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Developing Web-based Learning Media 'Geopedia' Using SAM Model

Saiful Amin*[1], Muchammad Akbar Kurniawan[2], Muhammad Akmal Muzakki Dwi Syah Putra[3], Renata Tiand Indriansyah[4]
Universitas Islam Negeri Maulana Malik Ibrahim Malang, Jalan Gajayana 50 Malang, Indonesia[1,2,3,4]
E-mail: *[1]amin.geo87@pips.uin-malang.ac.id , [2]210102110072@student.uin-malang.ac.id,
[3]akmalmuzakki00@gmail.com, [4]210102110007@student.uin-malang.ac.id

Abstract. Web-based learning media is important to develop in order to improve the quality of learning. This research aims to develop Geopedia web media in geography lessons in high school using the Successive Approximation Model (SAM). The development of Geopedia web media in this study used the SAM 1 model with its stages, namely 1) evaluate, 2) design, and develop. Data analysis methods are qualitative descriptive analysis and quantitative descriptive analysis. Qualitative descriptive analysis collected data on reviews and recommendations given by Geography material experts, media experts, teachers, and students. Quantitative analysis in the form of percentage values obtained from the analysis of criteria scores with a Likert scale. Based on the results of the study, the development product in the form of web learning is suitable for use in learning Geography, especially Lithosphere. The feasibility value of the material expert is 91.25%. Then from media experts is 93.33%. Then, the feasibility value from students is 88.44% and the teacher is 88.27%. Therefore, the average feasibility value of this web learning is 91.25%, including in the very effective category.
Keywords. Research and Development; Web-based Learning Media; Geopedia; SAM Model; Geography Learning

A. INTRODUCTION

The material object of geography studies science by emphasising the special characteristics of a phenomenon that must be studied as a whole. According to Marshall (2021), the material object is general and broad, namely the geosphere, including the lithosphere, atmosphere, hydrosphere, biosphere, pedosphere, and anthroposphere. The lithosphere is one of the most important material objects of geography to study, so it is important to integrate in learning. Knowing this lesson, the material studied must be related to geological and geomorphological processes involved in the physical formation of the Earth (Effendi & Akmal, 2020; Handoyo, 2022). In this lesson, greater attention is given to the material of lithospheric dynamics and how it impacts life. Sumanti (2022) explains that observing, talking and reporting, recognising problems and finding solutions to the impact of lithospheric dynamics are the main activities in learning these basic competencies.

Understanding geography materials requires several abilities including high spatial thinking skills. A deep understanding of geography encourages innovation in learning (Han & Abdrahim, 2023; Soeharto et al., 2024). Teachers are expected to develop creativity for more efficient learning (Swanzy-Impraim et al., 2023). It aims to improve students' spatial thinking ability, which is very useful in understanding geography materials (Kutor et al., 2022; Liu & Biljecki, 2022). Liu and Biljecki (2022) revealed that through improving spatial thinking skills, students are expected to recognise their geographical environment, understand regional characteristics, master regional aspects, and play a role in the management and planning of an area.

In fact, the majority of students do not have good spatial thinking skills, as stated by Salam et al. (2023) and Adzani et al. (2023), who found that the average score of students' spatial thinking ability was low, around 53 and 56.4 respectively. The cause of this low ability is due to the focus of

geography learning that centres on conventional learning methods, as well as the low use of technology by teachers. Research by Alvia et al. (2024) also showed that more than 50% of students have very poor spatial thinking knowledge, which is caused by the absence of developing analytical tools that are able to address spatial problems thoroughly. As a result, although students have extensive knowledge of one area, they struggle to analyse the space in other locations due to the lack of spatial thinking skills acquired in the classroom.

The results of preliminary observations in class X in Geography at MA Ahmad Yani Jabung, Malang Regency showed that many students did not succeed in achieving the average score on the indicator of spatial thinking questions, with only 57% of 60 students who managed to reach the score. The cause of this low spatial thinking ability in geography is due to the dominant teacher-centred learning pattern in the school, where teachers are more likely to provide material by lecturing and giving examples of spatial analysis problems without actively involving students. The limitation of students' projects and the lack of independent involvement in assignments make the learning process less engaging for students. In addition, teachers have never used media in learning.

The solution that can be done to overcome the low spatial thinking ability is by utilising web-based technology (Li, 2023). The utilisation of technology to overcome this problem is the use of web-based learning media. The use of web learning media is based on its advantages, namely 1) improving learning outcomes (Luzyawati et al., 2024); 2) increasing learning interest (Fauziyah & Triyono, 2020; Sari & Trisnawati, 2021); 3) increasing cognitive understanding (Sinclair et al., 2024); dan 4) increasing creativity (Maslin et al., 2023). Based on this empirical evidence, it can be concluded that web-based learning media is important to develop in order to improve the quality of learning. This research aims to develop Geopedia web media in geography lessons in high school using the SAM model.

B. METHODS

This type of research is Research and Development (R&D). This research aims to produce Geopedia web media products, so the researchers used the *Successive Approximation Model* (SAM) development model (SAM) (Allen & Sites, 2012). The development of Geopedia web media in this study used SAM model 1 with its stages, namely 1) evaluate, 2) design, and develop (see Figure 1).

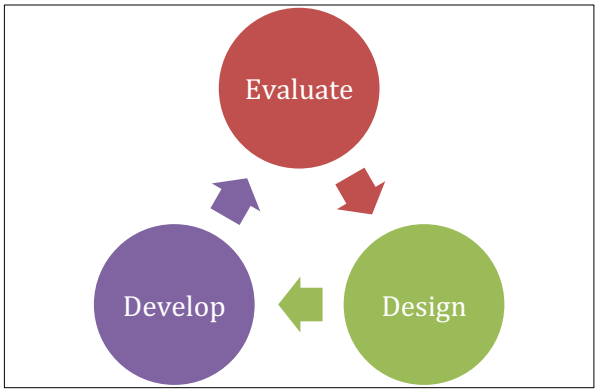


Figure 1. Model SAM 1

Two data analysis methods were used in this study, namely, qualitative and quantitative descriptive analysis. Qualitative descriptive analysis collected data on reviews and recommendations given by Geography material experts, media experts, teachers, and students. The results of the qualitative analysis were then used to revise the Geopedia web media product.

Quantitative analysis used percentage descriptive statistics to process data obtained from the analysis of criterion scores with a Likert scale (1-5) with 16 questions for geography material experts, 16 questions for media experts, 15 questions for students, and 15 questions for teachers.

The percentage formula for each subject's answer was found using the following formula (Arikunto, 2002).

$$\text{Percentage (\%)} = \frac{\sum(\text{Overall Questionnaire Answer})}{\text{N} \times \text{n} \times \text{Highest Score}} \times 100\%$$

Explanation:
N = number of respondents
n = number of all questionnaire items

To be able to give meaning and make decisions, the following provisions are used.

Table 1. Criteria Percentage Value

Achievement Level (%)	Qualification	Description
≥ 86	Very Effective	Feasible
≥ 71 – < 86	Effective	Feasible
≥ 56 – < 71	Moderately Effective	Not Feasible
≥ 41 – < 56	Less Effective	Not Feasible
< 41	Very Less Effective	Not Feasible

Source: Arikunto (2003)

C. RESULT & DISCUSSION

Development Process

The product of this research is Web Media Named 'GEOPEDIA'. This Geopedia web media aims to facilitate students and teachers in classroom learning in Geography subjects, especially Lithosphere material. The stages of developing this media include Evaluate, Design, and Develop.

At the evaluation stage, researchers began with an analysis or evaluation related to the situation, needs, and goals of MA Ahmad Yani Jabung students. Researchers conducted observations and unstructured interviews. The following results were obtained by researchers, namely: (a) learning activities are less interactive, (b) learning experiences are less memorable for students, (c) rarely use media, especially powerpoint due to lack of tools and infrastructure (d) there are only exercise books or LKS.

In the design stage, researchers developed an outline of the menu and content to be included, and collected data in the form of Lithosphere materials that would be integrated into the Geopedia web platform. This process involved selecting important topics, designing an intuitive navigation structure, and systematically collecting and organising information for easy access and understanding by students. In addition, the researcher also ensured that all content collected was relevant and of high quality to support effective learning objectives.

In the development stage, researchers designed and built a website using the WordPress platform, and incorporated the outline that had been compiled into the Geopedia web. Next, the researcher conducted in-depth validation for the material and media experts to identify and improve the shortcomings in the web media. This validation process includes testing the functionality, interface, and performance of the system to ensure that all features run well and are user-friendly. Once all issues were resolved and researchers were confident in the quality of the web, the next step was to trial it to students and teachers during a lesson to get feedback and make further improvements.

Product Specifications

For smartphone users, the minimum operating system is Android KitKat 4.0, and for PCs, the minimum is Windows 7. The app is developed using WordPress and accessed through a browser, automatically taking the user to the learning menu. Specifically, after logging into the web, users will see an image display before entering the opening menu, and can click once to go to the main menu. To exit the web, the user can click the 'back' button on the smartphone or browser.

Flow Using the Web

The procedure for using this media is equipped with various menus that can be utilised by users for various purposes. For a clearer view of the menu options available on the Geopedia web platform, please refer to Figure 2, which displays the complete interface of the menus.

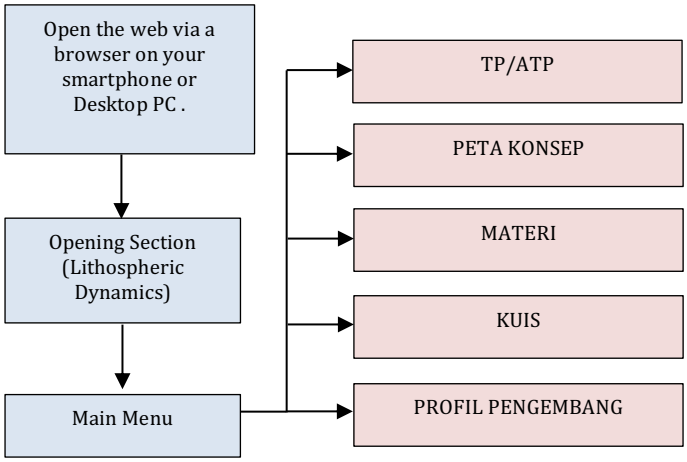
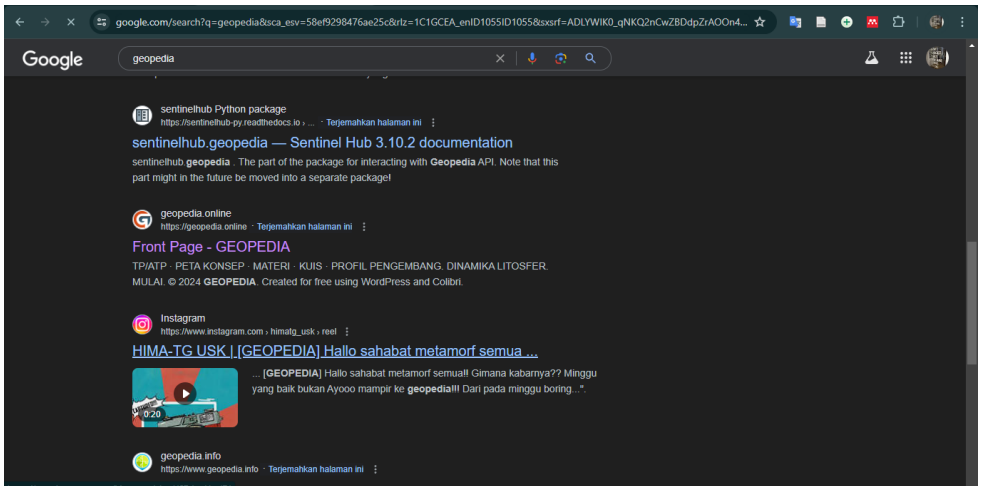
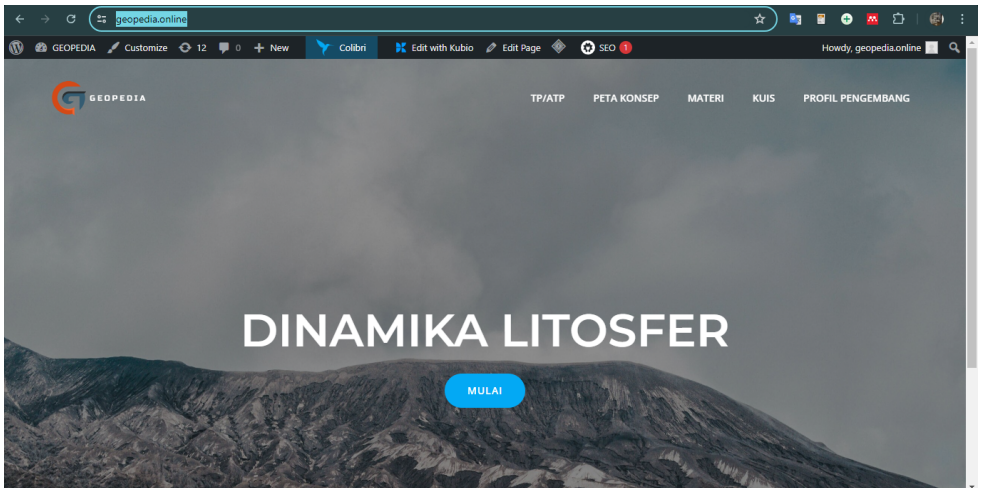


Figure 2. Web Usage Flow

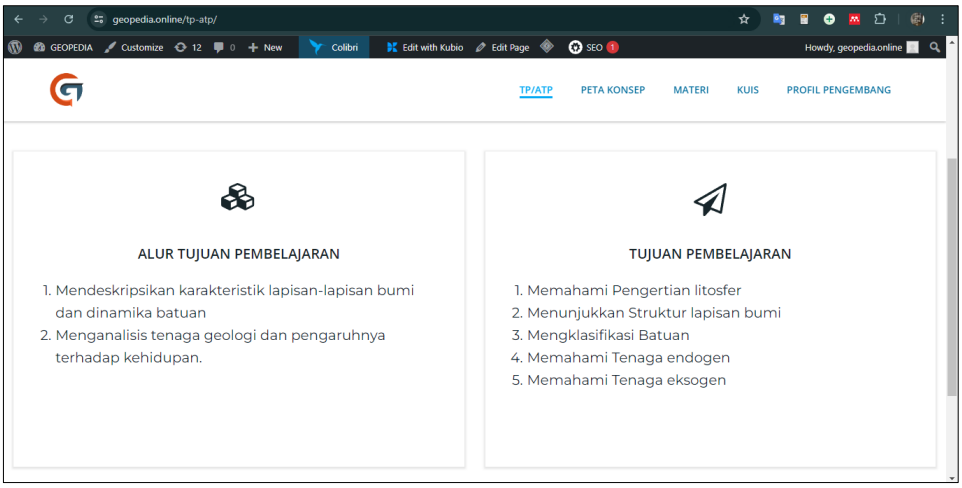
1) Open a web browser and type 'geopedia.online' (link: https://geopedia.online/)



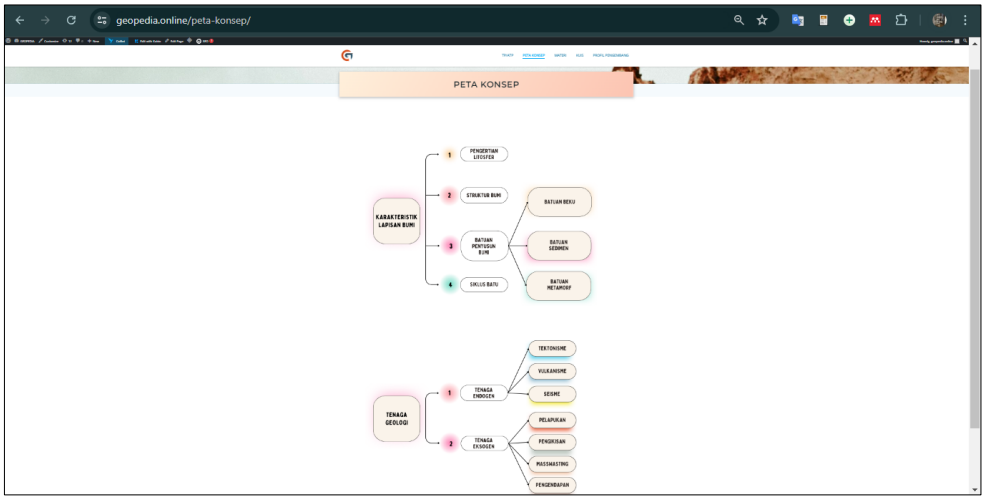
2) After clicking, an image of the opening display of the application will appear. It can be seen in the following image.



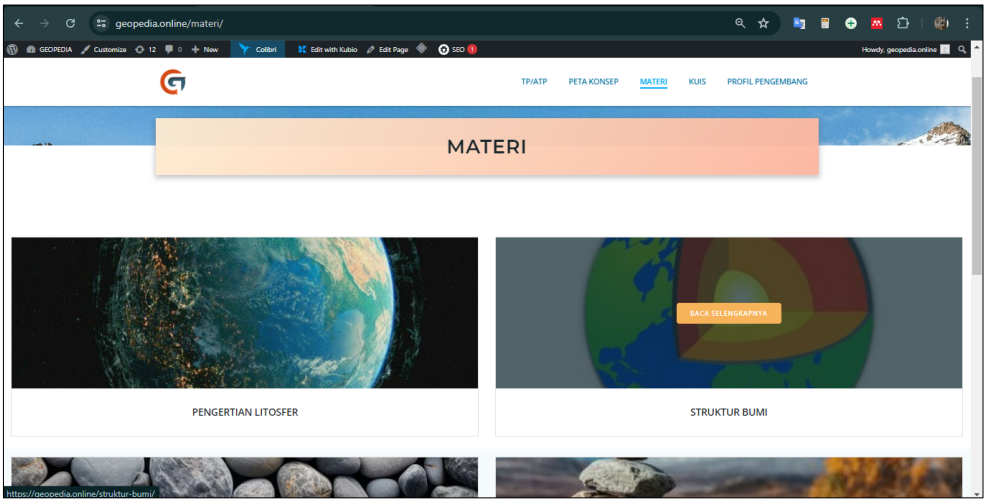
3) It will then automatically go to the introduction section. Click the **START** button. After that, the user is directed to the learning objectives menu or the flow of learning objectives as a learning prefix. The picture can be seen below.



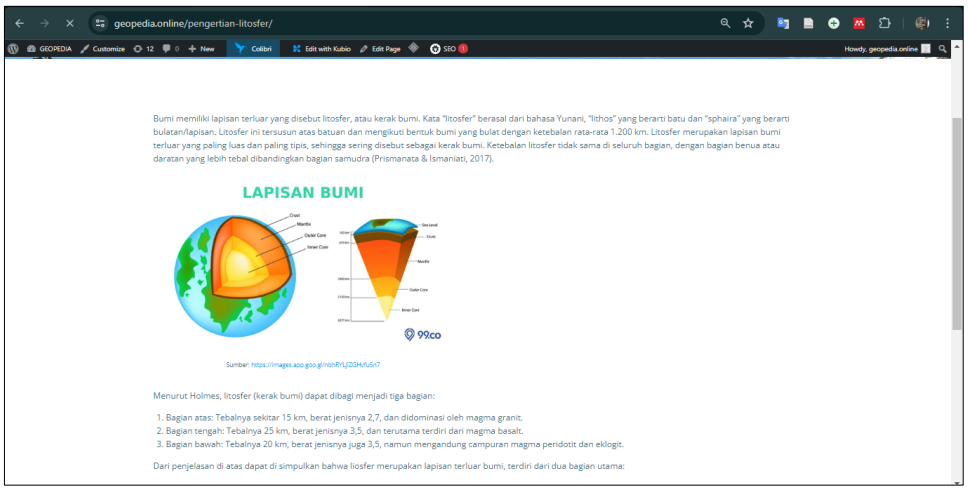
4) Then, users can visit the Concept Map Menu. It can be seen in the following picture.

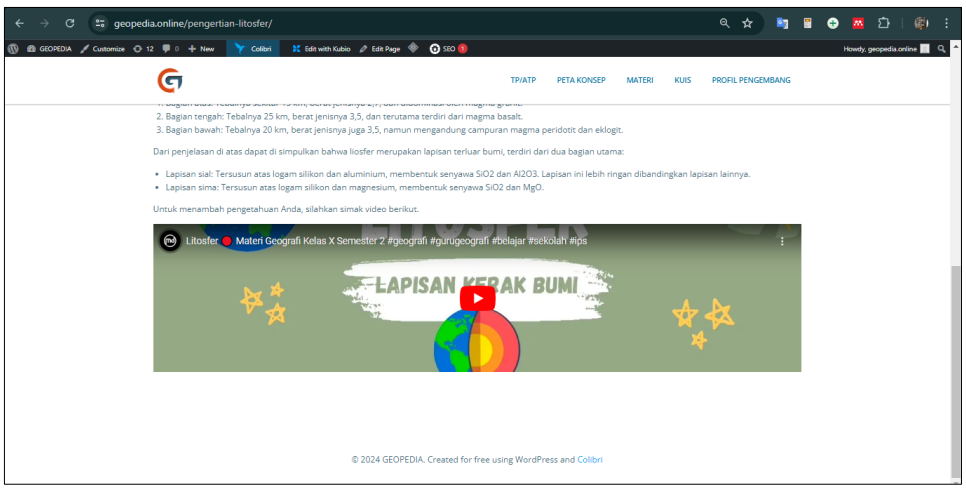


5) Then the user can press the material menu related to the Lithosphere. It can be seen in the following picture.

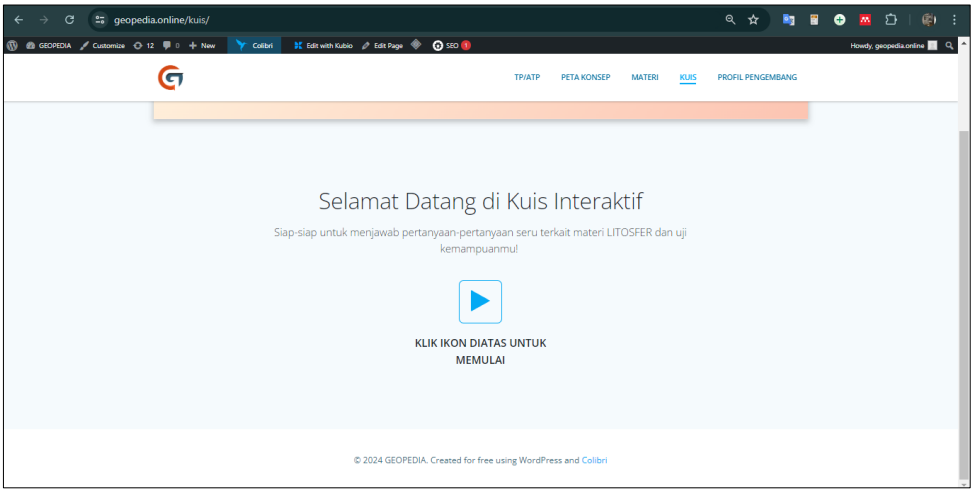


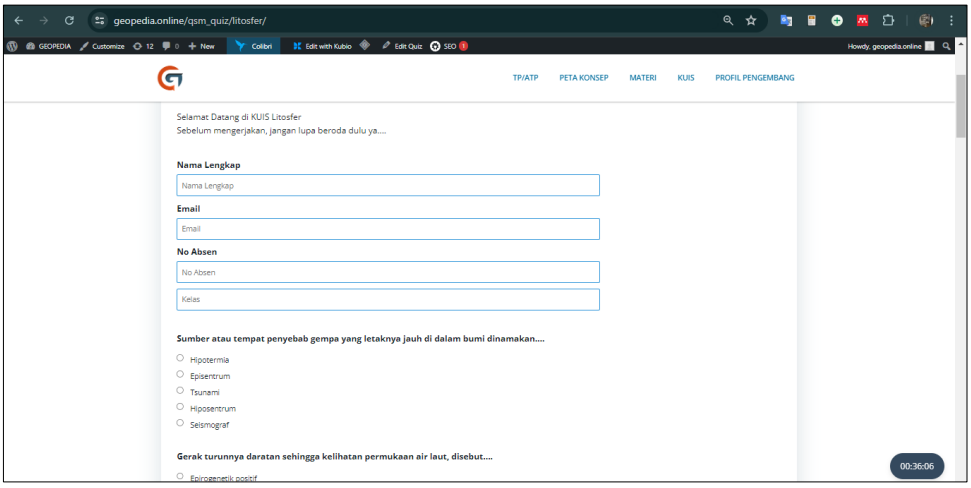
6) Each material section has learning resources that can be used by students, both images or videos. It can be seen in the following picture.



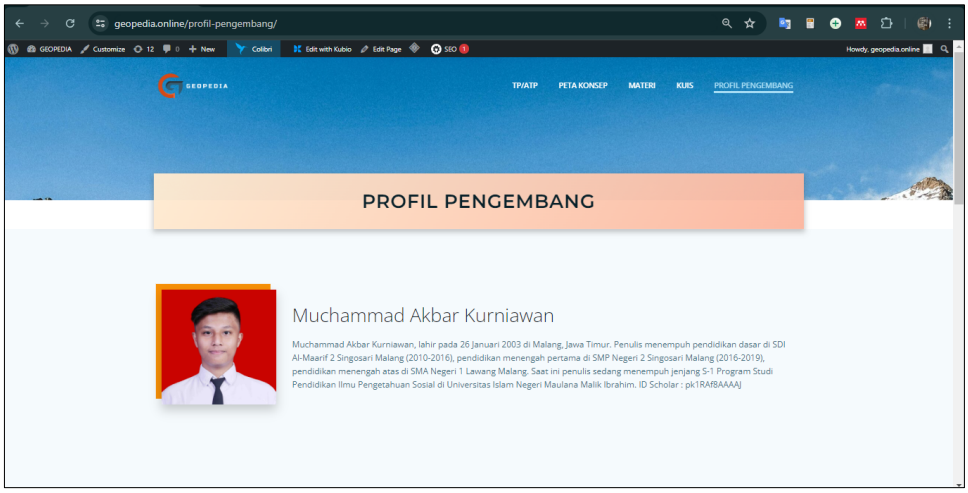


7) Then, students can take a quiz to measure the level of understanding of the lithosphere material. It can be seen in the following picture.





8) Next, users can visit the Developer profile menu. It can be seen in the following picture.



Product Feasibility

The data presented, namely data obtained from the following stages: (1) material expert validation data; (2) media expert validation data; and (3) field trial data. At the validation stage, each expert is given an assessment instrument and the Geopedia web media product developed to be given

a score according to the expertise of each validator. The highest score of the instrument is five (5), while the lowest score is one (1).

Table 2. Geography Material Expert Response Questionnaire Score Data

No.	Question Items	Score
1.	Breadth of material on Lithospheric Dynamics	5
2.	Depth of Lithospheric Dynamics material	5
3.	Accuracy of facts	5
4.	Correctness of theory or concept	4
5.	The logicality of the concept	5
6.	The conciseness of the concept	4
7.	Correctness of principles / laws	5
8.	Accuracy of procedures/methods	5
9.	Suitability with the development of science	5
10.	Relevance of features and references	4
11.	Fostering work ethic	3
12.	Fostering competitiveness	5
13.	Fosters curiosity	5
14.	Provides a challenge to learn further	4
15.	Develops academic skills	4
16.	Presents material contextually	5
Total		**73**
Percentage (%)		**91.25**

Source: Data Processed

The results of the assessment from the Geography material expert showed that the Geopedia web media was very effective with a feasibility percentage of 91.25%. Although no major revisions were needed, improvements were made based on the material expert's suggestions, such as using up to date examples and adding problem solving-based performance sheets. The researcher also coordinated with the material expert to improve the material according to the input given.

Table 3. Media Expert Response Questionnaire Score Data

No.	Question Items	Score
1.	Media design in accordance with Lithospheric Dynamics material	5
2.	The typeface used is clear and legible	5
3.	Media packaging according to Lithospheric Dynamics material	5
4.	Media design is interesting to look at	4
5.	Media design presents real examples of Lithospheric Dynamics material	4
6.	Colour selection in the media	5
7.	Unique media selection	5
8.	Contains the integration of the concept of Lithospheric Dynamics material	4
9.	The media display is attractive and easy to carry/move	5
10.	Given the title / description of the media	5
11.	Media presentation is able to develop spatial abilities	4
12.	Video is related to the material	5
13.	The video sound used is clear	5
14.	Between video and sound is appropriate	5
15.	Presentation of material in the media is done coherently	5
16.	Media presentation supports students to be involved in learning	4
Total		**70**
Percentage (%)		**93.33**

Source: Data Processed

The data recapitulation from table 3 shows the results of the questionnaire assessment from media experts, with a percentage response of 93.33%, which indicates that the Geopedia web media meets the eligibility standards and is very effective. Although it does not require revision,

improvements are made based on the media expert's suggestions to improve the product. In addition to quantitative data, there were also qualitative data in the form of comments from media experts, such as increasing the interactivity of concept maps and materials, and making quizzes more varied. Researchers made improvements according to these suggestions and coordinated with media experts for revision of the learning design.

Product Trial

The Geopedia web media development product trial was conducted on grade 10 students of MA Ahmad Yani Jabung. Geopedia web products developed along with questionnaires were given to Geography students and teachers. Before the students and teachers filled in the response questionnaire sheet, the researcher first explained the purpose of the questionnaire and the Geopedia web media development results. Furthermore, students and teachers were given time to assess and respond to the Geopedia web media product based on the questionnaire questions. The next stage of web learning media was improved based on the comments of students and teachers.

Table 4. Data Recapitulation of Student Responses Questionnaire Ahmad Yani Jabung

Student	Respondents' Answers to Item Number:															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
1.	5	4	3	2	5	5	4	5	3	4	4	5	5	5	5	64
2.	5	5	5	4	5	5	4	4	5	4	4	5	5	4	5	69
3.	5	4	3	4	5	5	4	5	3	4	4	5	5	5	5	66
4.	5	4	4	5	5	4	4	5	4	4	4	5	5	5	5	68
5.	3	5	5	5	5	4	5	5	5	5	5	5	5	3	5	70
6.	5	5	4	5	3	5	2	3	4	4	5	5	4	3	5	62
7.	5	5	3	2	4	3	3	4	5	5	4	4	5	5	3	60
8.	5	5	4	5	4	5	3	4	4	4	3	4	4	4	5	63
9.	5	5	4	5	4	5	3	4	4	5	5	4	4	5	5	67
10.	5	5	5	5	4	5	4	5	5	5	4	5	5	5	5	72
11.	5	4	5	4	4	5	5	4	5	4	5	3	5	5	5	68
12.	5	4	5	4	4	5	5	4	5	4	5	5	4	5	5	69
13.	4	5	4	3	4	5	4	4	4	4	3	3	3	3	2	55
14.	4	4	3	3	3	3	3	3	5	5	4	5	5	4	5	59
15.	5	4	5	5	4	5	4	5	4	4	4	5	5	5	5	69
16.	5	5	5	4	5	4	4	4	4	5	5	5	4	5	4	68
17.	5	5	5	4	5	4	5	5	5	5	5	4	4	5	5	71
18.	4	5	5	5	5	5	5	5	5	4	5	5	5	4	5	72
19.	5	4	4	4	4	5	5	5	3	5	4	5	5	5	5	68
20.	5	4	3	5	5	5	3	4	5	5	5	4	3	4	5	65
21.	4	5	5	5	5	5	4	4	5	5	3	4	4	5	5	68
Total																**1.393**
Percentage (%)																**88.44**

Source: Data Processed

Data from table 4 shows that the Geopedia web media received an effective assessment from students, with a response percentage of 88.44%. Although there was no need for major revisions, the researcher made improvements based on students' comments to improve the quality of the product. Students' comments suggested the addition of interactive games and quiz variations. The researcher accommodated these suggestions for further improvement of the web media.

Table 5. Data Recapitulation of Geography Teacher Response Questionnaire

Teacher (Initial)	Respondents' Answers to Item Number:															Total
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
KA	5	5	5	4	4	5	5	4	4	5	5	5	5	4	4	67
Percentage (%)																**92.00**

Source: Data Processed

Table 5 shows the results of the geography teacher's assessment that Geopedia web media is very effective with a feasibility percentage of 92.00%. Although no major revisions were needed, the researcher made improvements according to the teacher's comments, such as adding videos of locations near the school and making the material denser. The researcher also tried to improve the product based on the feedback.

If all respondents who provided comments and responses are analysed into a table, it can be seen in Table 6 below.

Table 6. Recapitulation of Assessment Results of All Respondents on Web Learning Geopedia

No	Correspondent	Percentage (%)	Category					Conclusion
			SE	E	CE	KE	SKE	
1	Material Expert	91,25	√	-	-	-	-	Feasible
2	Media Expert	93,33	√	-	-	-	-	Feasible
3	Students	88,44	√	-	-	-	-	Feasible
4	Teacher	92,00	√	-	-	-	-	Feasible
Rata-rata		91.25	√	-	-	-	-	Feasible

Source: Data Processed

Explanation:

SE : Very effective
E : Effective
CE : Moderately Effective
KE : Less Effective
SKE : Very Less Effective

Based on the results of all recapitulations, it can be concluded that the web learning media has met the appropriate standards. This is evidenced by the average results of expert validation and limited trials of 91.25% Based on this data, it shows that Geopedia web media is in very effective qualifications and is suitable for use as a learning media on Geography material, especially the Lithosphere.

Development of Geopedia Web Media in Geography Lessons

The development of this Web Media called Geopedia follows the flow of the *Successive Approximation Model* (SAM) in all its stages. The first process begins with conducting a thorough evaluation that focuses on analysing student needs. This step is very important to ensure that the media developed can truly meet the learning needs of students and is relevant to the existing curriculum. This evaluation includes identifying the skills and knowledge that students need to acquire, as well as the barriers that may be encountered in the learning process. The data collected from this evaluation becomes the basis for designing and developing the features and content in Geopedia, so that it is expected to provide an optimal learning experience and improve learning effectiveness.

The second stage involves conceptual design, where the outline or framework of the web is carefully created. This design includes systematic planning of the content structure to ensure that the material is presented in a logical and understandable way to the students. The determination of interactive features, such as quizzes, and supporting videos, was carefully done to enhance student engagement and interactivity. A visually appealing and user-friendly layout was also designed to ensure that users can navigate the web easily and enjoy an enjoyable learning experience.

This thoughtful design aims to minimise errors and ensure all web elements support the learning objectives. Every component, from navigation to content presentation, is optimised to help students better understand the material. This careful planning also allows for early identification and resolution of potential problems, so that the development process can run more smoothly and efficiently.

In the final stage, the development of Geopedia web media is done with care and attention to detail. This process includes content creation, programming of interactive features, and technical

testing to ensure that the web works well on various devices and platforms. Validation activities by experts are also an important part of this stage, where experts provide valuable feedback to improve the quality and effectiveness of the media.

In addition, product trials were also conducted on students at MA Ahmad Yani. This trial aimed to obtain direct feedback from the end users, namely the students, regarding their experience in using the media. Based on the feedback from the students, the necessary improvements and adjustments were made so that Geopedia can really be an effective and fun learning tool. With this approach, Geopedia is expected to be able to make a significant contribution in improving the quality of learning in schools.

Feasibility of Geopedia Web Media in Geography Lessons

The results of this study are in line with previous research on web learning development by Amri (2015), Kalatting et al. (2015), Styawati et al. (2020), and Andry & Stefanus (2020). The effect of learning media on spatial thinking also has similarities with previous research conducted by Esterningari (2022), Febrianto et al. (2024), and Mahendra (2024). In contrast, the difference with previous studies is that this study develops web learning to measure students' spatial thinking ability. This is based on the reason that, research that develops web media on spatial thinking ability still does not exist, so it needs to be developed, especially at Ahmad Yani Jabung school.

The Geopedia web media development product applied to Ahmad Yani Jabung students on lithosphere material has advantages. The advantages of web media, including 1) presentation of material in an innovative and effective way in helping students' understanding; 2) provide ease of navigation buttons in accessing topics more in-depth and according to student needs; 3) attractive display design can increase student motivation to learn; 4) presented student worksheets that can be done online; and 5) online learning media that can be accessed anytime, anywhere, and in any condition. The advantages of web learning media development products support the improvement of spatial thinking skills in Geography lessons, especially lithosphere material.

D. CONCLUSION

Product development used the *Successive Approximation Model* (SAM) through the stages of evaluate, design, and develop. Then, the development product in the form of web learning is suitable for use in learning Geography, especially the topic of Lithosphere. The feasibility value of the material expert is 91.25%. Then from media experts is 93.33%. Meanwhile, the feasibility value from students is 88.44% and the teacher is 88.27%. So, the average feasibility value of this web learning is 91.25%, including in the very effective category.

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