

Development of Project Based Learning Media Using Google Sites on Alternative Energy Topics

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Abstract. Learning is carried out to arrange and organize the environment around students to foster their learning process. The student's learning process is carried out through inquiry, responding to questions regarding a problem or a complex challenge. This learning process can be conducted by applying the project-based learning model. The project-based learning model can be applied in the field of information and communication technology in line with the 21st century, such as using Google Sites. Therefore, this research aims to describe the specifications of Google Sites as a learning media using the project-based learning model on alternative energy topics and describe the assessment results from experts, educational practitioners, and learners regarding Google Sites as a learning media using the project-based learning model on alternative energy materials. This development research employs the 4D model by Thiagarajan, which consists of the following stages: define, design, develop, and disseminate. The learning media obtained validation from two experts and assessment from educational practitioners regarding content, media, and language aspects. The development trial of this media was conducted with phase E students. Data collection techniques included interviews and questionnaires, with data analysis performed qualitatively and quantitatively. The learning media comprises a primary topic, alternative energy, organized based on project-based learning syntax. It consists of three menus: the welcome menu, the main page, and the author's identity. Validation by experts and assessment by educational practitioners indicate that the learning media meets excellent content, media, and language criteria. The development trial results show that the learning media meets excellent criteria at each trial stage.

Keywords: Google Sites; learning media; physics learning; project-based learning

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INTRODUCTION

Learning is essentially a process of arranging and organizing the environment around learners in such a way that it can foster and encourage them to engage in the learning process (Pane, 2017). Learning is an activity aimed at influencing feelings, thinking abilities, and spiritual essence so that individuals are motivated to learn without coercion from others. Learning is also expected to enhance a student's moral and intellectual development. According to the National Educational Technology Standards for Students (NETS-S), there are six essential skills that a student must possess, namely: (1) Creativity and innovation, (2) Communication and collaboration, (3) Research and information fluency, (4) Critical thinking, problem-solving, and decision-making, (5) Digital citizenship, (6) Technology operations and concepts (Syahputra, 2018).

Previous research stated that students need help converting problems presented in verbal form into mathematical representations (Hartono, 2017). Student's low critical thinking skills are caused by their lack of interest in physics learning; teachers' lecture-based teaching model makes them feel bored during lessons (Melinda, Sinaga, & Ferenie, 2016). Project-based learning will guide students through several processes, including investigation, responding to questions about a complex problem or challenge, and developing skills required in the 21st century (collaboration, communication, and critical thinking) (Bie, 2012). Many teachers still use printed media as a learning tool, which decreases students' interest in studying physics (Hakim, 2021). This is also outside current technological advancements (Azis, 2019).

Implementing the project-based learning model in the classroom using Google Classroom is still perceived to have shortcomings, as it has yet to integrate with other Google facilities such as Google Drive, Google Forms, Google Slides, and many more (Pradana & Harimurti, 2017). The relevant research conducted by Mukti, Puspita, & Anggraeni (2020) indicates that the researchers created this learning media using Google Sites due to its ability to combine various information in one place, such as videos, presentations, attachments, text, and more. In previous research, there still needed to be more information regarding the schedule for the upcoming month related to the learning agenda, no videos were directly displayed on the Google Site page, and no feasibility tests had been conducted on the developed learning media. Therefore, in this study, a learning media will be developed using a project-based learning model based on information and communication technology, utilizing Google Sites as the learning media, which will be integrated with other Google tools.

METHOD

This type of research is Research and Development using 4D model by Thiagarajan, Semmel, & Semmel (1974), which consists of Define, Design, Development, and Dissemination. The researcher chose the 4D development model because each stage of define, design, develop, and disseminate is explained in detail.

The subjects of this research are 102 students from SMA Negeri 3 Sukoharjo and 110 students from SMA Batik 1 Surakarta who have received material on alternative energy. This research was conducted from May to October 2023.

The data collection techniques in this research include:

- Interview

The interview was conducted to obtain qualitative data regarding the needs of teachers in the implementation of physics education in schools.

- Questionnaire

There are three types of questionnaires: (1) Needs analysis questionnaire, (2) Expert validation questionnaire, and (3) Student and teacher response questionnaire.

The data in this study is sourced from experts, education practitioners, and students. This research has two types of data: qualitative data is analyzed using the triangulation of sources approach. This aims to test the credibility of the data by investigating information from multiple sources (Sugiyono, 2012). Meanwhile, the quantitative data from this study will categorize the assessment scores based on the formulation in Table 1 (Azwar, 2010).

Table 1. Criteria Score Interval Media

Skor	Criteria
$M_i + 1,5 S_{bi} < X$	Excellent
$M_i + 0,5 S_{bi} < X \leq M_i + 1,5 S_{bi}$	Good
$M_i - 0,5 S_{bi} < X \leq M_i + 0,5 S_{bi}$	Pretty Good
$M_i - 1,5 S_{bi} < X \leq M_i - 1,5 S_{bi}$	Bad
$M_i - 1,5 S_{bi} \geq X$	Very Bad

Source: Azwar, 2010

RESULT AND DISCUSSION

Define Stage

This analysis was conducted by interviewing teachers and distributing a needs analysis questionnaire to students. The analysis occurred at SMA Negeri 3 Sukoharjo and SMA Batik 1 Surakarta.

Based on the results of interviews with education practitioners from SMA Negeri 3 Sukoharjo, it is known that in physics learning, especially on the topic of alternative energy, a cooperative learning model is used with the aid of learning media such as PowerPoint, handbooks, and educational videos. The challenges encountered by education practitioners during this learning process are the need for students to be interested in physics, as they tend to prefer social sciences and the students' unwise use of smartphones during lessons.

As many as 81% of students are still struggling with this material, citing reasons such as unclear explanations from educators (34%), monotonous learning media (19%), not participating in the lessons at that time (16%), and the tedious way educators explain (15%). Most educators use textbooks (95%) as their learning media and deliver lessons through lectures (75%), resulting in 54% of students feeling bored with physics lessons.

Based on the results of interviews with education practitioners from SMA Batik 1 Surakarta, it is known that in physics learning, especially on the topic of alternative energy, the teaching models used are discovery learning, project-based learning, and two stay two stray, with the assistance of learning media such as PowerPoint, handbooks, and educational videos. The student handbook is equipped with a QR code that directs students to a page containing explanations of the material; however, this may trigger students to access other programs during lessons.

As many as 53% of students still face difficulties with alternative energy material; according to them, the explanations from education practitioners are still unclear (46%), the delivery of the material is considered tedious (25%), the learning media used is monotonous (8%), and some of them did not participate in the lesson at that time (5%). The learning material is delivered by education practitioners through lectures (55%) and presentations (34%) using handbooks (44%) and PowerPoint (31%), resulting in 81% of students feeling bored with this physics lesson.

This analysis determines the learning materials included in the teaching materials by the learning outcomes and elements of learning outcomes in the Merdeka Curriculum. The learning materials available in this media include kinetic energy, potential energy, mechanical energy, work, the relationship between work and energy, and types of alternative energy sourced from Physics Principles with Application Global Edition, Fundamentals of Physics Tenth Edition, high school textbooks, and others.

Design Stage

At this stage, the test instruments are being developed to measure students' understanding of the material presented during the learning activities, the selection of media to be used and integrated, the choice of learning model formats and material presentation, as well as the initial design of the media to be created.

Develop Stage

At this stage, several assessments and validations are carried out:

- The validation conducted by these experts covers the aspects of media, material, and language. The first expert rated the media, material, and language aspects as good criteria. The second expert rated the media, material, and language aspects as excellent criteria. Based on the total validation results from both experts, it was found that both experts provided validation in excellent criteria.
- The responses from the education practitioners were from four education practitioners whose assessments covered aspects of media, material, and language. Based on the total validation results from the four education practitioners, it was found that all four practitioners rated it in excellent criteria.
- Student material, media, and language responses are divided into limited and field trials. A limited trial was conducted on nine students, while a limited trial was conducted in 3 classes. In the limited

trial, the assessment results showed that 17% met the good criteria and 83% met the excellent criteria, with an average score of 109,9. In this limited trial, the learning media meets the excellent criteria while still considering some assessment scores that are not yet optimal. In the field trial, the assessment results indicated that 43% met the good criteria and 57% met the excellent criteria, with an average score of 107,8. Thus, in this field trial, the learning media also meets the excellent criteria while considering some assessment scores that are not yet optimal.

Learning Media Specification

This learning media contains one main topic, which is alternative energy. This topic comprises several subtopics: work, energy, and forms of alternative energy. The menu available in this learning media includes a welcome menu, a main page, and the author's identity. There is also a submenu for usage instructions and a schedule of learning activities. This learning media presents essential questions, PhET virtual laboratory simulations, instructional videos, material reflections, and exit tickets. This learning media can only be accessed online, so it does not require storage space and can be accessed on Android, iPhone, Windows, and MacOS.

This learning media is structured based on the project-based learning syntax by The George Lucas Educational Foundation (2005), which includes (1) Starting the learning process with essential questions, (2) Planning the project to be created, (3) Determining the schedule for project completion activities, (4) Monitoring the progress or development of the student's projects, (5) Analyzing data and drawing conclusions, (6) Then communicating or reporting the product, after which students are invited to complete an exit ticket.

In previous research, there still needed to be more information regarding the schedule for the upcoming month related to the learning agenda; no videos were directly displayed on the Google Sites page, and there needed to be instructions for using Google Sites. Therefore, this research will develop a learning media that uses a project-based learning model based on information and communication technology. This media will include videos that can be directly viewed on the Google Sites page, along with usage instructions linked to a Google Document, thus collaborating this media with various Google tools.

Validation and Assessment Result

Based on the validation data analysis involving two experts, four education practitioners, a limited trial with nine students from three classes phase E at SMA Negeri 3 Sukoharjo and SMA Batik 1 Surakarta, as well as a field trial, it was concluded that the project-based learning media using Google Sites on alternative energy material meets excellent criteria.

CONCLUSION

Learning media developed by this researcher integrates Google Sites with Canva, the PhET virtual laboratory, and several features on Google. This learning media is guided by the learning outcomes outlined in the teaching module by implementing the Independent Learning Curriculum, which includes knowledge and skill elements structured based on the project-based learning syntax. This learning media consists of 3 menus: the welcome menu, the main page, and the author identity page. Learning media can be used in classroom learning and self-study and accessed on Android, iOS, Windows, and macOS. Based on the analysis of validation data involving two experts, assessments from four education practitioners, a limited trial with nine students from three X classes at SMA Negeri 3 Sukoharjo and SMA Batik 1 Surakarta, as well as field trials, it is concluded that the project-based learning media using Google Sites on alternative energy material meets excellent criteria.

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