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Research Artikel

INTERACTIVE MULTIMEDIA DEVELOPMENT USING GOOGLE SITES TO IMPROVE STUDENT LEARNING OUTCOMES AND ENERGY

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Abstract

The use of interactive multimedia is very important to develop in physics learning. The purpose of this study is to develop interactive multimedia-based Google sites on the subject of work and energy to improve the learning outcomes of class X students at SMA Bina Warga 1 Palembang that are valid, practical, and have a potential effect. The method used is research and development with a Rowntree development model consisting of several stages, namely, planning, development, and evaluation. The evaluation used is a modified Tassmer evaluation consisting of self-evaluation, expert review, one-on-one, small group, and field testing. The data collection technique uses a walkthrough to test the validity of the product, which consists of three validators to assess the product from the material, media, and language aspects, and one-to-one and small group stages to test the practicality of the product developed. The results showed that interactive multimedia was valid and practical (3.56 interformations were very valid) and (94% were very practical stage one to one, 87% were very practical small group stage) with an N-Gain value of 0.72 in the high category. So it can be concluded that interactive multimedia in the form of Google sites is suitable for use in learning physics.

Keywords: *Interactive multimedia; work and energy; learning outcomes.*

Abstrak

Penggunaan multimedia interaktif sangat penting untuk dalam pembelajaran fisika. Tujuan penelitian ini adalah mengembangkan multimedia interaktif berbasis google sites pada pokok bahasan usaha dan energi untuk meningkatkan hasil belajar siswa kelas X SMA Bina Warga 1 Palembang yang valid, praktis dan memiliki pengaruh potensial. Metode yang digunakan adalah Research and Development dengan model pengembangan rowntree yang terdiri dari beberapa tahapan yaitu: perencanaan, pengembangan dan evaluasi. Evaluasi yang digunakan adalah modifikasi evaluasi Tassmer yang terdiri dari evaluasi diri, expert review, one to one, small group, dan field test. Teknik pengumpulan data menggunakan walkthrough untuk menguji validitas produk yang terdiri dari tiga validator untuk menilai produk dari aspek materi, media dan bahasa, tahap one to one dan small group untuk menguji kepraktisan produk yang dikembangkan. Hasil penelitian menunjukkan bahwa multimedia interaktif valid dan praktis (3,56 interformasi sangat valid) dan (94% sangat praktis tahap 1-1, 87% sangat praktis tahap kelompok kecil) untuk nilai N-Gain diperoleh rata-rata 0,72 tinggi kategori. Sehingga dapat disimpulkan bahwa multimedia interaktif berupa google sites cocok digunakan dalam pembelajaran fisika.

Keywords: *Multimedia interaktif, usaha dan energi, hasil belajar.*

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INTRODUCTION

Physics is a subfield of natural science or science that plays a role in solving problems in everyday life. The principles and concepts of physics are applied in a variety of technological products that are currently developing (Bogusevschi et al., 2020). Therefore, it is no exaggeration to say that today's modern technological advances are the result of the application of physics (Lia, 2018). Therefore, appropriate learning facilities are needed in the application of physics, namely learning media.

The concepts of physics are generalizations of natural phenomena encountered in everyday life. The concepts of physics are obtained through observations of the universe and the interactions between its elements. Therefore, understanding the concepts of physics will help in understanding various phenomena so that the results of learning physics should be able to solve problems in everyday life.

The use of inclined planes to lift objects that are quite heavy from one place to another that is higher is the application of the concept of physics. The function of the inclined plane is to reduce the gravity which is affected by the mass of the object. The presence of an inclined plane makes the total gravity decompose in the direction of the x-axis and y-axis so that the force required to lift the object is smaller or lighter.

The slope principle is also applied in building roads in mountains or hills. The roads leading to the top of the mountains are usually spiral or curved and are never straight. The goal is that the force required to climb to the top of the mountains is not too great. The magnitude of the force needed to climb the mountain peak is indicated by feeling more tired or the condition of the vehicle running sluggishly even though the gas is strong.

The principle of the inclined plane is also closely related to the concepts of work and energy. Although lifting an object or walking on an inclined plane requires less force, the energy required is the same, which is known as the concept of energy conservation. The concept of

energy conservation is an important concept in physics learning.

The phenomenon of a falling coconut causing the ground to fall into a concave position is a physical phenomenon. To explain how deep the coconut goes into the ground, the concept of mechanical energy can be used. When the coconut will fall all the energy it has is in the form of potential energy, while when the coconut hits the hold ($h=0$) all the potential energy becomes kinetic energy. Kinetic energy that causes objects to be pushed into the ground.

The phenomenon of falling coconuts can be demonstrated by using pictures or videos via a computer or smartphone. Using a computer or smartphone to display a physical phenomenon is easier than using a lecture. A computer or smartphone is a device that can be used as a learning medium.

Learning media are components that are interconnected with other components to create a conducive learning environment, abstraction of concepts, and reduce misunderstandings and improve learning activities (Puspitarini & Hanif, 2019). Multimedia learning media is used to explain and improve students' understanding. Multimedia that is inserted in the learning module becomes attractive and increases student learning motivation (Puspitasari et al., 2019). The need for this type of learning media is interactive multimedia (35.3%), video/simulation (32.5%), mobile learning (21.9%), and powerpoint materials (10.3%). Multimedia is a mixture of various media formats such as reading, photos, graphics, animation, video and interrelationships, which are packaged in digital files to convey messages to the public (Fang, 2018; Zhu et al., 2020). On the other hand, interactive interpretation is bound by two-way dialogue or more and has reciprocity with one another (Tri & Yanto, 2019). There are 3 types of interactions that can be identified, namely, interactions with a program, such as answering questions; interaction with machines, such as using simulators, language laboratories; interaction between students in an orderly manner through learning

games or simulations by Miarso 2011 in Linda, 2015s.

Interactive multimedia is complemented by a user-operable navigation system (Elwi et al., 2017). The use of interactive multimedia applications in learning will increase efficiency, motivation, and facilitate active learning, experimental learning, and student-centered (Husein et al., 2017). In interactive multimedia, there is a feedback process by the media in response to user requests (Elwi et al., 2017). Learning the concepts of effort and energy using interactive multimedia allows interaction between students and available multimedia facilities (Rahmawati, 2019). Interactivity is the advantage of interactive multimedia so that it can improve physics learning outcomes, and energy affects the mastery of the physics concept itself (Yulianci et al., 2017). There is a significant effect of using interactive multimedia-based learning media on student learning outcomes (Akbar et al., 2019).

The development of interactive multimedia in previous studies used various applications including: flipbook to improve students' science process skills (Darmaji et al., 2019); students' understanding of concepts with an N-Gain value of 0.50 medium category (Santhalia & Sampebatu, 2020); Adobe Flash CS5 that meets the criteria of being valid, practical and effective (Puji et al., 2014) and Macromedia Director with an average valid category (Melianti et al., 2020). MMI development innovation in the form of Course Lab is declared very valid, and very practical (Elwi et al., 2017). MMI development that runs on smartphones as Mobile Learning on websites builder shows that it is valid, effective

and practical (Sulaiman et al., 2020). The MMI on the Website shows that it is valid in terms of media, material aspects, and attractiveness aspects, very good and suitable for use in learning (Sadikin et al., 2020).

To support the teaching and learning process activities can use the website which is a group of homepages and browser-based websites that are interconnected and can be accessed via the internet. Google sites are online applications released by Google that can create study rooms, schools, and so on. Multimedia is able to have a substantial effect on the enthusiasm and learning outcomes of students. Google sites can combine various data or information in one container (including videos, presentations, attachments, readings, animations, sounds, and others that can be distributed according to user needs) so that they can display material in the form of text, images and videos.

METHOD

This type of research is development (Research and Development). The development method is a research method used to produce a particular product, and test the effectiveness of the product (Sugiyono, 2017). The development model used is the Rowntree model (Prawiradilaga, 2008) which consists of several stages including: planning, development and evaluation stages. Prior to product development, it begins with making GBIM, JIM, flowcharts, storyboards, and drafting. The evaluation functioned by formative evaluation according to Tessmer (1993) at this stage consists of: self evaluation, expert review, one to one, small group and field test.



Figure1. Rowntree Development Model Stage

The planning stage includes activities including: analyzing student needs and then determining learning objectives based on the

syllabus as a basis for compiling indicators of learning outcomes. The development stages include making an Outline of Media Content

(GBIM) in the form of a table with the title above the subject and the subject matter. This GBIM contains Core Competencies as well as Basic Competencies equipped with indicators, subject matter and the last reference used. Description of Material Contents (JIM) in the form of a table composed of indicator columns, material descriptions along with examples of questions and discussions and the last column is a description of the program flow. Interactive multimedia flowcharts are made as an initial design stage by making words starting from the first click until the user exits the application, flowcharts are made through the NCHsoftware application in making flowcharts each symbol has a meaning for the first symbol, namely start or end

in the form of a square with each obtuse angle, the second symbol, namely a plain rectangle, is a process used for the name of the main menu, under the main menu there is a symbol subprocess. Furthermore, the input symbol is in the form of something that we type or the output of something that is displayed in the form of a parallelogram, the last symbol is a confirmation symbol in the form of a rhombus whether the user will exit the application of his choice, Yes or No. The storyboard is a sketch of each menu that appears. The last is making drafts by preparing tools and materials in the form of laptops, internet or wi-fi networks, gadgets and others, then immediately designing interactive multimedia based on the instructions from the storyboard.

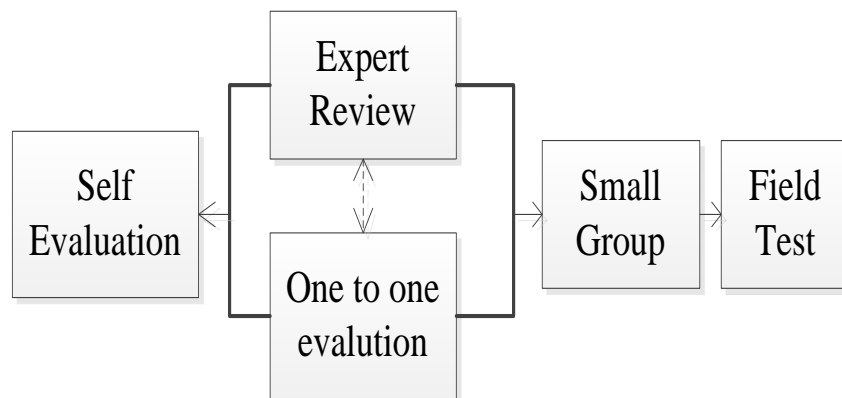


Figure 2. Formative Evaluation Design (Tessmer, 1993)

The evaluation consists of five steps, namely self evaluation, expert review, one to one, small group and field test. The following is the description, Self Evaluation of this matter aims to identify the location of the shortcomings of the products that have been developed before being assessed by experts at the next stage. Expert review was conducted to measure the level of product validity before being tested in the field of interactive multimedia product validators based on google sites including material, media and language experts. When the product is confirmed to be valid, then its practicality will be tested through the one to one and small group stages.

One to one The trial was conducted by three students who had below average, medium, and above average abilities and then students

were given interactive multimedia in the form of Google sites links and questionnaire sheets to assess the practicality of the products that had been developed. The small group was tested on ten (10) students in which students were given a questionnaire to assess the practicality of the product. This stage aims to determine the level of practicality of the Google Sites product before being tested to the next stage. In the last stage, the product that has been revised based on the expert review stage, one to one evaluation, a small group will be used as research subjects in the field test. The purpose of this field test is to determine the final product developed and meet the criteria of being valid, practical, and having a potential effect.

The research subjects were students of class X in one of the schools in the city of Palembang. Data collection techniques implemented include: interviews and observations, walkthroughs, questionnaires and tests. Interview between researcher and physics teacher(Widyoko, 2012). The interview in the form of a table consists of thirteen questions and thirteen answer columns. This activity is asked directly or in an open interview to the teacher concerned. The function of this interview and observation is to get information about the problems in the school. Walkthrough used in the form of a table that contains aspects of the subject matter, media, and language with a detailed description of the questions for each aspect that is measured. walkthrough is a way of collecting data that is done during expert validation to see the validity of the product by using a check list sheet or a list of questions. Questionnaire is a method of accumulating information which is done by submitting a written question to the respondent (Widyoko, 2012), the questionnaire used is also in the form of a table containing ten questions in which this questionnaire serves to assess the practicality of a product that has been developed. The test is a tool for evaluating, namely a tool for collecting data on the characteristics of an object(Widyoko, 2012). The test used in this study consisted of ten multiple choice questions. This test serves to determine whether there is a potential effect of interactive multimedia in the form of google sites on student learning outcomes.

The data analysis technique used is walkthrough analysis technique to see the validity of the product, questionnaire data analysis to determine the practicality of the product, and test data analysis. The criteria for the validation value are from not good to very good with an assessment score range of one to four and for the validation level category from very invalid the average is (1.00-1.74), invalid if it is in the number (1.75 -2,49), valid is in the range (2.50-3.24), the last is very valid when the value is in the number (3.25-4.00) which is modification of(Apriyani et al., 2018).For the criteria for the

practicality of the word very not very good to very good, the assessment range is one to five modifications of(Latifah & Dwiningsih, 2018). For the practicality category, starting from the word impractical with a percentage of 54%, less practical the percentage range is 55-59%, quite practical if the percentage is at 60-75%, is said to be practical if the percentage is 76-85%, and a product is said to be very practical if the value obtained is 86-100% modification of(Julyal, 2010).

The learning implementation observation sheet consists of 8 aspects and indicators that are assessed, namely first) honest in recording the results of the practicum as it is, second) discipline in compiling practicum tools, third) responsibility for making assignments, fourth) cooperation with groups in compiling reports, fifth) polite in expressing opinions and responses, sixth) being responsive in answering questions from the teacher, seventh) being pro-active in every learning activity, and finally communicating with the teacher about the results of the practicum, for the assessment in the form of a YES or NO check list. The N-gain calculation technique can be seen in the formula and table below:

Table 5. Category of N-Gain Interpretation

<i>N-gain</i>	Interpretation Criteria
$N - gain > 0.7$	Tall
0.3 –0.7	Currently
$N - gain < 0.3$	Low

(Meltzer, 2002 in Tawil & Suryansari, 2012)

RESULT AND DISCUSSION

The results of the planning stage include the results of the analysis of student needs obtained by conducting observations and interviews at one of the schools in the city of Palembang. Based on interviews conducted by researchers, the teachers at the school have implemented curriculum 13. The learning model used in teaching and learning activities uses the inquiry model, problem based learning, scientific. Based on the results of observations the teacher applies the experimental method, demonstration in the laboratory and discussion in class. The

teacher relates physics lessons to everyday life because it is very important where physics events are natural phenomena. Learning tools have been prepared by the teacher before the start of the odd or even semester, which consists of: time allocation, educational calendar, annual program, semester program,

Regarding the Minimum Completeness Criteria (KKM) in the school, of course, they vary, namely for class X KKM of 65, class XI of 65, and class XII of 73. From the observation activities observed by researchers, student activities in the class are very active, which can be seen from the activity. students respond to questions posed by the teacher. Students discuss

together when the questions asked are not solved and students also seek additional information from various sources, such as the internet, not only from books they have. Student responses to the lessons that have been given by the teacher are very good for physics subjects in every meeting. However, there are several obstacles encountered during the learning process where students find it difficult to understand the questions given and determine the formula, if the practicum is constrained by inadequate tools and materials. For learning media that are often used in learning activities in the form of powerpoints displayed on the blackboard, when online learning activities use zoom meeting, google meet, google classroom, and whatsapp groups.



Figure 3. Interactive multimedia homepage

In an open interview with class X students out of 27 students only 2 liked physics, 25 other students didn't like physics. This incident arose because students had the opinion that physics was difficult, complicated, lots of formulas, less interested in exact lessons. In an open interview with class X students out of 27 students only 2 liked physics, 25 other students didn't like physics. This incident arose because students had the opinion that physics was difficult, complicated, lots of formulas, less interested in exact lessons. In an open interview with class X students out of 27 students only 2 liked physics, 25 other students didn't like physics. This incident arose because students had the opinion that physics was difficult, complicated, lots of formulas, less interested in exact lessons.

Based on the results of interviews and observations to see the analysis of student needs, the researchers saw that there were problems which needed more in-depth research. Some of the points include that students are less motivated to learn physics because the learning used is the same as in general so that there are still some students who get learning outcomes under the KKM. In addition, the learning media implemented by the teacher has not accommodated the achievement of learning objectives, there is no use of interactive multimedia implemented in the school so that the teaching and learning process is still less interesting and monotonous. Therefore, researchers will create interactive multimedia in the form of google sites that can build students' enthusiasm for learning. Further analysis of the syllabus.

Next is the results of the development stage, at this stage the researcher creates interactive multimedia in the form of google sites on business and energy materials, based on GBIM, JIM, interactive multimedia flowcharts, storyboards and drafts that have been made previously. Which is used in the interactive multimedia development process. The following are product images along with interactive multimedia explanations that have been created, one of which is the front page as shown figure 3.

The interactive multimedia homepage consists of a header, middle and footer. This page contains clickable menus, namely the learning objectives menu which contains Core Competencies and Basic Competencies selected based on Curriculum-13. The material contains the subject matter of work and energy as well as examples that have been encountered in everyday life. The selection of this material was done because there were still some students who obtained learning outcomes under the KKM, this business and energy material was included in the even semester. The instructional video above is taken from YouTube. The video was chosen because the explanation and description of the material was explained in a concise and complex manner with an efficient duration. The virtual laboratory contains PhET simulations and Student Worksheets (LKS). By using this virtual laboratory interactive activities occur between the user and the computer. For example, when students enter numbers, PhET will display the results (output). PhET simulation can also be an alternative for schools whose laboratories are limited or there are obstacles in the tools and materials that are not sufficient to carry out practical work directly. Sample questions and discussions in accordance with the material being taught. Next, the Posttest menu, before going to the posttest questions, the teacher displays a login menu, by instructing students to input subjects (Physics X MIPA) and the password (12345678) that the researcher has determined. The goal is to prepare students before taking the ability test. Without going through this login menu, students cannot directly open the google form for posttest questions. With this login, students also become more disciplined in the learning process. Reference is a reference for researchers in teaching. The last menu is profile. This profile was created as a form of indirect introduction to students with contacts that can be contacted. This menu is very useful because when students are absent or late in collecting assignments, they can be confirmed to the researcher through the number listed. All the contents of these menus are adjusted to the results of the analysis of student

needs. This menu is very useful because when students are absent or late in collecting assignments, they can be confirmed to the researcher through the number listed. All the contents of these menus are adjusted to the results of the analysis of student needs. This menu is very useful because when students are absent or late in collecting assignments, they can be confirmed to the researcher through the number listed. All the contents of these menus are adjusted to the results of the analysis of student needs.

The results of the evaluation phase include self-evaluation which evaluates independently and conducts discussions with the lecturers involved in this research. expert review based on the diagram below, the results of the assessment of the three validators obtained an average of 3.57, as shown figure 4 so that categorized as very valid. In the One to one stage which is used to see the practicality of a product, the average obtained is 94%, meaning that the google sites product developed belongs to the very practical category as shown figure 5.

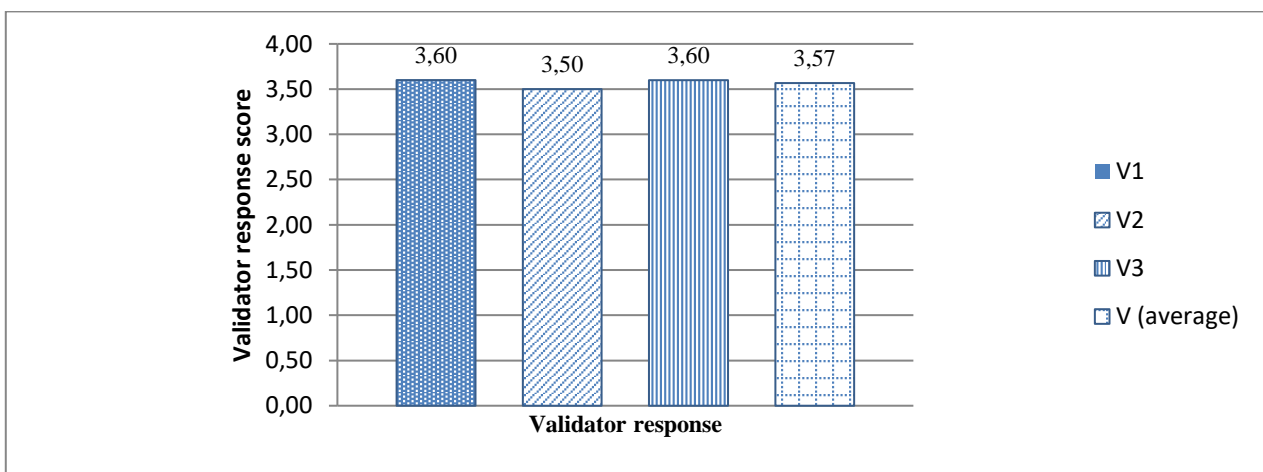


Figure 4. Diagram of the recapitulation and average value of the validator

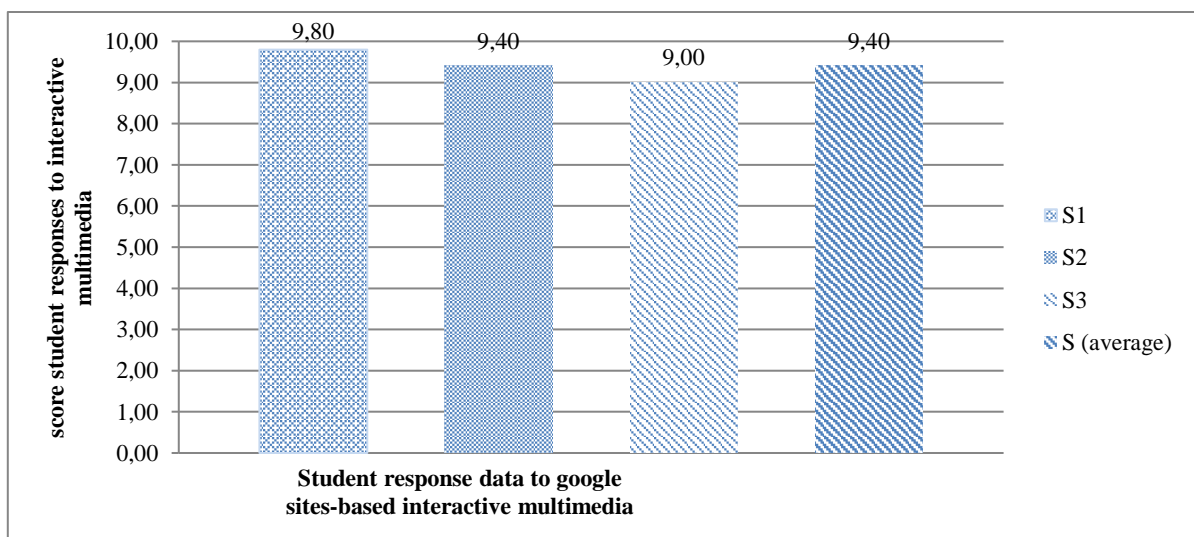


Figure 5. Diagram of practicality test results at the one to one stage

At this stage the researcher identified criticism, input and suggestions from students at the small group stage. A total of 7 students said that the google sites were very interesting, 5 students said the material was easy to understand, and other students said it was neat, cool and the use of these

google sites could motivate students. So it can be concluded that at the small group stage, it is very practical, this can be seen from the average value of 87%. Of the several advantages above, there are also shortcomings that will later be corrected, the diagram is as follows:

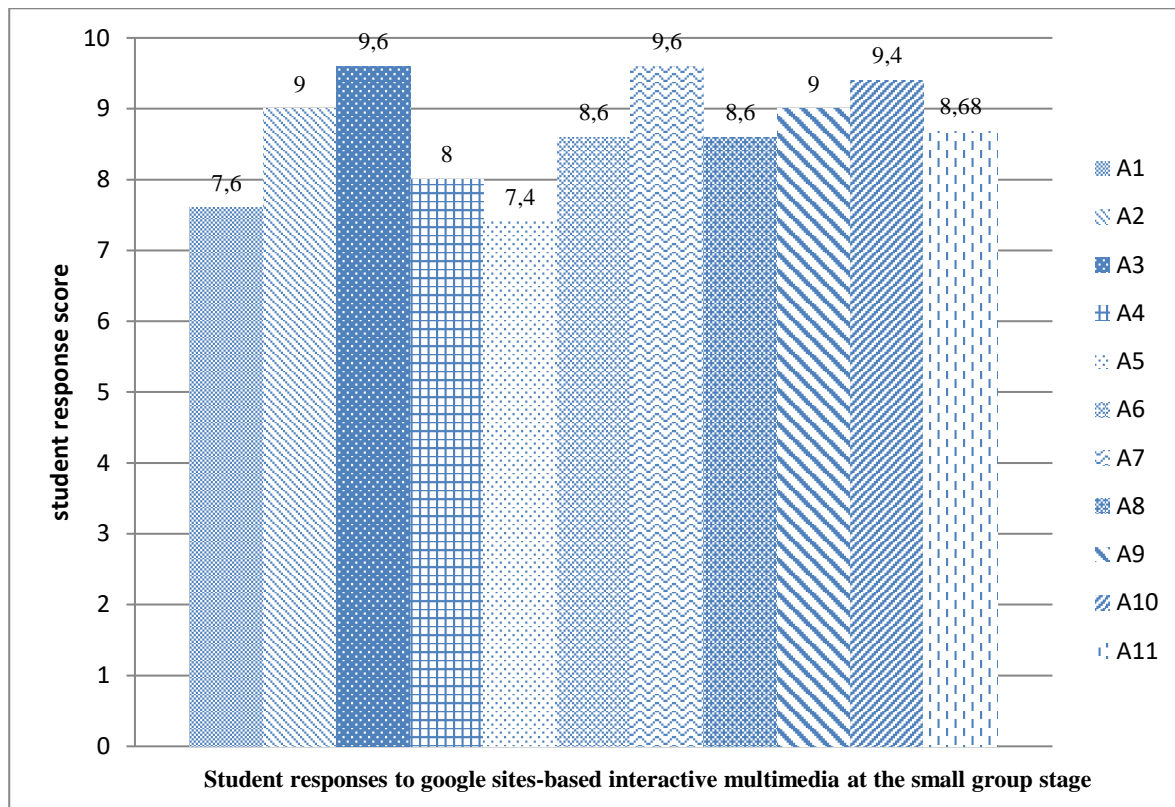


Figure 5. Diagram of practicality test results at the small group stage

Filed test also called field trials which based on the results of the pretest scores obtained by students, it can be concluded that learning outcomes in business and energy materials are still relatively low because the initial test scores obtained by most students have not reached the KKM applicable in schools and only five students get value above the KKM. The next day, the researcher distributed the google sites link to the whatsapp group to be seen and understood independently by students. By greeting and greeting, then the students were divided into five groups, each group consisting of five to six students who were divided heterogeneously. In the learning process students discuss in groups, present the results of their discussions, then are given reflections on the lessons learned by the teacher.

During the teaching and learning activities, the researcher observed the characteristics of each student by making a checklist for the assessment of Core Competencies which included an attitude of honesty as evidenced by the results written by students on student worksheets in accordance with the practicum carried out, discipline was seen when compiling tools and materials according to procedures and time discipline as evidenced by the allocation of time for group practicums and presentations in front of the class. Responsibility is seen from the writing of student worksheets that are done well, cooperation can be observed when group discussions take place, polite with good manners in conveying arguments, responsive when given a question but only a few students can answer the questions asked individually. Spontaneous, being pro-active in teaching and learning activities,

and how to communicate students to educators when delivering their practicum results. After analyzing the characters of the five groups, the researcher concluded that students were less responsive in answering questions from the teacher during presentations in front of the class. This can be influenced by several causes, for example students are less confident when standing in front of the class, it is different from sitting in a chair and causing students to be a little nervous when asked questions orally.

Next, the researcher calculated the results of the posttest that had been done by the students based on the ten questions presented. There is a choice of level of belief which serves to determine whether students have misconceptions, or do not understand the concept, or already understand the concept of the material obtained. It can be seen in the table below:

Table 1. Recapitulation of Student Learning Results through Posttest

No	Indicator	Correct answer	Confidence Level
1	Remember	92.3%	96.2% Sure
2	Define	88.5%	84.4% Sure 19.2% Doubtful
3	exemplify	88.5%	100% sure
4	Explain	73.1%	73.1% Sure 30.8% Doubtful
5	Compare	84.6%	15.4% Doubtful
6	Count	84.6%	76.9% Sure 15.4% Doubtful 7.7% Not Sure
7	Count	19.2%	76.9% Sure
8	Count	69.2%	69.2% Sure
9	Analyze	69.2%	73% Sure 26.9% Doubtful 3.8% Not Sure
10	Analyze	42.3% Correct 57.7% False	60% Sure 36% Doubtful 8% Not Sure

Of the ten questions, only numbers 7 to 10 are classified in the difficult category because calculating (C3) and analyzing (C4) the answers to this seventh question are very diverse from choices a to e, all chosen by students, only 5 (19.2%)

answered others correctly guessed but the confidence level was 76.9%, meaning that some students in the seventh question had misconceptions about the questions given.

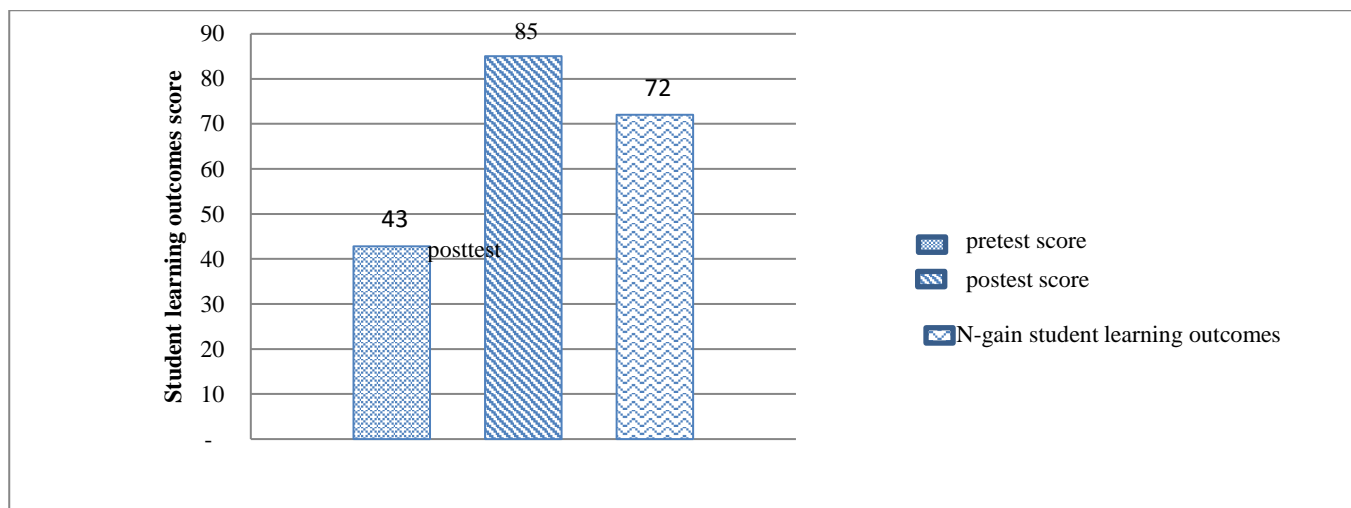


Figure 6. Student learning outcomes data

The ninth question is to analyze there is one student whose answer is not correct but he is sure of the answer, this shows that the student does not understand the material that has been studied. The function of this level of confidence is to be able to see in detail which parts of the subject the students do not understand, so that educators can improve the learning system for the future.

After analyzing one by one the questions worked on by the students, the researcher calculated the acquisition of the N-gain value. Student learning outcomes can be seen that there is an increase from the initial test and the final test before and after using interactive multimedia in the form of google sites, as shown in figure 6.

The results obtained stated that the interactive multimedia developed was valid, instant, and able to provide improvements to student learning outcomes. Based on previous research, namely (Mukti et al., 2020) which states that multimedia is able to have a substantial effect on motivation and student learning outcomes. As according to (Rahmawati, 2019) The results showed that the use of interactive multimedia as a means of support in learning can improve student achievement. The average value of the three validators, which is 3.56, meets the very valid category. This research is in line with previous research, based on the results of research conducted by (Putri et al., 2019), which shows that interactive learning media using Adobe Captivate on simple harmonic motion material has positive responses from teachers and students, namely the percentage

of 84% and 85% and is feasible to use. The development of interactive modules helps students understand concepts through visualization so that the material presented to students is very interesting (Maisessa et al., 2021). Likewise with the results of research conducted by (Zainuddin et al., 2019) stated that the results of the analysis of both academic and practitioner validators on student learning outcomes were categorized as very valid, very practical, and high effectiveness.

After going through the expert review stage, the one to one, interactive multimedia small group was declared valid and practical. These results are explained by research by Ketang Wiyono (2015) which states that the ICT learning model in the form of interactive multimedia drill models, tutorials, simulations and instructional games on physics subjects developed is valid and practical. Next in the field test stage. As according to (Ainyn et al., 2022) N-gain results show that interactive multimedia is effective for improving student learning outcomes with a score of 81.2% of students in the high category and 18.2 in the medium category. Based on the posttest data recapitulation of the research conducted by the researcher, the average N-gain value was obtained at 0.69 in the medium category.

Interactive multimedia can involve students actively learning. Student involvement in the learning process has an effect on improving students' cognitive abilities. Therefore, the use of interactive multimedia improves the learning

outcomes of the concept of effort and energy of students (Syafriyanto & Rahman, 2017).

Obstacles when conducting research, at the field test stage at the second meeting of the practicum when explaining the working procedures for using PhET simulation using an LCD projector but not turning on or off. Therefore, the researcher had a little difficulty in explaining it to each group. The solution is explained in detail to each group in turn and given sufficient time, of course, this research activity runs smoothly.

CONCLUSION

Interactive multimedia in the form of google sites on business and energy materials is stated: very valid, stated by experts with an average of 3.56, very practical, seen in the scores obtained at the one to one stage 94% and small group 87%, and has a potential effect on the research subject so as to improve student learning outcomes seen from the average N-Gain value of 0.72 with a medium category so that interactive multimedia products in the form of google sites are suitable for use in the teaching and learning process.

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