technology has become an essential part of the world of education, especially in learning mathematics. Based on a survey conducted by Project Tomorrow (2016) at British NGOs exploring the use of technology in learning, 600 respondents, the majority being principals and teachers. The results show four main reasons for using technology: increasing student engagement & motivation, broadening the realm of learning outside the classroom, enabling different instruction according to ability levels, and improving the quality of learning materials. In addition, several studies also state that the use of technology can improve the quality of learning (Borba, Chiari, & de Almeida, 2018), engage students in learning (Attard & Holmes, 2020), have a positive impact on students and improve students' understanding of mathematics and motivate students in learning mathematics (Sakat et al., 2012).

Based on the survey and several previous studies, using digital technology in the learning process, including learning mathematics, is essential. However, teachers must be careful in choosing technology that suits the characteristics of the material and students. As of 2014 alone, 75,000 applications were included in the Education category in the Apple App store (Wartella, 2015). More than 75% of these apps are made without any educational research to support their development of these apps. So in its use, it only pleasures without any learning goals to be achieved (Vaala & Levine, 2015). Therefore, in developing and using learning media, it is necessary to pay attention to the suitability of digital technology-based learning media with learning objectives and student characteristics.

This is a big challenge for teachers to design digital technology-based learning to facilitate students according to the times Dineva, Nedeva, & Ducheva, 2019). Answering these challenges, teachers are expected to be able to be proactive toward technological developments. As well as increasing their knowledge and skills in designing and using technology as a learning medium in the learning process in this digital era. Various kinds of technology-based media have been developed in recent years to support digital-based learning. Many technologies, such as computer devices, web-based programs, gaming, or skill-based videos, can be used in learning mathematics and others that improve students' higher-order thinking skills (Higgins, Crawford, Huscroft-D'Angelo, & Horney, 2020). Using technology-based learning media can facilitate students to do social networking, access learning more broadly, and integrate the internet into a more expansive environment (Borba et al., 2018).

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One of the technology-based learning media that can be used by teachers in learning mathematics is website-based learning media. The learning media is part of e-learning, where students can access learning materials through websites designed by teachers (Muhie, 2020). The use of website-based learning media provides many benefits. Darussalam (2015) suggests several benefits of using web-based learning media, including 1) using web learning media helps students learn independently so that they further expand and improve their knowledge, 2) student-centred learning, because students are active in the learning process and do learning activities are not just listening to the teacher's explanation, and 3) the existence of web-based learning media can be an additional learning resource for students that can be accessed anywhere and anytime.

Several studies have been conducted regarding website-based mathematics learning media. This research suggests that the use of web-based learning media can optimize mathematics learning (Kurtulus, 2009 dan Moreno-Guerrero et al., 2020), create interactive and exciting learning (Darussalam, 2015), increase motivation and student learning outcomes (Husna, Septia, & Cesaria, 2018; Loong & Herbert, 2012), increasing student involvement in learning, and getting positive responses from students after using web-based learning media (Wilson & Hoyles, 2019). Based on the description above, the teacher should have skills in designing learning that can utilize technology using website-based learning media with the right approach.

Therefore, it is necessary to develop website-based learning media that can be used by teachers as support in the learning process. The developed website is named GEMATIKA, which stands for Gemar Matematika. This website contains math material that focuses on class VII comparative material. This website is expected to help students understand the concept of comparison, carry out appropriate procedures in solving the comparison problems presented, and increase students' motivation to learn mathematics. The focus of this study aims to determine the process of developing GEMATIKA website learning media that meets valid and practical criteria.

METHODS

This research is a research and development (R & D). The researcher developed the website-based GEMATIKA learning media using the ADDIE development model. According to (Branch, 2009), the ADDIE development model contains five stages: Analysis, Development, Implementation, and Evaluation. The procedure for developing website-based GEMATIKA learning media can be seen in Figure 1.

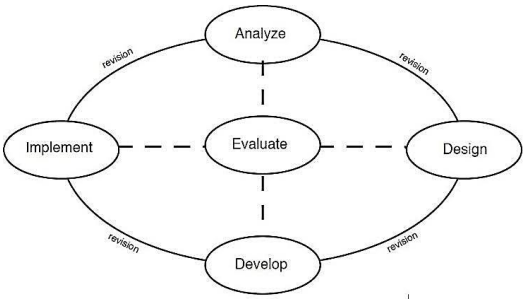

Figure 1. ADDIE development model

The sampling used a purposive sample technique, namely several seventh-grade students from schools with computers and good internet connections. The subjects of this study were class VII.1 students who had been taught using the GEMATIKA website

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learning media. The instruments used in collecting data are validation sheets and student response questionnaires. The data analysis technique used is validity data analysis in the form of validation sheet analysis of media experts and material experts and practical data analysis in student response questionnaires after using the GEMATIKA website learning media.

The GEMATIKA website-based learning media is valid if the value is in the interval, meaning that revisions must be made if it is below 3.5. The data obtained from the student response questionnaire were analyzed using the formula (1) (Akbar, 2013).

$$M = \frac{number\ of\ student\ assessments}{sum\ of\ highest\ score} \times 100\% \quad (1)$$

Furthermore, the analysis results of student responses to the GEMATIKA website learning media are interpreted using the percentage criteria in Table 1.

Table 1. Criteria for the percentage of student response questionnaires to the GEMATIKA website

Interval	Interpretation
85,01% - 100%	Very Good
70,01% - 85,00%	Good
50,01% - 70,00%	Enough
01,00% - 50,00%	Bad

Determine the practicality of the learning media on the GEMATIKA website. It can be seen from the student response questionnaire if the number of students who gave a positive response is greater than or equal to 70,01%. If not, it means that revision is needed.

RESULT AND DISCUSSION

The development of learning media for the GEMATIKA website uses the ADDIE development model. The development procedure goes through 5 stages: Analysis, Design, Development, Implement, and Evaluate. The final product produces the GEMATIKA website learning media. The GEMATIKA website (Gemar Matematika) is a website-based mathematics learning media developed to teach the concept of comparison in class VII.

1. Analysis Stage

The first stage carried out in this research is the analysis stage. The analysis phase is carried out to identify problems faced by students and teachers during limited face-to-face learning. Researchers conducted observations and interviews with teachers and students to obtain valid information. Based on observations and interviews, information was obtained that during limited face-to-face learning, the teacher bears a double burden of teaching directly in the classroom and online. In addition, the teacher only uses WhatsApp groups to send learning materials to students. It makes mathematics learning less effective, and students need help understanding the material. The teacher chooses the WhatsApp group platform because, according to the teacher, it is easy for students to reach. In addition, teachers do not have and cannot make learning media that can be used during online and face-to-face learning limited. Whereas learning media is very helpful in delivering material to students, primarily based on student interviews, almost all students have mobile phones and stable internet connections. This information becomes supporting data for researchers to choose to develop learning media.

After that, the researcher analyzed the mathematics material for class VII and took the comparison material. This material is one in that most students need help solving comparative

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problems, especially the comparison of reversed values (Raharjanti et al., 2016). The difficulties experienced by students in working on comparative material questions are conceptual and procedural errors. Students need help understanding the concept and have difficulty using the concepts needed in solving comparative problems (Sari, 2020). Furthermore, the researcher analyzed the product maker tools and decided to create a website-based learning media using the google sites platform because there needed to be more research on website-based learning media using google sites, especially in learning mathematics. In addition, website-based learning media products are easily accessible by students wherever and whenever they are connected to the internet and can be accessed with various devices, including mobile phones, tablets, and laptops.

2. Design Stage

The second stage in this research is the design stage. This stage must be done as a reference in making the learning media framework used at the development stage (Branch, 2009). At this stage, it begins by determining learning objectives, designing learning activities, and designing website-based learning media that will be developed. Researchers make a flowchart to show a concept map of the website-based learning media. It can be seen in Figure 2.

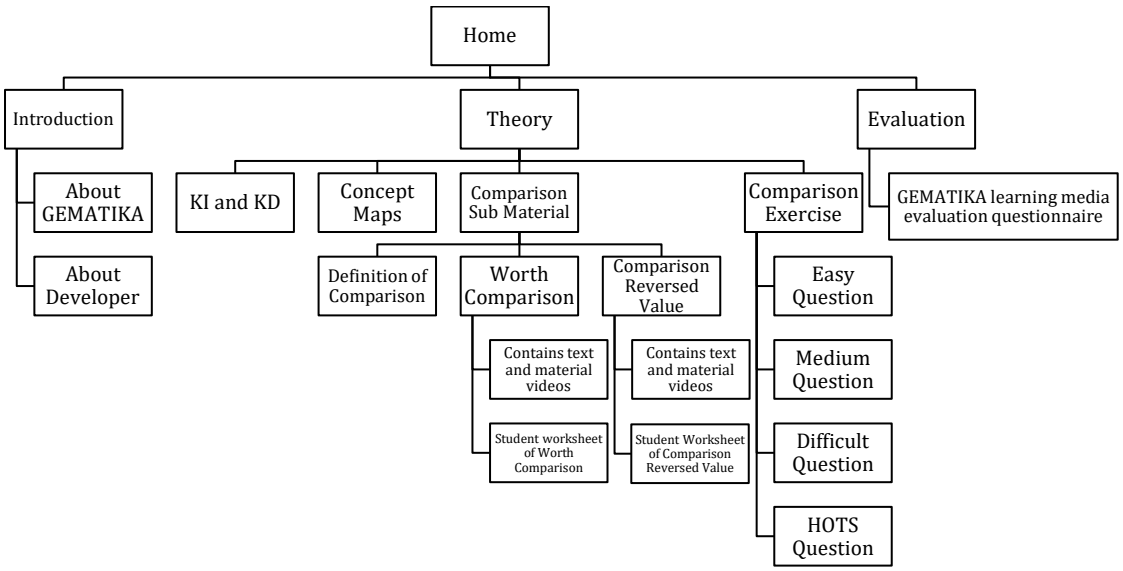

Figure 2. Flowchart of Learning Media Website GEMATIKA

3. Development Stage

This development stage aims to develop or realize a product that has been previously designed until it is ready to be tested (Branch, 2009). Researchers make learning media that refers to the design stage. Website-based learning media is made in full which contains videos, materials, student worksheets, and also evaluations accompanied by clear instructions for use. In the process of developing learning media, the GEMATIKA website pays attention to learning aspects which include use review in learning, be sure verbal content is effective, use clear assignment and direction, ask one

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question, work in feedback, and follow with appropriate technique, and connect material to the real world (Lee & Owens, 2004).

After the development of the GEMATIKA website learning media is complete, the next stage is the validation process by the validator team. The validator team consists of one mathematics lecturer, one mathematics teacher, and one master's degree student in mathematics education. The validation process took place twice with several improvements made based on suggestions from the validator team. The appearance and characteristics of the GEMATIKA website are based on the learning aspect after the repairs have been made as follows:

a. Use review in learning

The GEMATIKA website contains aspects of use review in learning, where this website provides a review of relevant information that highlights the main points that students will learn and presents an introductory video before entering the material, so that it can make it easier for students to understand the flow of the material they will learn. This is in accordance with what was stated by Lee & Owens (2004) that students will learn more and more effectively when learning begins with apperception or reviewing the material that students will learn. The display of the GEMATIKA website which contains the principle of review in learning can be seen in Figure 3.

Figure 3. Website GEMATIKA used to review learning

b. Be sure verbal content is effective

The material presented on this website is packaged in the form of text and videos using clear language and is easy for students to understand. And also presented clear learning objectives so that students know the goals to be achieved after studying comparison material. Lee & Owens (2004) explained that students would learn more effectively if the verbal content presented was precise, fluent, and straight forward. The display of this part can be seen Figure 4.

(a) (b)

Figure 4. Verbal content of the website GEMATIKA is effective, (a) display of learning objectives and (b) video of learning materials

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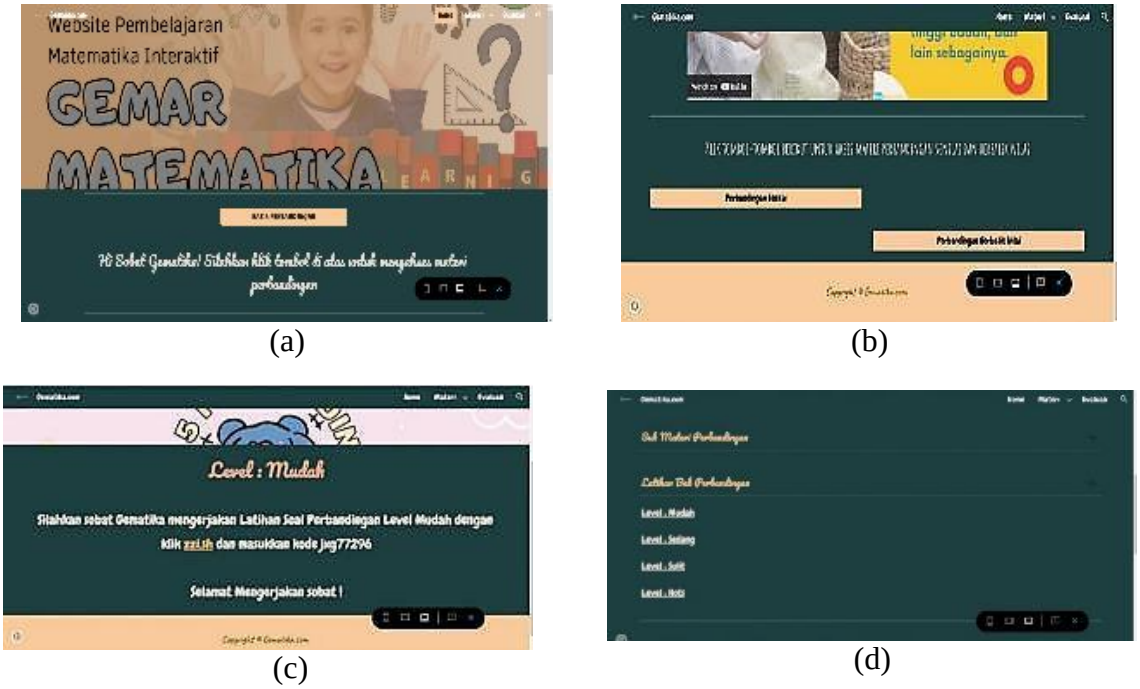
c. Use clear assignment and direction

Lee & Owens (2004) suggest that students learn more effectively when given clear and concise assignments and directions. The GEMATIKA website contains clear instructions, so the students can easily access the information on the GEMATIKA website, including materials, learning videos, worksheets, and practice questions. Each student completes one material. There are clear instructions to direct students to the following material. In practice questions, there are also several levels that students can choose to measure. The display of assignment can be seen in Figure 5.



(a) (b) (c) (d)

Figure 5. (a), (b), (c), (d) Use clear assignment and direction

d. Ask one question, work in feedback, and follow feedback with appropriate technique

Lee & Owens (2004) suggested learning more effectively and working on questions when questions are asked one by one that is relevant to what students have learned, and there is a response after students answer the questions. The practice questions on the GEMATIKA website are displayed one by one so that students can focus on solving the questions on the screen. After students answer the questions will be given feedback to students. Students who answer correctly will get a response that your answer is correct, and students who answer incorrectly will get a response that your answer is wrong and will be given an explanation regarding the solution to get the correct answer. This part can be seen in Figure 6.

Figure 6. (a) Display the GEMATIKA website which contains the principle of asking one question

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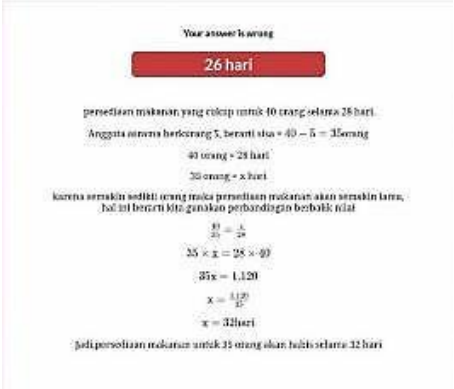
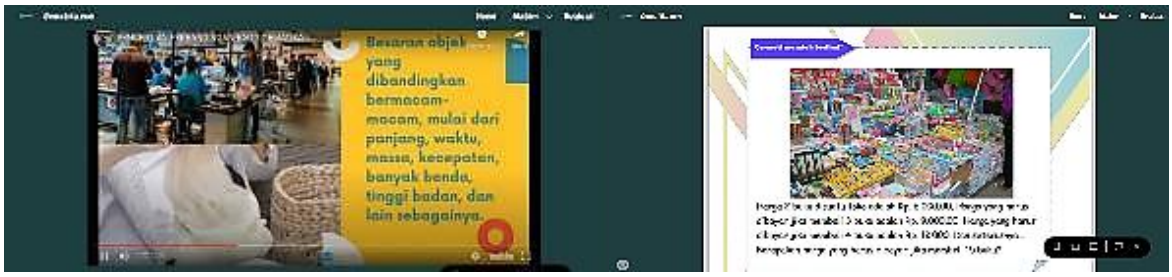


Figure 6 (b). Follow feedback after answering the question

e. Connect material to the real world

The material on the GEMATIKA website is packaged with contextual learning so that the students can learn effectively when the material and questions are related to everyday life and make it easier for them to understand because they know the benefits of studying the material. This is by what stated by Lee & Owens (2004) that students learn more effectively when the concept taught are closely related to the real world or students' daily lives.



(a) (b)

Figure 7. (a) (b) Connect material website GEMATIKA to the real world

Furthermore, the learning media of the GEMATIKA website was validated by the validator. The assessment results given by the validator team include material validation obtaining an average value of 4.13 and media validation obtaining an average value of 4.29. Based on the results of this validation, the learning media is declared valid and suitable for use in the trial process.

4. Implementation Stage

This GEMATIKA website is applied in the learning process of comparative material in class VII.1 of MTs As'adiyah Puteri 1 Pusat Sengkang. Students study comparative material through the GEMATIKA website at their respective homes. Furthermore, in the classroom, the teacher guides and directs students to work in groups on the LKPD on the GEMATIKA website. After the learning process is complete, students are given a questionnaire. The student's responses to the use of GEMATIKA learning media in the learning process can be seen in the Table 2.

Table 2. Results of student responses to the learning media GEMATIKA website

No	Aspect	Percentage	Description
1	Website Display	81.00 %	Very Good
2	Material Presentation	80.76%	Good
3	Website Benefits	81.70%	Very Good
Average		**80.82%**	**Very Good**

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Based on the results of the questionnaire that has been filled out by students in Table 2, it can be seen that the percentage of student responses for each item in the questionnaire statement is above 70% and the average is 80.82%. If interpreted, students give good and very good responses to each statement given. The criteria set for saying that students give a positive response is if the percentage given by students is at least 70%. It can be said that students gave a positive response after using the GEMATIKA website learning media. Thus the criteria for a positive response from students have met and can be declared to meet the criteria for media practicality. The positive response given by students based on the results of the questionnaire means that students support, feel happy and interested in the use of the GEMATIKA website learning media in the mathematics learning process and help them understand comparative material. This is in line with research (Husna et al., 2018; Loong & Herbert, 2012; Wilson & Hoyles, 2019) which revealed that the use of website-based learning media increased student engagement and received positive responses. Other research also suggests that website-based learning media optimizes the learning process so that it becomes more effective (Kurtulus, 2009; Moreno-Guerrero et al., 2020). Based on the results of the positive responses of students, it can be said that the GEMATIKA website learning media is practically used in the learning process.

5. Evaluation Stage

The last stage of this development is the evaluation stage. This final stage is important to do to evaluate the shortcomings of the learning media that have been made so as to produce better learning media (Branch, 2009). At this stage, improvements are made again based on the suggestions obtained at the implementation stage. However, there are no significant changes to the GEMATIKA website-based learning media.

Based on the results of media and material validation as well as student responses, the goal of developing website-based GEMATIKA learning media is considered to have been achieved because it has met the valid and practical criteria. The results of the research on the development of the GEMATIKA learning media based on this website have a novelty value, namely the GEMATIKA learning website in which there is comparative material presented in text form and also an explanation in the form of video. In addition, there are student activity sheets (e-worksheets) that students can do independently or in groups to provide opportunities for students to be actively involved in the learning process. The GEMATIKA website also provides practice questions consisting of several levels ranging from easy, medium, difficult, and HOTS questions so that students can measure their understanding of the material by working on questions according to their ability level. This website-based GEMATIKA learning media can be accessed using various devices, including mobile phones, tablets, and laptops. The results of this study also have limitations, namely the GEMATIKA learning media based on this website can only be accessed if you have an internet connection and is only limited to comparison material for class VII, so it is hoped that further research will cover wider material.

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CONCLUSION AND SUGGESTION

Based on the study results, it was concluded that: (1) The validity of GEMATIKA as a website-based learning media developed is proven by the average media and material validation results that meet valid criteria. (2) The practicality of GEMATIKA is seen from the average percentage of student responses to the GEMATIKA website, namely 80.82%, which met the practical criteria. It can be seen from the positive responses given by students that the GEMATIKA website is helpful and helps students in learning mathematics, especially in understanding the concept of comparative material. In addition, students can access this GEMATIKA website wherever and whenever they want. The GEMATIKA website benefits students in the limited face-to-face learning process with very little learning time at school. Students can study independently at home by accessing material and Practice questions on the GEMATIKA website.

Some recommendations for further research are suggested to develop website-based learning media that can facilitate the development of students' mathematical abilities for a broader mathematics subject. Future research is also expected to be able to test the developed media on a larger scale.

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