

Development of a Biology E-Module Based on Google Sites on Circulatory System and Digestive System Material

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Abstract: Technological developments have a big influence on the learning process. Various positive influences can be seen with technological developments, one of which is electronic learning media. The existence of electronic-based media has a positive impact on learning because of the various advantages it has. In reality in the field, there are still many biology teachers who do not use electronic learning media in the learning process. Learning media that does not utilize technology tends not to attract students' attention due to its monotonous nature. Based on these reasons, researchers developed electronic learning media in the form of e-modules based on Google sites. E-module can visualize and clarify various abstract concepts. E-modules can help teachers to facilitate students in learning and support the learning process. The development of a Google Sites-based e-module was created using the Plomp model which consists of 3 stages, namely the initial investigation stage (preliminary research), the development or prototyping phase (development or prototyping phase), and the assessment phase (assessment phase). The results of the e-module development show that the overall validation value of the Google Sites-based e-module is 86.40% (very valid) from experts. Furthermore, the practicality assessment given by the teacher towards the Google Sites-based e-module showed an average result of 96.25% (very practical).

Keywords: Biology; E-module; Google sites

Introduction

Technological developments have had a major influence on the learning process, as can be seen from various significant changes over the last few decades. These changes make the learning process easier, including creating distance learning and making it easier to provide access to learning material information (Akhsan et al., 2023; Nuri et al., 2023; Setianingrum et al., 2022). Learning materials can now be accessed via the internet, online learning platforms and electronic-based media. The use of technology such as electronic-based media in learning can improve student learning outcomes (Fajrina et al., 2020).

The existence of electronic-based media has a positive impact on learning because of the various advantages it has. These advantages include being able

to create a variety of interesting material content, being easy to carry anywhere, and being able to convey information visually and interactively (Eliyasni et al., 2021; Johan et al., 2022; Kiriana, 2021; Mulyadi et al., 2019; Yevira et al., 2023). Interactive media is really needed in the learning process, especially in subjects that have many abstract concepts (Puspitarini et al., 2019). One subject that has many abstract concepts in it is biology.

Biology is a subject that is closely related to learning media. Interactive learning media is really needed to visualize and clarify abstract material in biology. This is in line with the statement (Aprilia & Suryadarma, 2020; Chaniago et al., 2023; Eroika et al., 2019; Hadiprayitno et al., 2019; Roemintoyo & Budiarto, 2021; Utomo et al., 2020) that not all material in biology learning cannot be observed directly, there is a lot of abstract material that

How to Cite:

Example: Susilawati, S., Doyan, A., Mulyadi, L., & Hakim, S. (2019). Growth of tin oxide thin film by aluminum and fluorine doping using spin coating Sol-Gel techniques. *Jurnal Penelitian Pendidikan IPA*, 1(1), 1-4. <https://doi.org/10.29303/jppipa.v1i1.264>

is difficult for students to understand. To make abstract materials easier for students to understand, more interactive learning media are needed (Santhalia & Sampebatu, 2020; Siti Rhomadhoni, 2022).

In reality in the field, there are still many biology teachers who do not use interactive learning media in the learning process. This is supported by the statement (Pramana et al., 2020), that there are still many teachers who use conventional media in delivering learning material. This is also in line with opinion (Fajrina et al., 2020) where learning should create students to be more active and creative in the classroom. The same reality also occurs at Adabiah 2 High School, Padang City. As a result of observations and interviews with class XI biology teachers, information was obtained that learning media was still minimal and did not meet the needs of all students in the class. Teachers have not utilized technology in the learning media they use. In general, the available learning media are printed books, modules, PowerPoint slides and other less interactive media.

Media that is less interactive tends not to attract students' attention due to its monotonous nature. Monotonous media will have an impact on students' low interest in learning. This is reinforced by the results of the student questionnaire analysis (attachment 5), which shows that 70% of students are less interested when using conventional learning media in the form of printed books or modules. Apart from interest in learning, less interactive learning media also has an impact on low student learning outcomes (Puspita, 2019). This is in line with the results of interviews with biology teachers, that students' test results still have not reached the Minimum Completion Criteria, especially in the circulation system material where 85% of students have not reached the Minimum Completion Criteria score.

E-module is a learning media that is packaged digitally. E-module is able to visualize and clarify various abstract concepts. E-modules can help teachers to facilitate students in learning and support the learning process (Fradila et al., 2021; Irdawati et al., 2023; Muniroh et al., 2023; Nazifah & Asrizal, 2022; Sholichin et al., 2022). The development of e-modules can help students learn independently, be more motivated and have an impact on improving learning outcomes.

Creating an e-module can be integrated using the Google Sites application. Google sites is a facility on Google that has the feature of visiting sites. Visiting sites are managed in the form of websites containing learning texts and videos (Nawawi, 2023; Nurdin et al., 2023; Tora & Rino, 2023). This application is able to make the appearance of electronic modules more attractive with additional animations, images, videos, audio-visuals, games, Google forms, docs, sheets, tables etc (Azis, 2019). Menurut (Muhammad et al., 2023) Google Sites is

an application that is capable of creating various features that support the learning process.

This Google Sites-based e-module will be developed to help students understand learning material through direct experience because they not only listen to the teacher's explanation but also carry out other activities such as observing videos, pictures and carrying out simulations. Research related to Google Sites-based e-modules has been carried out by (Rahmawati et al., 2022), The Google Sites-based e-module is very interesting to use because it is easy to access, stimulates students' interest in learning, makes it easier to understand the material and uses language that is easy to understand according to the students' level of thinking.

Based on the explanation above, Google Sites-based e-modules can be used as an alternative to improve student learning outcomes. So, researchers will conduct research with the title "Development of a Biology E-Module Based on Google Sites on Circulatory System and Digestive System Material for Class XI Students at Adabiah 2 Padang High School".

Method

Types of research

This type of research is research and development, which aims to produce a Google Sites-based e-module that is valid, practical and effective. The development model used in this research is the Plomp model. This model consists of three stages, namely the initial investigation stage, the development or prototyping phase, and the assessment phase) (Plomp & Nieveen, 2013).

Data analysis technique

Analysis of E-Module Validity Data Based on Google sites

The data collected from this research is the result of validating an e-module based on Google Sites. The validation results were analyzed using quantitative and qualitative analysis with the following steps: The scoring for each indicator is based on the validity instrument rubric with the following conditions: Score 4 = If 4 criteria are met, Score 3 = If it meets 3 criteria, Score 2 = If 2 criteria are met, Score 1 = If it meets 1 criteria; Determine the highest score : Highest score = number of validators x number of indicators x maximum score; Determine the score obtained by adding up the scores from each validator; Determine the validity value in the following way.

$$\text{Validity value} = \frac{\text{Total score obtained}}{\text{Highest score total}} \times 100\% \quad (1)$$

To determine the level of validity of e-modules based on Google Sites, it can be determined using the criteria from (Riduwan, 2009) following: 81% - 100% = very valid, 61% - 80% = valid, 41% - 60% = quite valid, 21% - 40% = less valid, 0% - 20% = invalid; Analysis of E-Module Practicality Data Based on Google Sites

Analysis of Google Sites-based e-module practicality questionnaire data used for teachers and students was carried out in the following steps: The scoring for each indicator is based on the practicality instrument rubric with the following conditions: Score 4 = If 4 criteria are met, score 3 = If 3 criteria are met, Score 2 = If 2 criteria are met, Score 1 = If 1 criterion is met; Determine the highest score: Highest score = number of teachers and students x number of indicators x maximum score; Determine the score obtained by adding up the scores of each teacher and student; Determine the practicality value in the following way.

$$\text{The value of practicality} = \frac{\text{Total score obtained}}{\text{Highest score total}} \times 100\% \quad (2)$$

To determine the level of practicality of an e-module based on Google Sites, it can be determined using the criteria from (Riduwan, 2009) following: 81% - 100% = very practical, 61% - 80% = practical, 41% - 60% = quite practical, 21% - 40% = not very practical, 0% - 20% = not practical.

Result and Discussion

Initial Investigation Phase (Preliminary Research Phase)

Problem Analysis

Researchers conducted interviews with biology teachers and gave questionnaires to class XI MIPA students at Adabiah 2 High School Padang. Based on the results of an interview with Mrs. Mutia Sari as a biology teacher at SMA Adabiah 2 Padang on May 23 2023, students at SMA Adabiah 2 Padang only use learning media in the form of books, modules, student worksheet and articles from the internet. Android-based electronic learning media such as e-modules that can be used on students' cellphones are not yet available. Student learning outcomes are also unsatisfactory, only a portion of all students in one class have their scores reaching the specified Minimum Completion Criteria.

Needs Analysis

Based on the results of the analysis of the need for e-modules based on Google Sites, it is known that 90.14% of students stated that they agreed if there were learning materials in the form of e-modules based on Google Sites in schools. 85% of students agreed that the Google Sites-based e-module consisted of an opening

page, cover, menu, profile, foreword, instructions for use, learning outcomes, learning objectives, learning activities, learning videos, evaluation, evaluation key, glossary and bibliography. 100% of students agreed that the Google Sites-based e-module was equipped with biology material and displayed interesting pictures and videos to make it easier to understand the material.

Curriculum Analysis

Based on the results of the curriculum analysis that has been carried out, researchers have determined the sequence and scope of material according to the learning outcomes contained in the Merdeka Curriculum. Researchers have also formulated learning outcomes and objectives in the circulatory system and digestive system material.

Concept Analysis

The concepts that will be presented in the Google Sites-based e-module are for circulatory system material including the heart, blood vessels, blood circulation, blood components, disorders of the circulatory system, and technology in the circulatory system. The material on the Digestive System includes food substances, digestive tract and glands, disorders of the digestive system

Development and Prototyping Phase (Development or Prototyping Phase)

Prototype I Development Results

The design of the Google Sites-based e-module prototype begins with designing a Google Sites-based e-module storyboard, then continues with designing the systematic presentation of the material and the learning objectives to be achieved which are divided into several learning activities and are guided by the learning outcomes in the Merdeka Curriculum. This Google Sites based e-module on the Circulatory System and Digestive System material was created using the Google Sites application. The components in the Google Sites-based e-module are as follows.

Splash Page

The opening page of the Google Sites-based e-module begins with the appearance of the symbol and the words tut wuri handayani, then continues with the words "Biology Learning Module Material for Circulatory and Digestive Systems for Class Circulation or Digestive System matter.



Figure 1. Opening Page

E-Module Cover Based on Google sites

The Google Sites-based e-module cover display is presented by containing the identity of the Google Sites-based e-module which consists of the material title, prayer before studying and is then equipped with several menu buttons including introduction, materials, learning videos, games, and evaluation. The Google Sites-based e-module cover also includes supporting images that match the material created. The colors on the Google Sites-based e-module cover for the circulatory system material is dominated by dark red and white, while the digestive system material is dominated by blue and white. These three colors were chosen because they are bright colors that are popular with teenagers as target users of Google Sites-based e-modules. And these colors also clarify the writing in the Google Sites-based e-module (Akhmadi et al., 2022; Sary &Wahjudi,2015).



Figure 2. Circulation system material cover



Figure 3. Cover of the digestive system

Introduction

The introductory section of the Google Sites-based e-module contains several important information including module identity, learning outcomes, learning objectives, concept map, brief description of the material, and instructions for using the e-module. This section uses blue and white to ensure important information is conveyed well and is easy to read.



Figure 4. Introduction

Material

The material displayed on the Google Sites-based e-module is presented with images that correspond to the

navigation buttons that students will click on. In the circulatory system material section, if students want to go to the heart material section, students can click the navigation button with a picture of a heart. The navigation buttons in the material section are also accompanied by writing to make it easier for students. The circulatory system material is dominated by red and white which corresponds to the color of blood and the human circulatory system. The digestive system material section is dominated by green and white to make it easier to read.



Figure 5. Circulation system material



Figure 6. Digestive System Material

Tutorial video

The learning video display on the Google Sites-based e-module is presented by containing learning videos related to the material to be studied and is useful for making it easier for students to understand concepts that are difficult to understand. The learning video page has a blue and white background for each learning material. The learning video page also has a home button to return to the menu and a next button to continue with another learning video.



Figure 7. Learning Video

Evaluation

The evaluation display on the Google Sites-based e-module is presented using a Google form. The evaluation section first contains instructions for working on the questions, then there is an identity section that must be filled in first, namely the name and absence number of the student concerned. The evaluation contains multiple choice questions (objective) and description questions that students must complete, then at the end of the evaluation there is a score from the evaluation results that have been carried out. The evaluation page has a green background for the Circulation System material and light blue for the Digestive System material. The learning evaluation page also features a home button to return to the menu and a next button to continue to the next question.

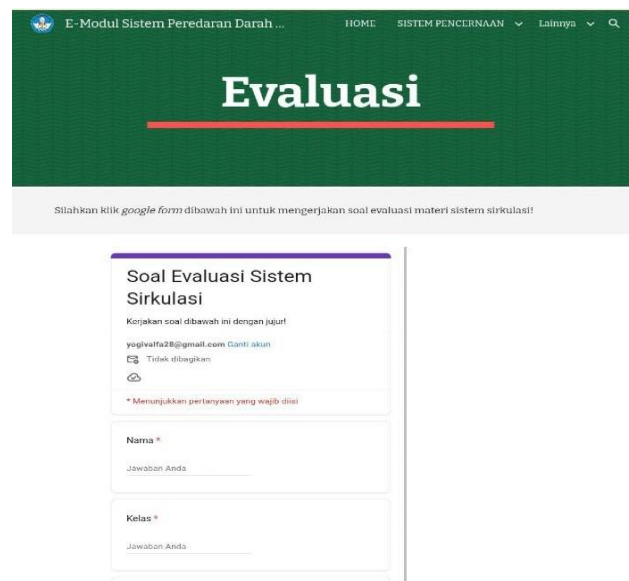


Figure 8. Evaluation

Answer key

The answer key display on the Google Sites-based e-module is presented by containing answer keys for evaluations which are useful for students so they can find out the correct answers to the evaluations they have completed. The evaluation key page has a blue and white background, both Circulatory System material and Digestive System material. The evaluation key page also includes a home button to return to the menu.

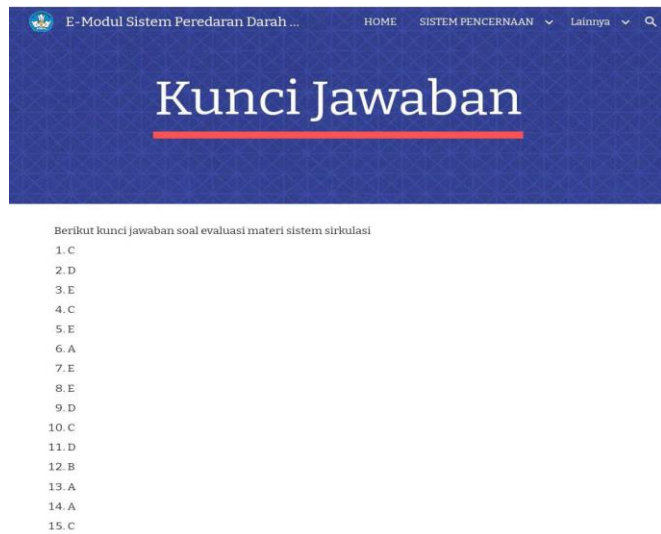


Figure 9. Answer Key

Bibliography

The bibliography display on the Google Sites-based e-module is presented by containing book references used in creating material on the Google Sites-based e-module. The bibliography page has a purple and white background for the Circulation system material and pink and white for the Digestive System material. The bibliography page also has a home button to return to the menu.

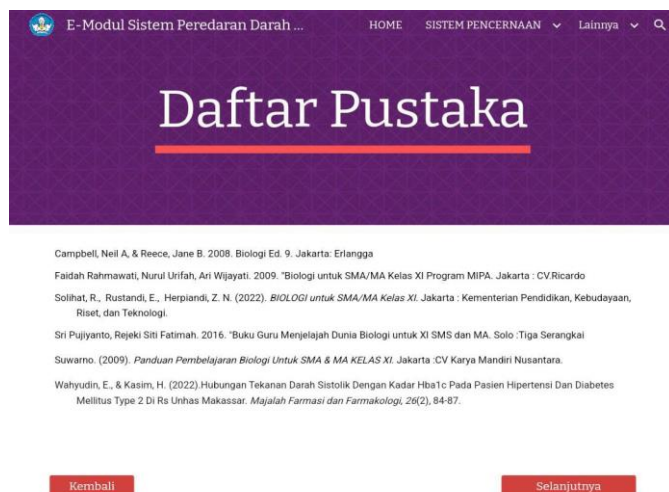


Figure 10. Bibliography

Glossary

The glossary display on the Google Sites-based e-module contains definitions of terms related to the circulatory system and digestive system. This glossary functions to help students understand foreign terms in the material. The glossary section has blue, green and white backgrounds for each material. The glossary page also has a home button to return to the menu.

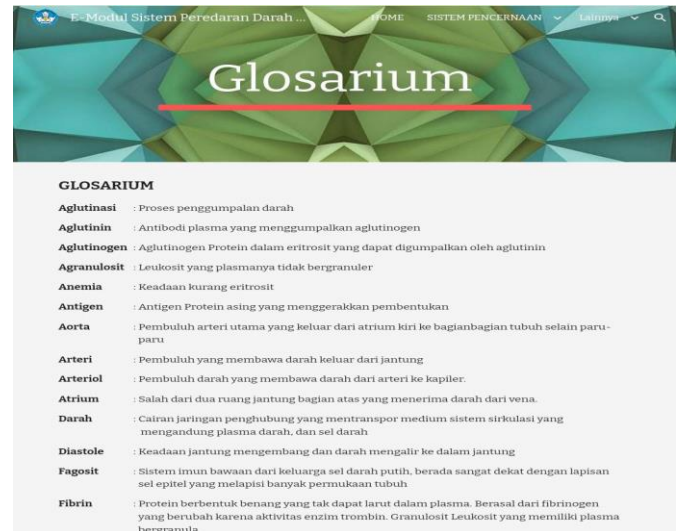


Figure 11. Glossary

After the Google Sites-based e-module was designed and results were obtained from prototype I, a self-evaluation was carried out by the researcher. The results of the self evaluation can be seen in Table 1.

Table 1. Self Evaluation Results

Repair	Follow-up
There are differences in writing size in the material description section.	In the description section of all the material the text is equalized to 14 pt.
There are different types of writing in the material description section.	The type of writing in the material description section is the same as "Comic Sans MS".
There are several spelling errors	Fixed word errors Fixed image errors

Prototype II Development Results

Improvements from the self-evaluation resulted in prototype II. The next stage is expert review and one to one evaluation on prototype II. Expert assessment is carried out based on four requirements, namely construction, content, graphics and language aspects. The formative evaluation used is an e-module validation sheet based on Google Sites. The quality criteria to be obtained at this stage is the validity of the product that has been made. The experts (experts) who validated the

Google Sites-based e-module that was developed consisted of four lecturers. The results of the validity of the Google Sites-based e-module on the Circulatory System and Digestive System material can be seen in the following table 2.

Table 2. Google Sites Based E-Module Validity Test Results

Rated aspect	Average (%)	Category
Construction Aspects	83.12	Very Valid
Content Aspect	85.93	Very Valid
Graphic Aspects	85.93	Very Valid
Language Aspects	90.62	Very Valid
Amount	345.60	
Average	86.40	Very Valid

Based on the validation results in Table 2, it can be concluded that the requirements to fulfill the validity criteria for a Google Sites-based e-module have been met. This can be seen from the overall average validation value of the Google Sites-based e-module which is 86.40% (very valid). Therefore, the Google Sites-based e-module on the Circulatory System and Digestive System material developed can be used for the next stage of testing. However, there are still several suggestions from validators that are used for revision. The suggestions

Table 3. Suggestions and Improvements from Validators for Google Sites-based E-Modules

Validator	Revision Suggestions
Abdurrahman	Pay attention to punctuation as in command sentences you must use the sign "!"; Pay attention to the foreign language writing adjusted to the description.
Darmansyah	On the front page, reduce the dominant color red; In the introduction, avoid sentences that are too long; Reduce writing that uses a different color background
Suci Fajrina	Improve the learning objectives section, readjust it more; Include quotations on each material and image; Correct the color parts that are less attractive
Elsa Yuniarti	Use scientific sentences in every material explanation; Revise parts of the concept map, clarifying them further; Avoid colors that don't clarify the writing; Each picture presented is adapted to the written narrative

The next step was to revise the Google Sites-based e-module on the Circulatory System and Digestive System material based on suggestions given by the validator and taking into account the assessment of students in the one-to-one evaluation.

Prototype Development Results III

Improvements from the expert validation stage (expert review) and the one-to-one evaluation stage (one to one evaluation) resulted in prototype III which was then carried out in the next stage, namely practicality testing by a small group. At this stage, an evaluation was carried out from six SMA class XI MIPA students with different levels of ability (high, medium and low), each consisting of two members. The Google Sites-based e-module which was valid in prototype III form was continued for small group testing. This formative

evaluation was carried out to see the practicality of the Android-based e-module for a small number of students, namely six students with different levels of ability (high, medium and low). Practical results in small groups can be seen in Table 4.

given by the validator can be seen in Table 3. Apart from the expert review stage or validity assessment from experts, during the development of the prototype stage, stage II also carried out one to one evaluation. At this stage three student with different abilities (high, medium and low) were asked to assess the Google Sites-based e-module that had been developed. Evaluation activities were carried out at school, where the researcher explained the Android-based e-module being developed, then interviews were conducted using interview sheets filled in by students.

Based on the results of interviews conducted with students, it is known that the Google Sites-based e-module developed is easy for students to understand and the design and appearance of the Android-based e-module makes students interested in reading and studying it. Apart from that, students revealed that the existence of electronic learning materials such as e-modules based on Google sites really helped students in learning. This is in accordance with the statement (Astalini et al., 2019; Istuningsih et al., 2018; Logan et al., 2021; Nurhasnah et al., 2020; Purnamasari et al., 2020; Sari et al., 2021) that e-modules are innovative learning media and are able to help students in the learning process.

evaluation was carried out to see the practicality of the Android-based e-module for a small number of students, namely six students with different levels of ability (high, medium and low). Practical results in small groups can be seen in Table 4.

Table 4. Results of E-Module Practicality Tests Based on Google Site in Small Groups

Assessment Aspects	Average (%)	Category
Ease of Use	86.58	Very practical
Learning Time	90.67	Very practical
Efficiency		
Benefit	88.11	Very Practical
Amount	267.36	
Average	89.12	Very Practical

Based on the results of the small group practicality

test in Table 4, with an overall average of 89.12% (very practical). This shows that the Google Sites-based e-module developed is practical and can be used for large group trials at the field test stage.

Assessment Phase (Assessment Phase)

Practical Results of E-Module Based on Google Sites by Large Group Students (Field Test)

The large group practicality test (field test) aims to see the practicality of the Google Sites-based e-module used in the learning process. In this research, a practicality test of the Google Sites-based e-module was carried out in class XI IPA 4, totaling 35 students. Aspects looked at include ease of use, efficiency of learning time, and benefits. The practicality test results in the field test can be seen in Table 5.

Table 5. Google Sites Based E-Module Practicality Test Results in Field Test

Assessment Aspects	Average (%) Category	Average (%) Category
Ease of Use	86.98 Very practical	86.98 Very practical
Learning Time Efficiency	87.46 Very practical	87.46 Very practical
Benefit	85.21 Very Practical	85.21 Very Practical
Amount	256.34	256.34
Average	85.45 Very Practical	85.45 Very Practical

Based on the practicality results of students in Table 5, it can be seen that the practicality assessment given by students towards Android-based e-modules shows an average result of 85.45% (very practical). The practicality test results show that the Google Sites-based e-module is very practical for students to use in the learning process.

Practicality Test of E-Module Based on Google Sites by Teacher

This activity was carried out to see the practicality of e-modules based on Google Sites. This assessment was carried out by a biology teacher who teaches at Adabiah 2 Padang High School. Data on the practicality of Google Sites-based e-modules by teachers was obtained from the Google Sites-based e-module practicality questionnaire given to teachers. The results of the module practicality data analysis can be seen in Table 6.

Table 6. Results of E-Module Practicality Test Based on Google Sites by Teachers

Assessment Aspects	Average (%)	Category
Ease of Use	93.75	Very practical
Learning Time Efficiency	100	Very practical
Benefit	95	Very Practical
Amount	288.75	

Average 96.25 Very Practical

Based on the results of the teacher's practicality in table 6, it can be seen that the practicality assessment given by the teacher for the Google Sites-based e-module showed an average result of 96.25% (very practical). The results of the practicality test show that the Google Sites-based e-module is very practical for teachers to use in implementing learning activities.

Conclusion

The Google Sites-based e-module on the Circulatory System and Digestive System material that has been developed has validity in the very valid category based on the validator's assessment. The Google Sites-based e-module on the Circulatory System and Digestive System material that has been developed has practicality in the very practical category based on assessments by teachers and students in class XI Science at SMA Adabiah 2 Padang.

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Author Contributions

This article can be published because of maximum team collaboration, namely Yogi Valfa, writer 1, Abdul Razak, writer 2, Suci Fajrina, writer 3, and Elsa Yuniarti, writer 4. Writers 1 and 2 designed the materials and design of the e-module being developed, writers 3 and 4 help revise and correct any errors in the development of e-module products based on Google Sites.

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Conflicts of Interest

The author publishes this article for research and publication purposes. There are no conflicts or other interests in writing this article.

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