



DEVELOPMENT OF WEB-BASED INTERACTIVE LEARNING MEDIA ON THE TOPIC OF LIVING ORGANISM ADAPTATION USING THE TUTORIAL METHOD

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Abstract. Web-based interactive learning media is a computer-based learning media, which was developed to provide feedback on user activities. The aim of this research is to develop appropriate web-based interactive learning media, on material on the adaptation of living things, using the tutorial method. The type of research used is Research and Development with the ADDIE development model, which has stages of analysis, design, development, implementation and evaluation. The test subjects were sixth grade students at SDN Sungai Miai 11 Banjarmasin. Data collection techniques were carried out using questionnaire techniques and test techniques. The data analysis techniques used are descriptive statistics and n-gain. The result of this research is web-based interactive learning media on the adaptation of living things using the tutorial method, which was developed using HTML, CSS, Bootstrap, Javascript, JSON, Firebase, Canva and Netlify technology. The results of the analysis show that the learning media material content is valid, in the very high category, while the media validity value is in the high category. The results of the practicality test show that the media is declared practical, with student responses on average agreeing. The media is also declared effective, with an n-gain value for medium qualifications and average student learning outcomes above the KKM. Therefore, web-based interactive learning media, on the adaptation of living things, using the tutorial method is declared suitable for use as supporting media in science learning in sixth grade.

Keywords: Interactive learning media, adaptation of living organisms, tutorial method

INTRODUCTION

The rapid advancement of technology and information technology (IT) has had a significant impact on various fields, including education. Teachers are required to utilize IT in teaching, one of which is through the use of IT-based learning media. The use of IT-based learning media is expected to increase students' learning enthusiasm with the aim of making the learning process more effective and efficient (Sukmawati, Pramita, Wiranda, Mahmudah, & Putri, 2022). Based on the results of surveys and interviews with several elementary school teachers in Banjarmasin, teachers have not yet utilized IT-based learning media in science education, especially on the topic of Living Organism Adaptation with its Environment. Consequently, the learning process remains teacher-centered, although active student involvement in learning would make it more meaningful. One alternative learning media that teachers can use is web-based interactive learning media.

Web-based interactive learning media is computer-based instructional media responsive to user activities and enables two-way interaction through the internet. The content presented usually includes text, images, videos, and audio (Astuti, Sumarni,

& Saraswati, 2017; Sukmawati, Ridhani, Adini, Pramita, & Sari, 2021). The use of web-based interactive learning media has advantages in cost and time efficiency, and it can motivate and train students' self-reliance in learning (Junaidi, 2019; Lin, Chen, & Liu, 2017). One widely applied method in computer-based learning is the tutorial method.

Computer-based learning with tutorials employs the computer as a tutor that displays material and practice questions on the monitor. If students answer correctly, the computer will proceed to the next material, but if the answer is incorrect, the computer will review the previous material (Rusman, 2018). This helps students understand the material comprehensively, and students can independently learn for the next material if they have not mastered it well. Research results (Sutarman, 2016) show that the tutorial method in science education is more efficient than the expository method.

This study aims to develop web-based interactive learning media on the topic of living organism adaptation for sixth-grade students using the tutorial method, and to describe the feasibility of the developed media. This research produces interactive learning media containing feedback from student interactions. Previous research has developed many web-based interactive learning media but has not included feedback features as responses to student activities. The results of this study are expected to be used by teachers as an alternative learning media that can support student-centered learning implementation.

METHOD

The design of this research is developmental research. This study will develop interactive media on the topic of Living Organism Adaptation. The development model used is the ADDIE development model consisting of five steps: analysis, design, development, implementation, and evaluation. This development model is suitable for developing learning media, where evaluation and revision are conducted at each phase, resulting in a product that is deemed suitable (Muruganantham, 2015; Sugiyono, 2016). The analysis phase is the initial step to understand the initial needs in the media to be developed, starting from defining the material to be taught to students. Analysis includes general analysis, content analysis, and technology analysis. The next step is the design phase, which involves creating the design of learning media based on the previous analysis. Design includes module or teaching material design, user interface design, flowchart design, and use case diagram design. The next step is the development phase, where the initial design is realized into a product ready for use. Development includes the creation of instructional videos and the creation of web-based interactive learning media according to the design. Subsequently, validation is conducted by experts to assess both the material and the media, and improvements are made based on the feedback and recommendations given during the validation process.

Media feasibility is measured based on validity, practicality, and effectiveness (Nieveen, 2010; Santana Purba, Sukmawati, Wiranda, Suryaningsih, & Aprilian, 2022). Learning media is considered feasible if it meets the criteria of being valid, practical, and effective. Data collection techniques in this study use questionnaire and test techniques.

The questionnaire includes material validation questionnaire, media validation questionnaire, and practicality questionnaire. Material validation is conducted by one Natural Science Education lecturer from FKIP ULM and one teacher from SD Muhammadiyah 3 Banjarmasin. Media validation is conducted by two Computer Education lecturers from FKIP ULM. The subjects for testing the practicality and

effectiveness of the media are 20 sixth-grade students from SDN Sungai Miai 11 Banjarmasin.

The questionnaire is designed using a Likert scale, while the test questions consist of 20 multiple-choice questions. The technique used to analyze the data in this research is descriptive statistical analysis. The validity analysis of the material and media is conducted by first calculating the Expectancy Score (ES) based on the highest score of each item (S), the number of items on the measured aspect (I), and the number of respondents (R). The ES value is calculated using the following formula (Sukmawati, Siswono, & Sutawidjaja, 2018).

$$SH = S \times \sum I \times \sum R$$

Then, based on the assessment results from the validators, the achievement percentage (PC) is calculated using the following formula adapted from Sugiyono (2016).

$$Persentase \text{ Capaian } (PC) = \frac{\text{Skor yang dicapai}}{\text{Skor yang diharapkan } (SH)} \times 100\%$$

Selanjutnya nilai PC dikonsultasikan dengan Tabel 1. Berdasarkan capaian ini, materi dan media dianggap valid apabila PC berada pada kriteria tinggi atau sangat tinggi (Sukmawati, Purba, et al., 2021).

Table 1. Criteria for material and media validation

Achievement Percentage (PC)	Criteria
$PC \leq 43,97$	Low Validity
$43,97 < PC \leq 62,93$	Moderate Validity
$62,93 < PC \leq 82,00$	High Validity
$82,00 < PC \leq 100$	Very High Validity

Adapted from Arikunto (2015)

The practicality of the product is measured from student responses and analyzed descriptively by calculating the average response value (RR). The average response value is obtained based on the sum of response values (R_i) and the number of respondents (N), calculated using the formula.

$$RR = \frac{\sum_{i=1}^N R_i}{N \times \text{Banyak Aspek}}$$

Next, the obtained average value is consulted with Table 2 to determine the practicality category of the tested media. Implemented media is considered practical if the average response is in the Agree category (Sukmawati, Ridhani, et al., 2021).

Table 2. Criteria of Student Responses

Average Value (RR)	Criteria
$3 < RR \leq 4$	Agree
$2 < RR \leq 3$	Neutral
$1 < RR \leq 2$	Disagree

Adapted from Sukmawati, Ridhani, et al., (2021)

The effectiveness data analysis is conducted descriptively on the test results of students before and after using interactive media. Based on the results of the pretest (S_f) and posttest (S_i), the normalized N-gain value (g) is determined using the formula from (Hake, 1999).

$$g = \frac{S_f - S_i}{100 - S_i}$$

The qualification of the average N-gain value is determined based on Table 3. The tested learning media is considered effective if the N-gain value falls within the moderate or high category, and the average student learning outcomes are at least 75 (school KKM).

Table 3. Criteria of student responses

Average Value (RR)	Criteria
$Rg \geq 0,7$	Agree
$0,3 \leq Rg < 0,7$	Neutral
$Rg < 0,3$	Disagree

Adapted from Hake (1999)

RESULTS AND DISCUSSION

This development resulted in web-based interactive learning media on the topic of living organism adaptation for sixth-grade students using the tutorial method. The following are the research results based on the stages that have been conducted.

Analysis Phase

Based on the results of material analysis and pedagogical analysis, it is known that the material on living organism adaptation includes text, images, instructional videos, practice questions, quizzes, and evaluations to train students' abilities after studying the material. The application of the tutorial method, using a computer as a tutor to organize learning and decide whether students will proceed to the next material or go back to the previous material (Rusman, 2018). The tutorial method is expected to help students overcome obstacles in understanding the subject matter. According to research results (Nurhalim, 2021; Utomo & Purwaningsih, 2022), computer-based learning with tutorials is considered more efficient and effective in improving student learning outcomes. Students are guided in detail and accompanied by attractive images that help them quickly receive, understand, and master the material. The steps of implementing the tutorial method in digital learning media can be seen in Table 4.

Table 4. Results of the tutorial method implementation analysis

Tutorial Method Stage	Application on Media
Presentation of information	The pages presenting the material are equipped with images, instructional videos, and exercises.
Question and response	Questions are located at the end of each subsection in the form of multiple-choice questions on the quiz page.
Evaluation of response	When students have completed the quiz, the media will process and provide responses to the students' answers.
Providing feedback on response	The media will provide feedback to determine whether students can proceed to the next material or review the previous material. Feedback is also accompanied by sentences of praise or criticism that can build students.
Remediation	This occurs if students have not completed studying the related material; then, students cannot access the next material and will be directed to review the material again.

Sequencing lesson segment	The learning management segment in the media can be seen in the flowchart at the design stage.
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Based on the results of material and pedagogical analysis, a technological analysis was further conducted. The results of the technological analysis can be seen in Table 5.

Table 5. Results of technology and software needs analysis

Needs	Technology	
Creating the structure of the learning media web page and building content from teaching materials such as text, images, and videos.	HTML	
Creating and organizing layouts, adjusting appearances such as providing background colors, borders, positioning elements, adjusting font sizes, and making the learning media web page responsive.	CSS dan Bootstrap	
Creating interactive features, implementing tutorial methods, validating answers input by students, displaying quizzes and evaluations, and calculating their values on the learning media web page.	Javascript	
Storing, transferring, or exchanging data. In this development, to store quiz questions and evaluations.	JSON	
Storing and synchronizing data such as quiz and evaluation results, stored data include names, student identification numbers, classes, schools, dates, and times, as well as student answers.	Firebase Database	Realtime
Creating and designing images and videos	Canva	
Video editing	Capcut	

Evaluation in the analysis stage includes suggestions to better understand the function of technology and symbols in creating flowcharts and use case diagrams. Additionally, it is also recommended to transform exercise questions from short-answer format to interactive ones with drag-and-drop features, checkboxes, and dropdowns. In line with research findings (Nurhalim, 2021; Sutarman, 2016), computer-based learning can be designed in such a way as to attract students' interest.

Design Stage

In this stage, the design of flowcharts, use case diagrams, databases, media interfaces, and the arrangement of teaching materials is carried out. The teaching materials are then validated by two validators. The validation results of the material can be seen in Table 6.

Table 6. Validation results of the material

Aspect	SH	SC		PC	Criteria
		Validator 1	Validator 2		
Content Validity	96	45	45	94	Very High
Presentation Validity	56	24	27	93	Very High
Language Proficiency	72	36	36	100	Very High
Total	224	106	108	96	Very High

From Table 6, it can be seen that the percentage achievement values are in the Very High criteria. Therefore, the teaching materials are deemed valid, and after being

revised according to suggestions, they can be used as content for the developed learning media. The improvements made include linking the teaching materials with students' daily lives. By connecting the teaching materials with students' daily lives, it will help students understand the material better. This is in line with research findings (Al-Tabany, 2017; Santana Purba et al., 2022; Wariaka & Walalayo, 2020). Selain itu, cakupan materi harus disesuaikan dengan Kompetensi Dasar yang harus dicapai (BSNP, n.d.).

Development Stage

The third stage is development, which includes the development of interactive web-based learning media according to the method used, namely the tutorial method. The learning media can be accessed at <https://adaptasi-makhluk-hidup-vi-sd.netlify.app/>. Here is an explanation of the development results:

- (1) Information presentation is available on the material page. The material page contains the content of the learning media, divided into two columns: the first column contains a table of contents navigation, while the second column contains the presented material content. The material page in the learning media consists of learning objectives and concise content presented in the form of narrative text, images, and instructional videos. The presentation of material content in the form of instructional videos displayed on the material page serves to provide the material along with examples in daily life more comprehensively and attractively. The appearance of presenting the content of the material is shown in Figure 1.



Figure 1. Appearance of material content with instructional video

- (2) After watching the video, students will answer questions related to the video content. After all questions are answered, students can press the check answers button to verify their answers. The system will provide feedback on the answers entered by the students, as shown in Figure 2.



Figure 2. Exercise display after watching instructional videos

- (3) After completing studying one subtopic, students will take a quiz. The quiz consists of ten multiple-choice questions. If the result meets the minimum passing grade, they can proceed to study the next subtopic. If they have not reached the minimum passing grade, students can review the material or repeat taking the quiz, as shown in Figure 3.



Figure 3. Quiz result display if not meeting the minimum passing grade

- (4) After completing studying all the material, students will take an evaluation. The evaluation contains 20 multiple-choice questions covering all the material that has been studied.
- (5) Teachers can monitor students' learning progress through the teacher page. On the teacher page, teachers can add classes, input and delete students, set the minimum passing grade, view and download all quiz and evaluation results.

After completing the development, media validation is conducted. Media validation is carried out by two validators. The results of media validation can be seen in Table 7.

Tabel 7. Results of media validity assessment

Aspect	SH	SC		PC	Validity Criteria
		Validator 1	Validator 2		
Feedback and adaptation	8	3	3	75	High
Presentation of display	64	26	24	78	High
User interaction	24	10	11	88	Very High
Total	96	39	38	80	High

Based on Table 7, the achievement percentage is 80 with a high validity criterion. After being improved according to the validator's suggestions, the learning media can be used for testing. Improvements mainly focus on several navigators that are not functioning well and the arrangement of the Drag and Drop question display. As stated by Nesbit, Belfer, & Leacock (2009), all navigators should function properly.

Implementation Stage

The use of media was tested at SDN Sungai Miai 11 Banjarmasin. The trial involved 20 sixth-grade students. Learning was conducted in 3 sessions, each lasting for 5 teaching hours. Table 8 shows the schedule of activities during the trial use of media.

Table 8. The Try-out schedule

Meeting	Day/ Date	Time	Activities
1	Sunday/ 9 Oct 2023	10:15 – 12:45	1. Pretest 2. Learning with interactive media assistance
2	Tuesday/ 10 Oct 2023	10:15 – 12:45	3. Learning with interactive media assistance
3	Sunday/ 16 Oct 2023	10:15 – 12:45	4. Completing practicality questionnaire 5. Post Test

During the try-out, the research team representatives acted as teachers. Each student used a laptop or Chromebook to access the learning media. With guidance from the teacher, students studied the material independently through the prepared learning media. When students encountered difficulties, they could ask their peers or the teacher for help. Figure 4 shows the students' activities when learning with the help of interactive media.

**Figure 4. Activities of testing media usage**

Based on observations, students participated in the learning enthusiastically. Learning using interactive learning media was a new experience for them. The students' response to the use of interactive learning media was positive. The average student response score was 3.43 with an agreement criterion. Thus, the developed learning media can be considered practical. This is consistent with research findings (Lee, Yusoff, & Tan, 2019; Sukmawati, Ridhani, et al., 2021; Sulistianingsih & Mukminan, 2019) that the use of interactive media prevents students from feeling bored during lessons and motivates them to learn. The pretest and posttest results of the students can be seen in Table 9.

Table 9. Pre-test dan post-test results

Description	Pre-test	Post-test
Minimum Score	25	70.0
Maksimum Score	70	95.0
Average Score	56.5	77.5
Average of N-gain		0.5

From Table 9, it can be observed that the average N-gain score reached 0.5 with a moderate qualification, and the average learning outcome was above 75. Thus, the learning media used can be considered effective. This is in line with research findings (Hidayatullah, yushardi, & Wahyuni, 2015; Permana & Nourmavita, 2017; Sutarman, 2016) that web-based interactive media can improve student learning outcomes.

The web-based interactive learning media on the adaptation of living things that was tested has met validity, practicality, and effectiveness. Thus, the developed learning media can be deemed suitable for use in education. The addition of feedback features as a response to student activities can provide information on how well students understand the learning material. Therefore, each student can regulate their own learning pace. Teachers no longer need to assess students' work; everything is done by the application. Thus, teachers can have more time to prepare lessons and provide guidance to students who need it.

This learning media has not been equipped with features for monitoring students' learning activities, as well as limitations in managing content materials, quizzes, and evaluations on the teacher's page. Therefore, further development is needed to enhance this learning media further.

CONCLUSION

This development research has produced an interactive web-based learning media on the topic of adaptation of living things for sixth-grade students using the tutorial method. The development process followed the ADDIE model, through the stages of analysis, design, development, implementation, and evaluation. This media development utilized technologies such as HTML, CSS, Bootstrap, Javascript, JSON, Firebase, Canva, and Netlify. Validation results indicate that this learning media is considered valid, with a material validation rate of 96 (very high) and a media validation rate of 80 (high). The learning media is deemed practical, with students' responses to its use generally agreeing. The average N-gain value is 0.5 with a moderate criterion, and the average student score is above the minimum passing grade. Thus, an interactive web-based learning media on the topic of adaptation of living things for sixth-grade students using the tutorial method has been successfully developed.

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