

Development of Google Sites-Based Learning Resources to Improve Mastery of Concepts and Process Skills in Electrical Circuit Materials

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Abstract: Trends in International Mathematics and Science Study (TIMSS) Indonesia's results in the last four editions ranked 44 out of 49 countries can show students' low literacy and science process skills. The research aims to develop products by utilizing google sites-based websites to improve students understanding of concepts and science process skills. ADDIE research method with steps of analyzing needs, designing products, developing products, trials and applying development results to students. The instruments used are expert validation instruments and data analysis techniques with triangulation, namely observations, interviews, and tests to see the effectiveness of the product. The validation results of the Material Expert showed a score of 4.3 indicating a very valid category, the Linguist showed a score of 4.46 indicating the category was very valid, the Media Expert showed a score of 4.69 indicating the category was very valid, and the Pedagogy Expert showed a score of 4.54 indicating the category was very valid. The effectiveness rate of this product is quite high, namely 19 students or 82.6% achieved and measured by N-Gain the score is at 0.5 with a moderate category. Aspects of electrical observing skills 82.14% or very high categories, grouping 92.86% very high categories, interpreting an average of 82.14% very high, forecasting average incidence 85.71% very high, formulating hypotheses averaging 89.29 very high, formulating product designs averaging 96.43% very high categories and communicating aspects 78.57% high categories. These results can be concluded that the development of learning resources by utilizing google sites as a learning resource can increase understanding of concepts and encourage students to be actively involved in learning.

Keywords: Google sites; Learning resources; Mastery of concepts; Science process skills

Introduction

The results of a session *Trend in International Mathematics and Science Study* (TIMSS) Indonesia from 2003-2015 Indonesia is always ranked 10 and below and in 2015 Indonesia is ranked 44 out of 49 countries. Since 2003 it has seen Indonesia's ranking seem to decline and last in 2015 it was in position 5 from the last position, the next TIMSS took place in 2019 but in the last TIMSS which took place in 2019 Indonesia was not involved in the TIMSS assessment (Mullis et al., 2019). This is a serious concern because it seems that the ability of

students in Indonesia in the fields of Mathematics and Science is still not optimal. Other problems seen from the survey results include teachers have not created effective and interactive learning patterns, teachers have not utilized learning resources that provide space for students to access ICT, there is still a lack of website-based learning resources in schools, teachers are still the only learning resource or (teacher center), and low student skills in learning science in the classroom. This problem has an impact on the low mastery of student concepts obtained and students are still low in process skills in learning Natural Sciences so that it affects the

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low cognitive learning outcomes of students and lack of student involvement in learning. Therefore, it is necessary to provide appropriate and student-centered learning components, namely by developing digital-based learning resources. The role of internet-based learning resources in learning is considered quite effective. According to Lestari (2020) explaining the purpose of using ICT can attract attention and motivate students in student learning. Sutisna (2020) explained that ICT-based learning has an impact on active and interactive student learning activities. Therefore, it can be concluded that the role of ICT in learning has a positive impact in improving effective learning processes and outcomes.

The type of ICT application that is effective and easy to use by teachers and can be used easily is to utilize a Google Sites-based website. The definition of google sites according to Kurniadi (2021) is that *google sites is a platform on Google that allows you to easily create websites*. Aulia (2021) said that google sites is a google site that has features in providing easy-to-use design templates, layouts, and free navigation menus, with a capacity of up to 100 Mb. The role of google sites according to Zainal (2021) is to make it easier for teachers to provide learning resources that can be easily accessed by students or learners by utilizing the ease of navigation, attractiveness of appearance and *usability* of the web or site. Kusumaningtyas (2022) explained that *Google sites can be used for learning because they are easy to use and able to maximize other Google features such as google docs, sheets, forms, calendar, and more*". From various sources referenced, it is a consideration for researchers to create an ICT-based learning resource by utilizing *websites* but can make it easier for students and teachers to learn. The development of Google Sites will be more effective if it is linked to the phet.colorado application as a supporting application to create a simple electrical circuit virtually. Bunga (2021) phet.colorado application is a virtual lab in this case using Physics Education Technology (PhET) software. *PhET* is a research-based and freely licensed interactive simulation software. This virtual lab was developed by a team from the University of Colorado United States. According to Riantoni (2019), PhET interactive simulations is a project at the University of Colorado that develops a simulation tool focused on learning physics. Based on the above understanding, it can be concluded that phet.colorado is a web-based application developed by the University of Colorado to simulate science learning.

According to Bunga (2021), the goal of making this interactive simulation software is *"help students visually comprehend concepts, ensure educational effectiveness and usability*. Helping students to visualize concepts fully and clearly, thus ensuring effective education and

continuous usefulness. Another opinion of the usefulness of applications or virtual laboratories according to Riantoni (Riantoni et al., 2019) explains the benefits of virtual laboratories proven to have a positive effect on the development of students' skills, attitudes and understanding of concepts. Another opinion according to Riantoni (Riantoni et al., 2019) virtual laboratory can be a support in developing and changing conceptually and helping students to understand physical phenomena in various scopes of physics learning. So, the conclusion that can be described about the usefulness of this application according to Riantoni (Riantoni et al., 2019) is that this application provides a positive effect from the use of PhET in learning.

The quality of learning in schools has an impact on the achievement of academic results or learning outcomes obtained by students, both knowledge and skills possessed by students. Nasution (2019) stated that learning is the ability obtained by students after going through learning activities. Ilmiyah (2021) explained that learning outcomes are changes in students' knowledge abilities, attitudes, skills and behavior after learning activities as a result of an experience. Anderson (Arisanti et al., 2017) concept mastery is a scheme, mental model, or implicit and explicit theory. While Bundu (Arisanti et al., 2017) considered to have mastered the concept are students who can provide responses to questions or stimuli that vary in the same group or category. Therefore, to develop mastery of concepts related to the concept of electrical components and their functions in simple electrical circuits in class VI, efforts are needed to master the concept, namely identifying facts, scientific concepts, principles, laws and theories, electrical components, and their functions.

Other competencies that students can obtain through learning outcomes include the science process skills possessed by students. Gunawan (2019) states that scientific process skills are behaviors that encourage skills to acquire knowledge. Sholahuddin (2020) who stated the role of science process skills has an important role in the progress of society by contributing to the emergence of knowledge. Gürses, Çetinkaya, Doğar, and Şahin (Ade, 2018) stated science process skills are fundamental skills that facilitate learning in science, enabling students to be active, develop a sense of responsibility, enhance learning and research methods. Meanwhile, Sunanto (2021) defines science process skills as skills that a person has in using his thoughts, reason, and actions efficiently and effectively to achieve a result. According to Wita (2022) concluding science process skills are skills to process information obtained from the teaching and learning process which provides opportunities for students to be able to observe, classify, interpret, predict, apply, plan, and evaluate the experimental results obtained. Based on expert

understanding, it can be concluded that students' science process skills are students' ability to use reason, skills, concepts, and knowledge to produce or do something based on science or scientifically.

According to Sutrisno (Murdani, 2020) explaining the types of process skills of each Physics skill as a process are (1) observing (2) classifying/categorizing (3) measuring, (4) asking questions, (5) formulating hypotheses, (6) planning investigations/experiments and (7) interpreting information. In the Basic Competence of Science in class VI in the realm of skills, namely conducting simple electrical circuit experiments in series and parallel, then with this can be described indicators of students having science process skills with a scientific approach, which has stages, namely observing, questioning, collecting information, processing information, and communicating.

Method

This research applies the *Research and Development* method using the ADDIE research design (Analysis, Design, Development and Production, Implementation or Delivery and Evaluation) developed by Dick and Carey (Winarni, 2018). The reason researchers choose the ADDIE model is that according to Piskurich in (Soesilo & Munthe, 2020) the ADDIE model has the advantage of being simpler, organized, and widely used in making learning programs and products effectively and validated by experts. The source of information in this study is grade VI students of SDN Pulau Kelapa 02 Pagi which totaled 23 students. This research took place in August-December 2022 or in the first semester of the 2022/2023 academic year. The instruments to be used are expert validation questionnaires, interview guidelines, observation sheets and learning outcomes tests. The results of questionnaires then validate and convert grades After validation by experts both material experts, media experts, linguists and pedagogy experts and obtaining practicality test data from teachers and students, the results will be converted into the following Formula 1:

$$\text{Mean} = \frac{\sum X}{N} \tag{1}$$

Explanation: M = average score, $\sum x$ = Total score, N = Total number of items (Aulia & Khalid Riefani, 2021).

Table 1. Expert Validation Data Conversion

Score Interval	Category	Information
$X > X_{i+1}$, 80 Sbi	Very valid	No Revision
$X_{i+0.60} \text{ SBI} < X \leq X_{i+1.80} \text{ SBI}$	Valid	No Revision
$X_{i-0.60} \text{ SBI} < X \leq X_{i+0.60} \text{ SBI}$	Quite Valid	Needs Revision
$X_{i-1.80} \text{ sbi} < X \leq X_{i-0.60} \text{ sbi}$	Less Valid	Revision
$X \leq X_{i-1.80} \text{ SBI}$	Very Less Valid	Revision

The results of the product presentation figures represent with a product feasibility table by modifying from Aulia (2021).

Table 2. Product Practicality Conversion

Score Interval	Criterion
4.22 - 5	Very valid
3.41 - 4.21	Valid
2.61 - 3.40	Quite valid
1.80 - 2.60	Less valid
1 - 1.79	Very invalid

Result and Discussion

Analysis Results

The first stage of development is the analysis stage regarding the needs needed in solving problems that occur at SDN Pulau Kelapa 02 Pagi, especially in class VI on the content of Natural Science lessons on Electrical Circuit material. The analysis was conducted by researchers as teachers in class VI. So based on the results of the analysis in the form of observations and interviews with students and class VI teachers and based on the results of input from the principal, the following conclusions were obtained: need to create innovative learning resources, utilize infrastructure facilities in schools in the form of computer labs at school, use learning accounts for education as digital-based learning resources, create *websites* Free schools, create interesting learning media, make interesting assessments, and provide virtual practicum menus with the help of phet.colorado.

Results of the Design

At the design stage, making a product design concept in the form of google sites-based learning resources begins with compiling a storyboard of learning resources using the website, then compiling components, materials, videos, assessments, and practicums. Development and model of learning resources with google sites using various supporting applications, including google sites that use a belajar.id account, Google search feature as an image reference search, YouTube application as a reference for finding interesting learning videos, phet.colorado application as an online practicum application, and google form application as a tool or place for making learning outcome tests. *Website* developed has 6 menus, consisting of: menu, contains as the initial display of the website, namely where menus can be accessed, developers, and also the title of the *website*, contains the purpose of learning materials that can be accessed by students, material contains the content and materials provided, namely the material of the circuit of electricity in class VI, menu video contains learning videos that can

be played through the YouTube application, the Simulation menu using the PHET application. Colorado as an effort to improve students process skills in making electrical circuits virtually, and the test menu to test students after learning the material both virtually and face-to-face with teachers. The design or model of website-based learning resources is developed independently, while the model or website storyboard with google sites is as follows:

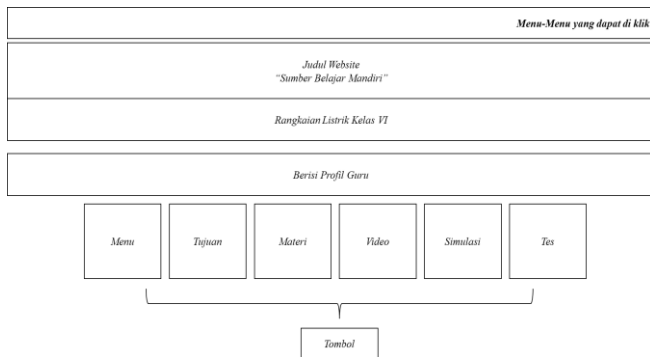


Figure 1. Google site home menu

Results of the Development Stage

The development stage is carried out with validation tests by experts. The development of this Google Sites product was validated by 4 experts in their respective fields, namely material experts, linguists, media experts, and pedagogy experts. Every aspect is tested by 4 experts. The results are as follows: The results of the material expert validation show a score of 4.3 out of a maximum score of 5 and show a very valid category, the results of linguist validation show a score of 4.46 out of a maximum score of 5 and show a very valid category, the results of media expert validation show a score of 4.69 out of a maximum score of 5 and show a very valid category, The validation results of pedagogy experts showed a score of 4.54 out of a maximum score of 5 and showed a very valid category.

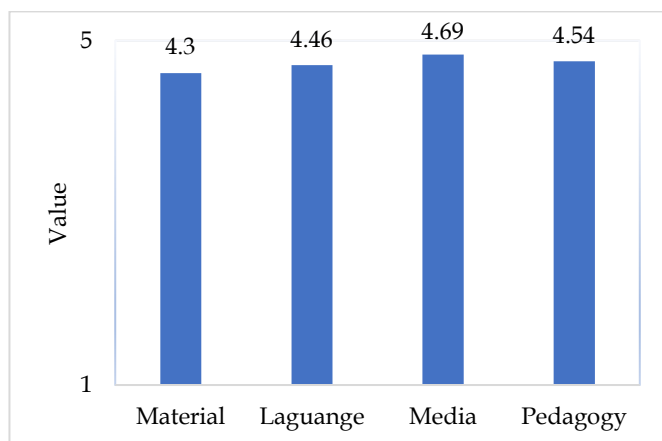


Figure 2. Expert Validation Results

Results of the Implementation

After validation of *website-based* learning resources using google sites by material experts, linguists, media experts, and pedagogy experts, learning resources in the form of products are evaluated and revised based on the results of notes, comments and suggestions written in questionnaires distributed to all experts. The trial of using *the website* by teachers was carried out at SDN Pulau Kelapa 02 Pagi Kepulauan Seribu. The implementation of trials for the use of learning resources is carried out once, namely in limited trials. The trial of using learning resources which was carried out once is the process of developing learning resources that will produce learning resources in the form of *websites* based on google sites on electrical circuit material in class VI. The trial was conducted on Tuesday, November 21, 2022, and during the trial there were teachers and students. The results of the trial with observation techniques from observations of the use of website-based learning resources conducted by two teachers, namely class V teachers and grade VI teachers, obtained results that from 15 aspects of assessment, 13 aspects appeared or around 86.7% and 2 aspects of assessment did not appear or around 13.3%, meaning that if converted the results of the first teacher's observations were included in the very high category, While the results of observations to the second teacher can be seen from 15 aspects of assessment, it can be seen that 12 aspects of observation appear or about 80% and 3 aspects of assessment do not appear or about 20%, meaning that if converted the results of the second teacher's observations fall into the very high category. In addition to observation techniques, product practicality trials are carried out by distributing questionnaires and interviews. The results of the questionnaire are as follows: from the questionnaire distributed to teachers, a score was obtained, namely the first teacher with a few 4.55 or 90.91% and entered the very high category, while the second teacher obtained a result of 4.55 or 90.91% and entered the very high category. Based on the results of the practicality test above, the development of website-based learning resources using google sites obtains very high yields. The results of the practicality test to students obtained the first student data of 85% and if converted into the conversion of grades entered in the very high category and the results of the second student practicality questionnaire were 85% when converted into the conversion of grades entered in the very high category.

In addition to the results of observations, product practicality tests are obtained from the results of questionnaires. Of four students, the average score was 4.64 or 92.28%, meaning that the product developed had a very high category. Data on product trials and implementation were also obtained from interviews

with teachers and students. Teachers generally state that the products developed have a good impact in helping students master a concept and are also practical in operating their learning resources. Apart from teachers, interview results were obtained from grade VI students, the result was that the development of learning resources with this website was quite easy and there were no significant difficulties in its operation and students felt helped in understanding the material with the help of websites with google sites and virtual practicum. This can be seen from the achievement of mastery of concepts and science process skills from the multiple-choice questions attended by 23 students, an average score of 78.26 was obtained. When viewed from the results of the pretest and posttest, the following data are obtained:

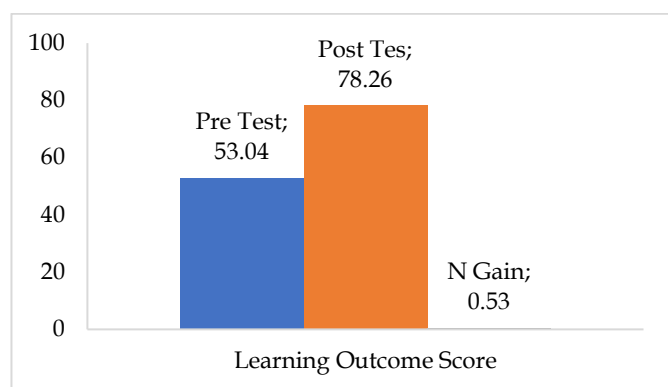


Figure 3. Results of mastery of concepts

According to Ilmiyah (2021) learning outcomes are changes in students' knowledge abilities, attitudes, skills and behavior after learning activities. This means that with the achievement of grade VI students with 82.6% of students completing KKM, it can be stated that students have experienced changes in students' level of knowledge of the concept of electrical circuits. Milala (2022) said that the effectiveness of learning and efficiency is seen from the level of achievement of its goals after learning is complete. If the learning objectives are achieved, then learning is said to be effective. To determine the achievement of learning objectives, tests are carried out and tests have achievement standards or criteria known as KKM. Weri (2019) said that the effectiveness of the use of interactive multimedia was reviewed in two ways, namely looking at the achievement of the Minimum Completeness Criteria (KKM) classically and by comparing experimental class and control class data. Nelasari et al. (2021) stated that the development of learning resources with websites affects the achievement of learning outcomes in mastering the concepts achieved by students. Salsabila and Aslam (2022) explained that google sites-based learning resources affect teachers in

creating effective learning and helping students improve their learning outcomes. Pubian and Herpratiwi (2022) explained that the use of Google Sites can foster student learning motivation. Aulia (2021), Google Sites resources developed can improve students' higher-order thinking skills. From the various research results above, it can be concluded that the results of research that have been carried out have effectiveness in improving the quality and quality of learning so that learning outcomes and achievement of learning objectives can be achieved using developed learning resources.

The results of process skills can be seen from the aspect of the skill of observing electrical circuits, obtaining data of 82.14% or being in the very high category, the aspect of grouping each group obtained an average result of 92.86% which means that in the very high category, in the aspect of interpreting electrical circuits each group has an average of 82.14% or in the very high category, the aspect of forecasting events obtained an average of 85.71% or the very high category, The aspect of formulating hypotheses obtained an average result of 89.29 or in the very high category, the aspect of formulating product design obtained an average of 96.43% or in the very high category and the aspect of communicating results of 78.57% or in the high category and from the aspects assessed obtained an average value of 86.73% or entered in the very high category. The use of ICT-based learning resources has an impact on the quality of learning. Laksana (2020) explained the importance of using ICT in learning to improve teacher competence in teaching and improve the quality of student learning. Rahman (2020) stated that learning resources in the form of the internet facilitate the learning process. The role of the phet.colorado application is very important to improve the science process skills in this learning, because this application is useful for encouraging students to use *sense-making* and *reasoning*, encouraging productive collaborative activities (Wieman et al., 2010). According to Yuniar (2021) explained that the phet.colorado application aims to help students to visualize concepts as a whole and clearly, then ensure effective and continuous education. According to Bunga et al. (2021) this application can activate students in solving problems.

Another opinion about the advantages of the phet.colorado application that can improve students' process skills is according to Muzan (2021) said that the help of the phet.colorado application functions: 1) effective learning media to increase student learning effectiveness; 2) help students learn without having to use real labs; 3) PHET simulation is also able to improve students' digital literacy skills; 4) match the reasoning material in science lessons; 5) Flexible in operation. The role of multimedia that can improve students' scientific

abilities is also evidenced by the results of Solé-Llussà's (2020) research that utilizes multimedia and that explains that strategies based on the use of video can support student inquiry activities and provide students with a structured mindset for the inquiry process and especially able to improve, questioning skills, collecting information, processing information, and analyzing information. According to Putri (2022), the use of Google Sites can encourage students to learn independently and affect student learning motivation. Student learning activation affects the achievement of student learning outcomes.

So it can be concluded that the development of website-based learning resources with google sites and with the help of the phet.colorado application helps students to solve problems and encourages students to think critically and creatively through virtual simulation activities. In addition, it also encourages students to master the concepts of the subject matter, and the use of technology in learning plays a role in improving the digital literacy skills of elementary school students.

Conclusion

Learning resources are important components and learning tools are provided by teachers to create quality and quality learning. Advances in technology and communication have a positive impact on learning. The use of ICT has proven to have a positive impact in creating project-based learning, problem solving and student engagement. The use of web-based learning resources helps teachers to organize active and interactive learning. The level of product validation developed at the stage is very valid and the results of practicality trials look high in line with the results of student achievement in mastering the concept of electrical circuit material that obtained an average result of 78.26 and consisting of students who achieved the minimum completeness criteria were 19 students or 82.6% and students who had not reached the minimum completeness criteria were 4 students or 17.4% and if you look at N-Gain the score was at 0.5 with the category keep. While aspects of science process skills students observed 82.14%, grouping skills 92.86%, interpreting skills 82.14%, forecasting skills 85.71%, hypothesis formulation skills 89.29%, design formulation skills 96.43% and communication skills results 78.57% and the average score of all aspects is 86.73% or falls into the very high category.

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Author Contributions

All authors in this article contributed to the process of completing the research. Hidayat as the first author contributed to the drafting of the research design concept, determining the methodology, collecting initial research data, processing data, writing research reports, writing articles. Otib Satibi Hidayat directs the flow of research, article content, validation of preliminary data collection instruments, and article reviews, Widiasih validates data collection instruments, refines results and discussion.

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Conflicts of Interest

The research in this article has no interest other than for scientific publications in the field of basic education.

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