Implementation of Google Sites Web-Based Learning Media to Improve Problem Solving Skills for High School Students the Subject of Sound Waves

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Abstrak : The use of instructional media is very necessary in learning physics, because many abstract phenomena and natural phenomena are difficult to understand both by students without the right means. Sound wave material which is dominated by theories and concepts requires a learning media that packs concepts to be effective and improves students' problem solving abilities. Problem solving ability is one of the goals of forming 21st century skills. The times have also brought progress in education, including interactive multimedia-based learning media such as web-based learning media such as Google sites. This study aims to determine the application of learning media based on google sites web-based learning media, the subject of sound waves to improve students' ability to solve physics problems. The type of research used is descriptive quantitative with the research design of MDLC (Multimedia Development Life Cycle). The research subjects were 31 students at XI MIPA 1 MAN 1 Situbondo. Web-based learning media google sites is declared effective in improving students' problem-solving skills if they meet the criteria for the average level of effectiveness of the n-gain score. The n-gain data was obtained through the students' pretest and posttest scores, and the average pre-test score was 59.35 and the post-test average score was 76.74. While the average percentage of N-gain is 44.03% which states the medium category, meaning that the developed web learning media can improve the problem solving ability of physics students. The student response questionnaire after using the media is in the very good category, with the average percentage of student responses to the learning media that has been given which is 82%. The results of these data indicate that the learning media has an attractive design for students and easy operation. So it can be concluded that the google sites web-based learning media with the subject of sound waves meets the criteria of a good learning media and is able to improve students' problem solving skills at MAN 1 Situbondo.

Keywords: Google sites web learning media; Physics problem solving skills; Sound waves

Introduction

In 21st century skills, students are required to have skills in the fields of knowledge, technology, media and information. In the 21st century learning aims to form students' skills, namely high-order thinking skills, analytical skills, and scientific skills. The indicator of critical thinking skills in high-level cognitive aspects is the ability to solve problems (Alwasilah, 2010; Wulandari & Nana, 2021). Tamami et al., (2017) describe that the low understanding of interrelated concepts is an obstacle to students' problem-solving abilities. Problem solving skills in 21st century learning are part of the focus in learning physics (Jayadi et al, 2020).

Suprihatiningrum (2013) describes that learning is a series that is structured in order to facilitate students in learning by involving information and the environment. Meanwhile, physics is a part of universal science that develops the power of reasoning and analysis of natural phenomena that includes facts, concepts, principles, laws, postulates, and theories, and underlies the development of modern technology (Sasmita et al., 2020; Tobing & Admoko, 2017) . Thus, learning physics is a process of building knowledge with teaching and

learning activities related to natural phenomena that are carried out according to the nature of physics, and are able to improve students' thinking skills in solving problems in the environment.

Physics learning does not only emphasize mastery of concepts, but also the application of concepts in solving student problems (Sujarwanto et al, 2014). Larkin & Reif in Rizqa (2020) stated that low physics problem solving ability is characterized by the difficulties faced by students in applying their knowledge to solve physics problems. In line with previous research, the low ability to solve physics problems is also due to the difficulty of students in understanding the problem. Naqiyah et al (2020) state that there are four indicators of problem solving ability in general, including: a) describing the known variables in the problem, b) determining the appropriate equation to solve the problem, c) replacing the known values into equations, and d) evaluating solution.

Constraints in physics problem solving skills are based on three main things, including the lack of experience of students in solving more complex problems, teachers do not facilitate teaching, and students are less able to connect the context of learning physics with everyday life (Abtokhi et al, 2021). One of the efforts that affect students' solving abilities is the use of learning media as a teacher teaching facility to students (Fahlevi & Anik, 2021; Karo-karo & Rohani, 2018; Naimah et al, 2019). Learning media is a means of channeling information that will be presented by the messenger to the target. Learning media is a means to channel messages or information that helps students get new concepts, individual skills, and competencies (Hasan et al, 2021).

Learning using multi-representation-based multimedia is able to improve science mastery both physics, mathematics, chemistry, and biology (Maghfiroh and Kuswanto, 2021). Technology-based multimedia learning media can be a collection of web. Nowadays, web-based learning media are very popular because they are flexible and effective in delivering learning materials via the internet (Erwin & Ghufron, 2016). Selection of appropriate learning media must meet the characteristics of students and learning progress. Ikhsan et al (2019) stated that media websites meet the characteristics of students, namely that they can be accessed at any time using a computer, laptop, notebook, or smartphone. Darussalam in Azmi, Ruku, & Maksum (2020) states that website-based learning media is able to create an effective, interesting, interactive learning process, and is able to increase student learning motivation.

One of the free applications in making web-based learning media is Google sites which is converted in the form of an application. Google sites is a platform that supports the creation of websites (Nalasari et al., 2021).

The selection of the google sites application is because it is very easy to access information, and can be used by students via smartphones or other devices anywhere and anytime (Maskar et al., 2021). Google sites web-based learning media contains material in the form of words or PPT, learning videos, practice questions with discussion, quizzes and PhET Simulations that can help students analyze problems easily (Waryana, 2021).

The role of PhET Simulation in problem solving abilities, based on research conducted by Yuyun, Fuadnazmi, & Sabda (2016) PhET simulation media is able to attract students into a meaningful learning atmosphere because students actively work together in digging up information and improving communication to improve their skills. solution to problem. In addition, learning with PhET simulations can show what is usually invisible becomes visible and provide multiple representations (macroscopic, graphic) of abstract concepts that can be applied in the problem-solving process (Yulianti et al, 2018).

The results of interviews with students of MAN 1 Situbondo obtained information that one of the materials that is not easy to understand is sound waves because there are many mathematical formulas that must be understood and problems that are difficult to solve. In addition, two students of MAN 1 Situbondo also expressed disinterest in physics. In this case, the researcher chose the sound wave material as the subject of the learning media. Based on an interview with a physics teacher at MAN 1 Situbondo, he stated that there had been no testing of google sites web-based learning media.

Based on the problems above, it can be seen that learning media has an important role as a stimulus to increase student interest in physics. Thus, it is necessary to have a new innovation of technology-based learning media in the form of a web as a support in the teaching and learning process in order to improve the ability to solve physics problems for high school students.

Method

The type of research used is descriptive research with a quantitative approach. The research model used in making learning media is the MDLC (Multimedia Development Life Cycle) model. Meanwhile, the research data to be analyzed are the effectiveness of the media and student responses to the use of web-based learning media google sites for physics subjects on sound wave material. The following is a schematic of the research conducted:
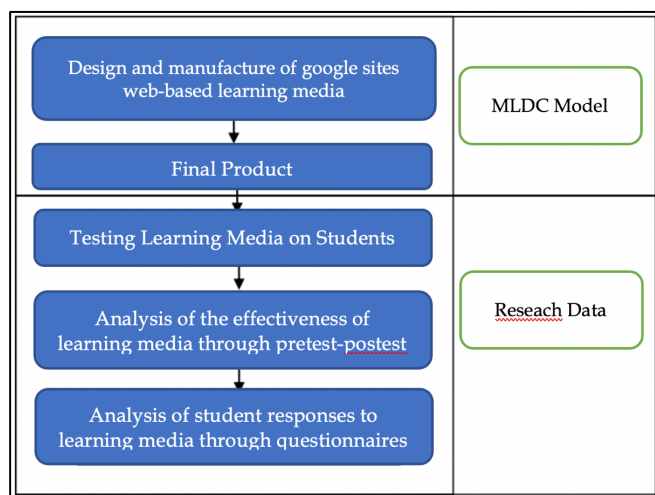
Figure 1. Research scheme

Learning Media Design

MDLC design is widely used as a software development method such as interactive learning media because it is multimedia-based (Mustika et al, 2017). The MDLC design has six stages, here is the MDLC (Multimedia Development Life Cycle) research flow:
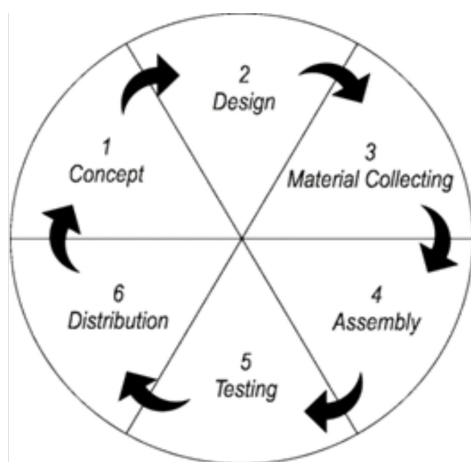

Figure 2. MDLC model

Concept

The concept stage is the stage for determining the goals and objectives of program users, in addition to determining the application to be developed (presentations, interactive, and others) based on an analysis of the needs of the audience.

Design

Design is the stage of making specifications regarding the program architecture, appearance, style, and material requirements for the program.

Material Collecting

Material collection is the stage of completeness of materials or materials according to the needs obtained.

At this stage, it is carried out in line with the assembly stage.

Assembly

The manufacturing stage is the stage in making all program objects according to the design and materials collected. The assembly process aims to match the program with the initial design.

Testing

The testing phase is carried out after the manufacturing phase is complete. The testing stage is the stage to find out if there are errors in the program made. This test is referred to as alpha testing, meaning that program testing is only carried out by the author and the author's own environment.

Distribution

The distribution stage is the application storage in the form of storage media. At this stage if the storage media is not enough, then compression of the application is carried out.

Effectiveness of Learning Media

After the learning media storage process, it will be tested the effectiveness of the media and student responses during the learning process using the learning media that have been made. The indicator of media effectiveness uses a one group pretest-posttest design, following the n-gain equation developed by Hake and Richard in Simanjuntak (2012) such as equation 1.

$$N - gain\ (g) = \left(\frac{S_f - S_i}{S_{maks} - S_i}\right) 100\% \tag{1}$$

The level of effectiveness of the average n-gain score in the form of descriptive quantitative data by Hake and Richard in Simanjuntak (2012), is observed through the categories of Table 1.

Table 1. Criteria for n-gain score

n-gain score	Categories
70% ≤ g	High
30% ≤ g < 70%	Medium
g < 30%	Low

Student Response to Learning Media

The instrument for assessing student responses is using a questionnaire. Questionnaire sheets were used to find out student responses after applying the learning media made. Student response data using equation 2.

$$P = \frac{\sum R}{N} x 100\% \tag{2}$$

The results of student responses can be concluded by reviewing the student response criteria in Table 2.

Table 2. Criteria for interpretation of student responses

Skor *n-gain* (%)	Categories
P < 20	Not good
20 ≤ P < 40	less
40 ≤ P < 60	Medium
60 ≤ P < 80	Good
80 ≤ P ≤ 100	Very Good

(Arikunto, 2010: 257)

Result and Discussion

This research produces web-based learning media products with the help of google sites that can be accessed via Android or PC. This learning media product is a medium with the subject of sound waves. This web-based learning media is able to help students learn independently and anytime, because it can be accessed easily. The product trial was carried out at MAN 1 Situbondo.

Google Sites Web Based Learning Media Design

The results of the learning media products above are arranged based on the research design stages of the MDLC (Multimedia Development Life Cycle) method which has six stages including the concept, the design, the material collection, the assembly, testing, and distribution stage.

Concept

The application used for making learning media is Google sites. The targets in this study were high school students in class XI. Concept stages in the form of material analysis and analysis of student needs consisting of student characteristics and the school environment. The subject matter used in this study is sound waves which can be seen in Table 3.

Table 3. Material Analysis

Analysis	The Aims	Basic competencies
Sound wave material	Learning objectives are determined based on Core Competencies, Basic Competencies, and indicators of competency achievement. The material that will be presented in the learning media is sound waves with Basic Competencies 3.10 and 4.10.	3.10 Apply the concepts and principles of sound waves in everyday life. 4.10 Conducting experiments on sound waves, the following is a percentage of the results and experiments on their physical meaning

Analysis of student needs was obtained through observation and interviews. The results of the detailed needs analysis data can be described in Table 4.

Table 4. Analysis of Student Needs

Analysis	The Aims	Summary
Student needs	To identify the characteristics of students and the school environment	1. Student Characteristics The results of the interview showed that some students already had a device in the form of a cellphone and some students were students who were not allowed to bring cellphone devices. 2. Student Environment Analysis of the school environment is related to the learning system applied in schools. Based on the observations made by the researchers, all students have been learning directly (offline).

Based on Table 4. The results of the analysis of student needs through interviews and observation activities require solutions, namely the creation of learning media that can support students to carry out interesting learning at school and contain various kinds of media that suit different student learning styles, which can be accessed via *smartphones* and laptops.

Design

The design stage consists of two stages, the first of which is to make a list of components needed for the preparation of web-based learning media google *sites* collected at the material collection stage. In detail some of the required components are seen in Table 5.

Table 5. List of Media Drafting Components

Component	How to Acquire Components
Material text and sample questions	Literature study
Picture	Images of some icons downloaded for free on the internet
Icon media	*Icons on* media are downloaded for free on *Pinterest* and *Free Icons*
Video	Videos obtained from Youtube
Audio	Audio downloaded for free over the internet

The second stage at the design stage is making a web-based learning media flowchart design. Broadly speaking, the media flowchart design that will be presented consists of: (1) Main menu page, (2) Core Competence and Basic Competence Menu, (3) Material

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menu, (4) Learning video menu, (5) Saol training menu, (6) Practicum menu, (7) Quiz menu, (8) Development team menu, and (9) Navigation menu. The results of the web-based learning media flowchart design can be seen in Figure 3.
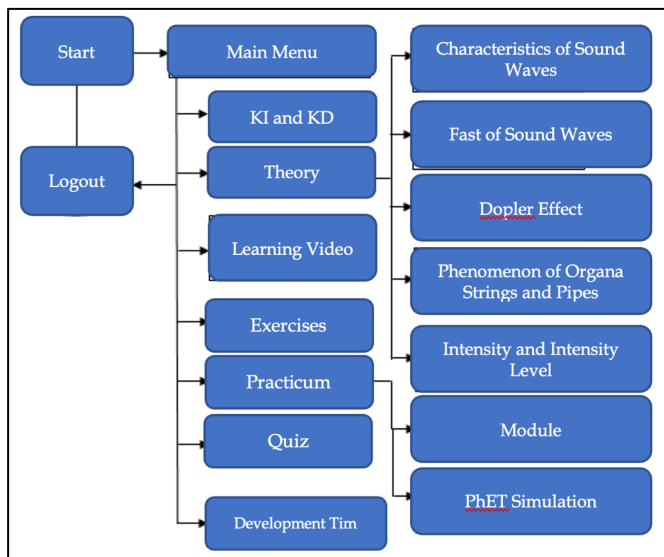

Figure 3. Media Flowchart Design

Material Collection

The material collection stage is carried out by collecting materials according to the needs of the media to be made, including literature studies, text collection, supporting images of the material, learning videos, *PhET simulation*, question exercises, audio as background audio on learning media, and *collection of icons*. Literature studies and text collection are carried out by conducting literature studies on several books on sound waves for students of class XI.

The collection of image objects and media background music that will be presented on the media is downloaded for free via the internet according to the needs of the media to be created. The collection of videos is taken from the *Youtube* application about the wave of sounds. Meanwhile, the PhET Simulation practicum on the media is obtained by *copying and pasting* the *PhET Simulation* link with the title *Wave-Sound*. The collection of several *icons* is done by downloading on the *Pinterest* application. The number of images, videos, audios, and icons presented on the media can be seen in Table 6.

Table 6. Number of Media Components

Media Components	Applications Used	Sum (item)
Picture	Internet	16
Video	Youtube	5
Audio	Internet	4
Icon	Pinterest	10

Assembly

At this stage, the process of making learning media in accordance with the *storyboard* is carried out, so that the learning media can run well. Here's what google sites web-based learning media looks like on android:
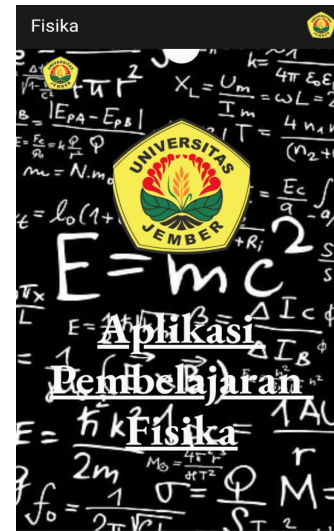

Figure 6. Main Menu Display

On the menu display, there is a physics image that shows the media material to be studied, the identity of the research agency. In addition, at the bottom there is music or *backsound* that can be *played or pause*.
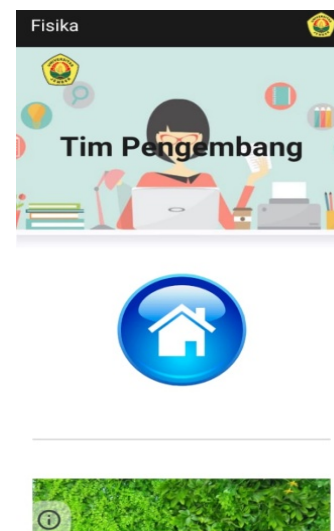

Figure 7. Development Team View

In this view, there are the names and identities of the *google sites web-based* learning media development team. On each media page, there is a music icon that can be turned on or not.
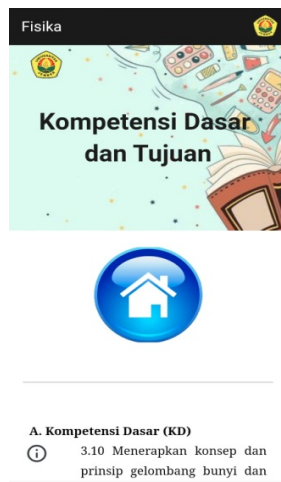
Figure 8. Display of Basic Competencies and Objectives

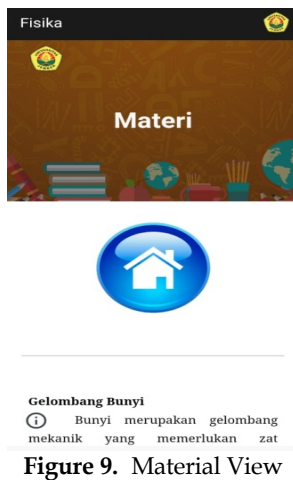On this page, the audience or students can find out the Basic Competencies and Objectives of the sound wave material.

Figure 9. Material View

In the material display, students can understand and obtain complete sound wave material and supporting images. This page also contains material sub-chapters that have been adapted to the Core Competencies and Basic Competencies of sound waves.

Figure 10. Learning Video Display

On this page, students can learn and obtain information through the videos that have been presented. Operation of the video by pressing the video you want to view.
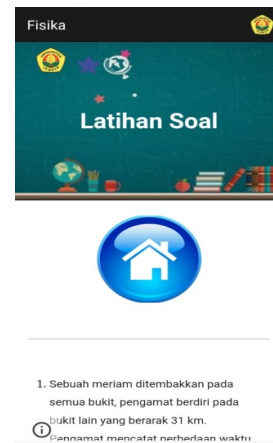
Figure 11. Practice Question Display

In the question practice display, there are several questions and answer keys that can make it easier for students to understand the material.
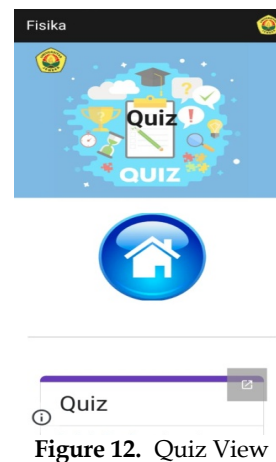

Figure 12. Quiz View

In the quiz display, there is a question in the form of *a google form*. Students can also immediately find out the results of the quiz that was carried out.
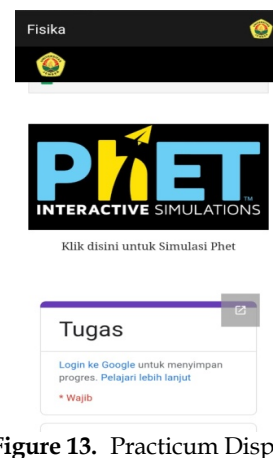

Figure 13. Practicum Display

In this display, there is a *google form* to fill in the results of the student practicum. In addition, the practicum page also contains a practicum module and a link that directly opens *PhET Simulation.*

Testing

The testing phase is carried out on icons that are buttons with their respective functions, the tests carried out include: whether the icons on the learning media can function properly, and whether the learning media that has been created does not occur errors. If there is an error in the icons, then repairs are made with the previous stage and so on. Here is table 7, showing the success of web-based learning media.

Table 7. Blackbox testing of learning media

Input	Process	Output	Successful
	Display the initial backround	Display the initial backround	√
	Display the start page after clicking another icon	Media start page	√
	Turn backsound on/off	Backsound sound on/off	√
	Displays the menu page for Core Competencies, Basic Competencies and Learning Objectives	Core Competencies, Basic Competencies and Learning Objectives Halaman	√
	Displays some lists of soundwave material	List of sound wave material sub chapters	√
	Display a soundwave material page	Sound wave material sub chapter	√
	View learning videos	Sound wave learning videos	√
	Display a practice question page	Practice questions page	√
	Display the answer page of the question	Question answers	√
	View module files and PhETSimulation links	Module files and PhET Simulation links	√

Input	Process	Output	Successful
	Display the quis page in the form of google form	Quis google form page	√
	Display the media developer page	Media developer page	√

Distribution

The distribution stage is the final stage of research conducted by implementing *google sites web-based* learning media. The media storage is in the form of *a download link* for learning media applications. Then, class XI students at MAN 1 Situbondo can download the media that has been given through the *WhatsApp Group.*

Effectiveness of Google Sites Web-Based Learning Media

The test of the effectiveness of *google sites web-based* learning media was carried out with the design of one *group pre-test post-test* in one class of MAN 1 Situbondo students. The selected class randomly *sampled* the results of recommendations from the MAN 1 Situbondo physics teacher, namely class XI MIPA 1 with 35 students. The effectiveness of learning media is determined based on the *N-gain* score of student learning outcomes through *pre-test and post-test*. In table 8. is a breakdown of pre-test and *post-test* results.

Table 8. Analysis of *Pretest-Posttest* Results

Component	XI MIPA 1
Number of Students	31 Students
Average Pre-Test Score	59.35
Average Post-Test Score	76.74
Average Percentage N-gain	44.03 %
Category N-gain	Medium

Based on the analysis data, it was found that the average pre-test score was 59.35 and the post-test average was 76.74. While the average percentage of N-gain is 44.03% which states the medium category.

Thus, it is known that the use of google sites web learning media can affect students' problem-solving abilities. This is also reinforced by the significant research results by Fatma and Partana (2019) that web-based learning can improve students' problem-solving abilities. The effectiveness of google sites-based learning media in the medium category is due to several factors, including some students in class XI MIPA 1 are students who are not allowed to bring electronic devices or gadgets at foundations or Islamic boarding schools, so students cannot learn material through learning media. it independently.

Student Response to Google Sites Web-Based Learning Media

Student responses are carried out to understand how students respond when carrying out learning aided

by learning media based on the google sites web. Student responses were measured using a response questionnaire that was given after the learning media was used. Details of the results of data analysis on student responses to google sites web-based learning media products are presented in Table 9.

Table 9. Analysis of Student Response Questionnaires

Questions	N (%)	Categories
The design of the learning media used is interesting	85	Very Good
The use of learning media is very easy	88	Very Good
Learning videos on learning media support to better master the sound wave material	81	Very Good
Learning media provides motivation for me to study sound wave material	82	Very Good
Submission of material in this learning media is related to everyday life	79	Good
The material presented in this learning media is easy to understand	81	Very Good
The presentation of material in this media helps me to answer questions	77	Good
The shape, model and size of the letters used are simple and easy to read	88	Very Good
The use of terms, symbols or icons in this learning media is appropriate	84	Very Good
Google sites web-based learning media, the subject of sound waves can help me study independently	76	Good
Total Persentase	82	Very Good

Based on the data obtained, it is known that the average percentage of student responses to interactive learning media that has been given is 82% with a very good category. The results of these data indicate that the learning media has an attractive design for students, easy operation, also contains PhET Simulation as evidenced by the student response questionnaire having a score of 82%.

Google sites web-based learning media provides a new color for the existence of learning media. The existence of this media can also assist teachers in providing material that has been arranged systematically and relatively easily. Teachers can access as an editor to add some components and other sample questions.

Conclusion

Google sites web-based learning media is one of the efforts that can improve the problem solving ability of

high school students on sound wave material. The design that is implemented in the learning media is in accordance with the criteria of good multimedia and is able to attract the attention of students to study independently. Another thing can be proven by the presence of significant results from the n-gain pretest-posttest with an average percentage of 44.03% including the medium category. In addition, high school students in class XI gave a very good response to the google sites-based learning media with an average percentage of 82%. So that the google sites web-based learning media can be applied as a medium for learning physics of sound wave material in schools.

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