

Website Development as a Physics Learning Media on Heat and its Transfer Materials

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Received: June 9, 2023

Revised: July 4, 2023

Accepted: August 25, 2023

Published: August 31, 2023

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DOI: [10.29303/jppipa.v9i8.4189](https://doi.org/10.29303/jppipa.v9i8.4189)

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Abstract: This study aims to describe the practicality and effectiveness of website development as a learning media on heat and its transfer. This type of research is research and development using the ADDIE method. Practical data collection was obtained through learning implementation sheets and student responses, while effectiveness was obtained through student activity sheets and learning achievement tests. The results showed that the product in the form of a Website as a Physics Learning Media on Heat and Transfer Material in Class VII of SMP Negeri 1 Boliyohuto, as well as a website product as a physics learning media on heat and transfer material has been declared practical and effective as learning media based on the results of three learning implementations. The average percentage of learning implementation was 94.44% with very good criteria, while student responses to website learning media obtained 86.96% with very good criteria. The effectiveness of learning media can be seen from the activities of students who obtained an average percentage of 81.78% with very good criteria, and the learning outcomes test obtained a gain of 0.46 with moderate criteria.

Keywords: Effectiveness; Physics Learning Media; Practicality; Website.

Introduction

The challenges faced by teachers are certainly not getting lighter because students are expected to be able to compete globally, which is characterized by technology. The teacher is no longer the center of learning resources and the main information transmitter, but more than that, namely being able to act as a facilitator, companion, mentor, and at the same time, a partner in developing skills and knowledge (Surjono, 2013; Abdjul et al., 2022; Irfansyah et al., 2023).

The development of education in the world cannot be separated from the development of the industrial revolution that has occurred in the world because changes in the economic order have also changed the educational order in a country (Risdianto, 2019). (Surjono, 2013) In the era of the industrial revolution 4.0, we can see how ICT (Information and Communication Technology) influences students to learn with abundant

sources of information, and teachers change the way of teaching to anticipate it. For this reason, according to Wartomo (2016), The role of the teacher in digital era learning requires the teacher's expertise to apply appropriate solutions to various problems. Also, it requires the ability to adapt to environmental changes. These changes require a new orientation in education that emphasizes creativity, initiative, innovation, communication, and cooperation.

The rapid development of information and communication technology has encouraged various educational institutions to utilize e-learning systems to increase the effectiveness and flexibility of learning. E-learning is one of the learning models being developed and will become a demand for education in the future. E-learning is distance learning using electronic media to convey learning through the Internet, CDs, or a cellphone. E-learning makes it easier for teachers and students to carry out learning and evaluations because,

How to Cite:

Sina, S. A., Uloli, R., & Abdjul, T. (2023). Website Development as a Physics Learning Media on Heat and its Transfer Materials. *Jurnal Penelitian Pendidikan IPA*, 9(8), 5874–5883. <https://doi.org/10.29303/jppipa.v9i8.4189>

with e-learning, all information can be quickly downloaded from e-learning sites and can quickly evaluate student learning outcomes without having to do exams in class (Amali et al., 2023; Ntobuo et al., 2023; Nurdyansyah et al., 2016). This concept, known as e-learning or web-based learning media, influences transforming learning into digital form, both in content and system. Web-based learning media is an innovation that has a very large contribution to changes in the learning process, the learning process is no longer only listening to material descriptions from educators, but students also carry out other activities such as observing, doing, demonstrating, and others (Januarisman et al., 2016; Figna et al., 2020; Astuti et al., 2020; Setiawan et al., 2023).

Using this website media as a companion in the learning process is increasingly needed to overcome problems that arise due to limited time, place, and other facilities. This is in line with what was obtained by researchers during carrying out learning activities (Wahyuni et al., 2018; Rukun et al., 2020; Susanti et al., 2021). The teacher wants to carry out more meaningful learning activities in a class by presenting various learning media such as showing videos via PowerPoint, carrying out simple practices to stimulate students' thinking skills, then carrying out simple assessments to determine the extent of student understanding. But sometimes, this can only be done partially due to time constraints (Buhungo et al., 2023; Zimmermann et al., 2019; Payu et al., 2023; Hagger et al., 2018; Hermanto et al., 2023; Honarзад et al., 2019).

Based on the description of the problem and the solutions offered, the researcher will conduct research and develop a website as a medium for learning physics on heat and its transfer in class VII of SMP Negeri 1 Boliyohuto. This research describes the validity of developing a website as a learning media on heat and its transfer materials. The benefit of website-based learning media is that students get material from the teacher and can reproduce lesson material through the website.

Theoretical Background

Media is a tool that facilitates the delivery of learning messages from teachers to students (Mahmudah et al., 2019). The general meaning of media is anything that can channel information from sources of information to recipients. The term media is very popular in the field of communication. The process of teaching and learning is also basically a communication process, so the media used in learning is called learning media (Wahid, 2018). Media is defined as anything that can be used to channel messages or content and stimulate students' thoughts, feelings, attention, and abilities, to encourage the teaching and learning process.

Based on the opinions of these experts, it can be concluded that learning media are all forms and means as a liaison between teachers and students to facilitate the delivery of information or lesson content, stimulate interest and thinking power to increase the effectiveness in achieving learning objectives that the teacher has formulated.

According Indriyani (2019) that some of the functions of learning media are to create effective learning situations, the media is an integral part of the learning system, to achieve learning objectives, to accelerate the teaching and learning process and to help students to understand the material in the classroom, as well as to enhance the quality of education.

The website is a collection of digital pages that contain information in the form of text, animation, images, sound, and video, or a combination of all that is connected to the internet so that anyone who is connected to the internet can see it (Sari, 2019). A website or site can be interpreted as a collection of pages for displaying textual information, still or moving images, animation, sound and all combinations of static and dynamic, which form a series of interrelated information buildings, each connected to a website page. The relationship between one web page and another is called a hyperlink, and the text used as a connecting medium is called hypertext (Batubara, 2012).

Based on the experts' opinions above, it can be concluded that the website is an information page in the form of text, animation, images, sound, and video or a combination of all provided via the internet so that it can be accessed online.

Practicality. According to van den Akker (Rochmad, 2012), practicality refers to the degree to which users (or other experts) consider that interventions can be used and preferred under normal conditions. In Nieveen's work (Rochmad, 2012), related to the development of learning materials, it can be pointed out that Nieveen measures the level of practicality seen from whether teachers (and other experts) consider that the material is easy and can be used by teachers and students. The product's practicality can be seen from the teacher's assessment data of the developed learning tools, student response questionnaires to find out student assessments of learning using the developed learning tools, and observation sheets of the implementation of learning in class. Meanwhile, according to Yulianti (2016), the quality of practicality can be seen by providing student and teacher response questionnaires that aim to see the usefulness and ease of learning using learning tools that have been developed.

Effectiveness. According Rochmad (2012), argues that the most important aspect of effectiveness is

determining the level or degree of application of a theory or model in a particular situation. This level of effectiveness, according to Mager, is usually expressed by a numerical scale based on certain criteria. Effectiveness refers to the degree that the experience and results of an intervention are consistent with the intended purpose. Meanwhile, according to Rahmadi (2015), analysis of learning completeness can be known from the results of the learning outcomes test of reasoning ability to determine the product's effectiveness.

Several things must be prepared to build a free website, so the following supporting elements must be available: (a) Domain name (Domain name/URL - Uniform Resource Locator). A domain name, commonly referred to as a Domain Name or URL, is a unique address on the internet used to identify a website; in other words, a domain name is an address used to find a website on the internet; (b) Home Website. Web Hosting can be interpreted as a room on a hard disk where various data, files, images, videos, e-mail data, statistics, databases, and so on will be displayed on the website; (c) Program Language (Scripts Program). Is the language used to translate every command on the website when accessed? The program language type determines a website's static, dynamic, or interactive nature. The basic language used by each site is HTML, while PHP, ASP, JSP, and others are supporting languages that act as dynamic regulators and site interactivity; (d) Website Maintenance. Site maintenance can be carried out per certain periods, such as every day, every week, or once every month regularly or only periodically, depending on needs (not routine). Routine maintenance is usually used by news websites, article providers, organizations, or government agencies. Meanwhile, periodic maintenance is usually for personal websites, sales/e-commerce, and so on; (e) Domain Name and Web Hosting Lease Period Extension. It should be understood that the domain name and web hosting are in rental status. As long as these two things are paid for the extended lease period, you can own and use them. There are many cases of forgetfulness in extending the rental period, or it is

difficult to contact a third party (web designer) as an intermediary for the initial registration, which will have fatal consequences. You will lose the domain name as an identity in the internet world.

Method

This research is development research, or Research and Development (R&D), which produces a product in the form of website learning media in Physics for class VII students of SMP Negeri 1 Boliyohuto. The research location or product trial is at the Boliyohuto 1 Public Middle School Computer Laboratory. In practice, the trial was carried out in one meeting. The target/target of the research and product trials were class VII students of SMP Negeri 1 Boliyohuto. The subjects or respondents involved in this study were class VII students. Determination of the subject based on the consideration that the material taught is by the needs analysis and lessons in semester II.

For more details, the test subjects were as follows: (1) the subjects for the needs analysis consisted of 46 class VII students, (2) the limited trial subjects were conducted by 10 class VII students of junior high schools in Depok Sleman District who were selected randomly based on does not interfere with the learning process and is willing to test the product, and (3) Subjects in the summative evaluation assessment (final product) involve 46 students of class VII.

The development research design model used in this development is the ADDIE research design model, one of the systematic learning design models. The selection of this model is based on the consideration that this model is developed systematically and is based on a theoretical foundation of learning design. This study uses the Discovery Learning model. The ADDIE research design model consists of five steps, namely analysis, design, development, implementation, and evaluation. The stages of the ADDIE Model can be seen in Figure 1.



Figure 1. Research flowchart of the ADDIE models.

Based on Figure (1) explain about The ADDIE models consist of analysis, design, development, implementation, and evaluation. Analysis is analyzing the characteristics of students about knowledge, attitudes, and skills that students have owned. Analyze learning objectives and relevant materials. Design is

designing website layout and website content. Development is activities in the development stage are activities to validate product development and revision according to input from experts. Implementation is development results are applied in learning to determine the effect on the quality of learning which

includes the effectiveness and practicality of learning media. Implementation is carried out in small groups to get input from students and teachers as material for improving product drafts. Evaluation is the last stage of the ADDIE model development step. Evaluation can be carried out at each stage of development, and an overall evaluation is carried out at the end of the development activity. In this study, limited trials were carried out until widespread trials, so the evaluation referred to here is an evaluation of implementation activities. The evaluation results obtained suggestions from teachers and students during the trial run so that a final revision was carried out from this evaluation stage.

The instruments to see practicality are learning implementation sheets and student response questionnaires, while the instruments to see effectiveness are student activity sheets and learning achievement tests. The practicality of the learning media developed was obtained from the conclusion of the percentage of learning implementation data and questionnaires. Analysis of data from observations of the implementation of learning using the equation (1).

$$K = \frac{\Sigma X}{N} \times 100\% \tag{1}$$

Information K = Execution (%), ΣX = The number of steps taken, and N = Planned number of steps. Learning implementation criteria can be seen in the Table 1 (Indrayanti et al., 2016).

Table 1. Learning Implementation Criteria.

Percentage (%)	Criteria
$K > 80$	Very Good
$60 < K \leq 80$	Good
$40 < K \leq 60$	Enough
$20 < K \leq 40$	Not Enough
$K \leq 20$	Very Less

Learning devices are practical if the implementation of learning has good or very good criteria. Data Analysis of student response questionnaire results According to Riduwan (2010) analyses, questionnaire results with positive student responses based on collecting questionnaire data. The instrument is distributed to respondents and then recapitulated (Akbar et al., 2021). For score interpretation criteria can be seen in Table 2.

Table 2. Score Interpretation Criteria.

Percentage (%)	Criteria
$81.25 < x < 100$	Very Good
$62.50 < x < 81.25$	Good
$43.75 < x < 62.50$	Less

The effectiveness of the developed learning media is obtained through the analysis of data from student activity observations and student learning outcomes data. Analysis of data from observations of student activity:

$$A = \frac{S}{S_{maks}} \times 100\% \tag{2}$$

Information A = Student activity (%), S = Earned Score, and S_{maks} = Maximum Score. Student activity criteria can be seen in the Table 3 (Indrayanti et al., 2016)

Table 3. Student Activity Criteria.

Percentage (%)	Criteria
$A > 80$	Very Good
$60 < A \leq 80$	Good
$40 < A \leq 60$	Enough
$20 < A \leq 40$	Not Enough
$A \leq 20$	Very Less

Analysis of learning outcomes seen from the pretest and posttest is done by giving test questions to understand the concept and measuring the learning outcomes to see the level of effectiveness of the product. The increase in student learning outcomes obtained before and after using the media website is calculated using the N-gain formula, which is determined based on the average gain. The gain score (g) obtained results from comparing the average pretest and posttest values. The average gain compared (N-gain) (Hake, 1998) is expressed in the following equation (3).

$$g = \frac{S_{post} - S_{pre}}{100\% - S_{pre}} \tag{3}$$

Information g = gain (increased ability), S_{pre} = average pre-test value (%), and S_{post} = average post-test score (%). Furthermore, if this value is obtained, the next step is to convert the value into an interpretation of the gain value (Hake, 1998), as shown in Table 4.

Table 4. Gain Category Learning Outcomes

Percentage (%)	Criteria
$g \geq 0.7$	High
$0.3 \leq g < 0.7$	Medium
$g < 0.3$	Low

Result and Discussion

The results of developing website learning media products for Physics for class VII students of SMP Negeri 1 Boliyohuto were successfully created using HTML, CSS, and Javascript and used in the online Physics learning process. Users can access this web learning media through the URL address

<http://belajaripa.rf.gd>. The following is a display of web-based learning media, which can be seen in Figure 2 and Figure 3.

Main Menu or Navigation

The main menu is a menu that displays several options available on the website, such as home, temperature conversion, quizzes, crosswords and understanding tests. The menu display is as shown in the Figure 2.

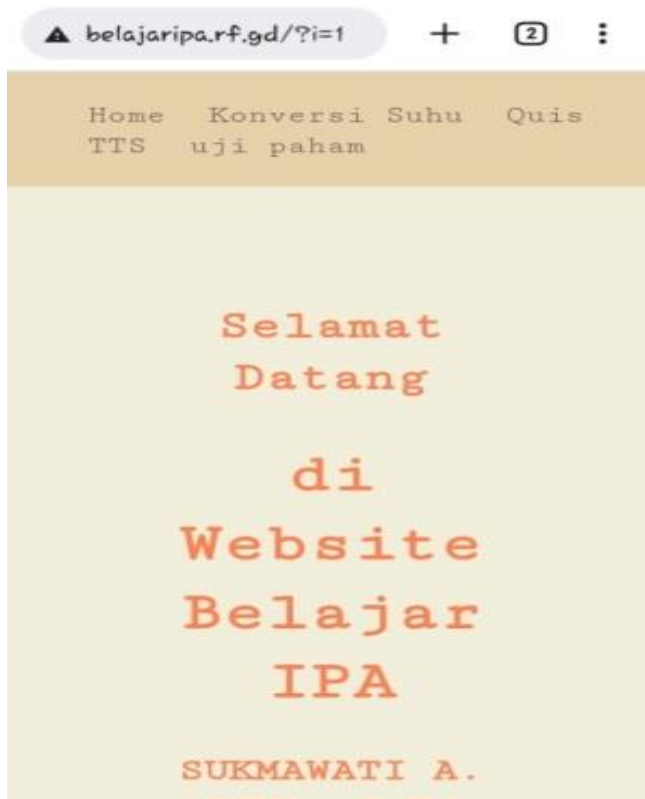


Figure 2. Initial menu design

Quiz

The quiz is a menu where students can practice their knowledge skills. Here also students answer questions according to the allotted time. After answering the questions, students can also see the value directly in Figure 3.

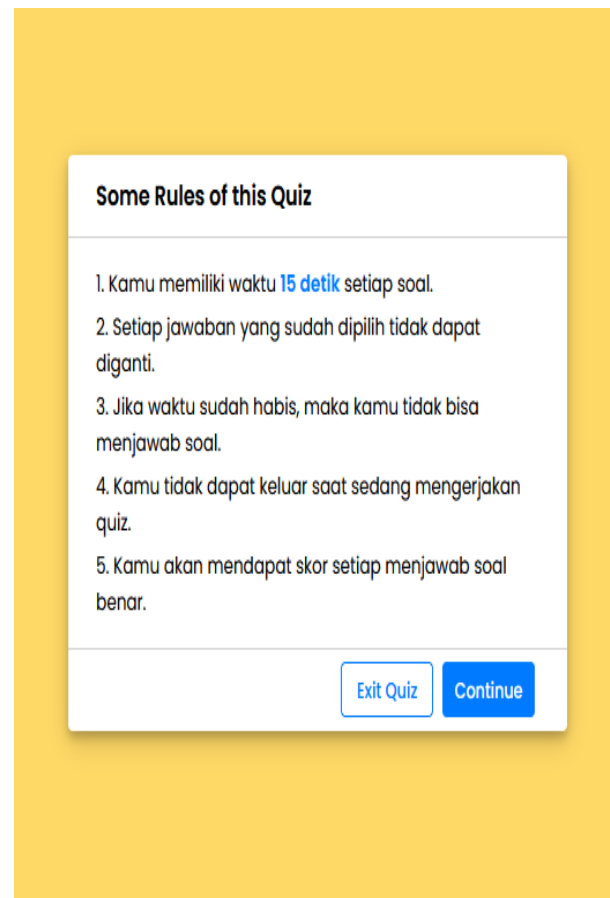


Figure 3. Quiz display

Crosswords

The crosswords are a fun way to answer questions. Here students are invited to play while answering questions. So that students do not feel pressured when answering questions. Students can see their grades immediately in Figure 4.

Understanding Test

The understanding test is a student worksheet that can be completed individually or in groups. In addition to training knowledge here, students can also practice skills in Figure 5.

Video

Video is a menu where students can learn by listening to the material and looking at Figure 6.

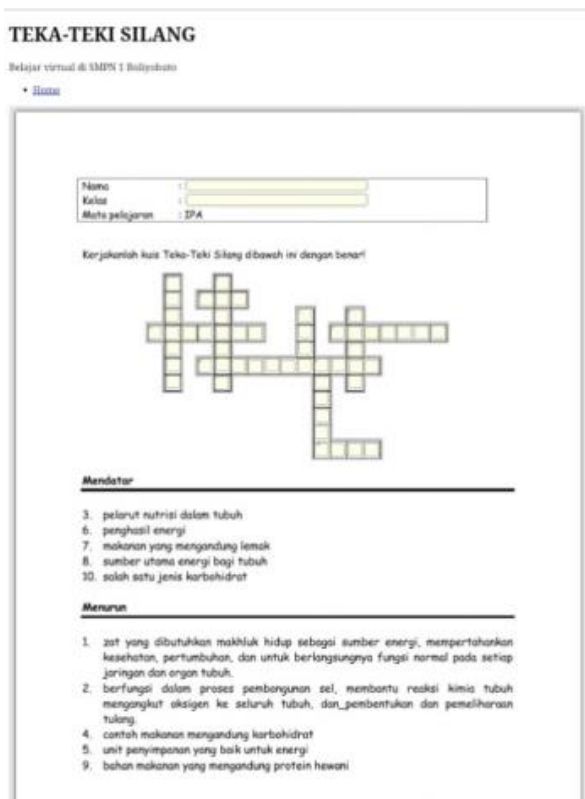


Figure 4. Crosswords display



Figure 5. Understanding test display



Figure 6. Video Display

The practicality of Learning Media

The practicality of this learning media looks at the implementation of learning and how teachers and students respond to the website learning media that has been developed by giving a questionnaire. The questionnaire provided consisted of 5 rating scales, namely 5 (very good), 4 (good), 3 (enough), 2 (poor), and 1 (very poor) and were assessed from the material aspect and website learning media programming.

The implementation of learning saw the learning activities carried out by researchers in the class carried out with very good criteria ($K > 80$), good ($60 < K \leq 80$), sufficient ($40 < K \leq 60$), poor ($20 < K \leq 40$) and significantly less ($K \leq 20$). Learning media is considered practical if the implementation of learning has the criteria of "good" or "very good". The results of the performance of knowledge can be seen in Table 5.

Table 5. Results of Learning Implementation

Meetings	Percentage (%)	Category
1	91.67	Very Good
2	94.45	Very Good
3	97.22	Very Good
Average	94.44	Very Good

Based on the data in Table 4.3, the research results at meetings 1, 2 and 3 successively website learning media obtained 91.67%, 94.45% and 97.22% with very

good criteria, and an average percentage of 94.44 % with very good criteria.

In addition, practicality can also be determined from the response to using these learning media. This response can be obtained from a response questionnaire that is distributed to be filled out by teachers and or students who use the learning media (Faradayanti, 2020). For this reason, in this study, a questionnaire was distributed to students to see their responses to using this learning website media. The following results of student responses can be seen in the following Figure 7.

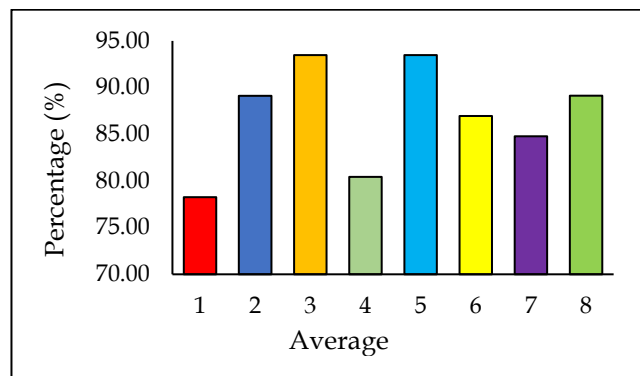


Figure 7. Student Response

From the results of the data on the student response questionnaire graph to 46 respondents to the use of website learning media, the average percentage was 86.96% with very good criteria.

The Effectiveness of Learning Media

In this study, observations of student activities and assessment of learning outcomes were carried out to obtain the effectiveness of learning media. Student activities include stimulation (stimulating), problem statements (problem identification), data collection, processing, and verification. Observation results in Student activity were seen from the two classes that were tested for three meetings with an average percentage. The results can be seen in Table 6.

Table 6. Observation Results of Student Activities

Meetings	Percentage (%)	Category
1	80.15	Very Good
2	82.06	Very Good
3	83.15	Very Good
Average	81.78	Very Good

Based on Table 6, student activity in two classes with three successive meetings, namely 80.15%, 82.06% and 83.15%, is very good. Apart from being seen in student activities, the effectiveness of the media is also seen in the assessment of student learning outcomes.

Media can be good if the media used in the learning process has affected student learning outcomes. Then the media website is an assessment of student learning outcomes (Alfiriani & Hutabri, 2017; Samsu et al., 2020; Erawanto, 2016). The results of the evaluation of student learning outcomes of knowledge competency can be seen in Figure 8.

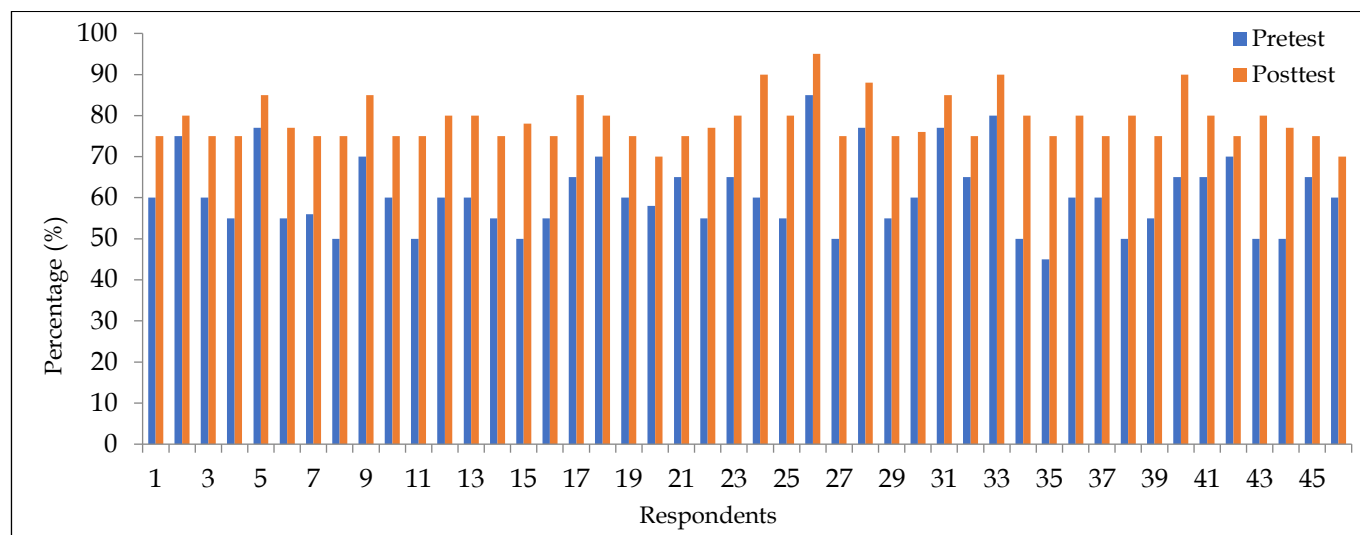


Figure 8. Assessment of Learning Outcomes Test

Based on the learning outcomes in Figure 8, the average student learning outcome in the pre-test was 60.26, while in the post-test, it was 78.76. After obtaining the average pre-test and post-test results, a gain index

analysis is performed using the following mathematical equation (3). Based on the mathematical equation, a gain of 0.46 is obtained with moderate criteria. So, students'

learning outcomes in the two classes experienced an increase in ability classified as average.

Conclusion

Practicality Aspect. Practicality is obtained from the implementation of learning and student responses. The average percentage of learning implementation is 94.44%, with very good criteria. Student responses to website learning media the average percentage of obtaining 86.96% with very good criteria, so the website media is classified as practical to use. Aspects of Effectiveness. Learning effectiveness is obtained from observing student activities and assessing student learning outcomes. The average percentage of student activity in two classes with three meetings is 81.78%, which is very good. Besides that, the learning gain is 0.46 with moderate criteria. So, students' learning outcomes in the two classes experienced an increase in ability classified as average, so the learning media was classified as effective.

Author Contributions

Sukmawati A. Sina: Conceptualization, methodology, writing—original draft preparation, Writing—review and editing; Ritin Uloli: Formal analysis, validation, data curation; Tirtawaty Abdjul: Methodology, Writing—review and editing.

Funding

This research received no external funding.

Conflicts of Interest

The authors declare no conflict of interest.

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