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Creation of Dynamic Electricity Digital Teaching Media Based on Problem Solving Learning Model to Facilitate Students' Physics Problem-Solving Skills

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ABSTRACT

The problem encountered in the field is the lack of digital teaching media based on the problem solving learning model that can facilitate problem-solving skills. The difficulty of understanding the concept of physics in dynamic electrical materials has an impact on the low ability of students to solve Physics problems. In addition, the application of the learning model in schools has also not been able to facilitate students' problem-solving skills. Thus, the purpose of this research is to create a dynamic electrical digital teaching media based on the Problem Solving learning model to facilitate students' valid and practical physics problem-solving skills. This type of research is research and development with a 4D development model consisting of define, design, develop, and disseminate. Research is limited to the development stage. Research data is data for the analysis of needs, validity, and practicality. The data obtained were analyzed using Aiken's V formula for validity and using the Likert Scale for practicality. The results of the study were obtained that the dynamic electricity digital teaching media based on the problem solving learning model was valid with an average score of Aiken's V ≥ 0.6. The values of the content, linguistics, presentation, and graphics components were 0.72, 0.72, 0.74, and 0.70, respectively. This media is also declared practical with a percentage of more than 60%. The students' responses to each assessment indicator were average 85.8%, 90.2%, and 87.4% with very practical criteria. The teachers' responses showed an average of 98.6%, 95.8%, and 97.5% with very practical criteria.

Keywords : Student's Problem Solving Ability; Media; Problem Solving.

I. INTRODUCTION

Physics is a part of Natural Sciences (IPA) that studies natural phenomena physically and presents them in mathematical form for ease of understanding and utilization for learning. Physics learning itself aims to improve students' understanding, knowledge, and analytical ability of the environment and the surrounding context. In physics learning, the focus is on inanimate objects such as natural objects and phenomena. Abstract concepts related to this phenomenon are often difficult for students to understand. Therefore, educators need to pay attention to this problem so that the learning process can achieve its true goals [1]. The purpose of learning physics is to gain a deep understanding of physics concepts and develop the ability to utilize scientific approaches and rely on scientific mindsets to address issues.

Problem solving is a series of steps or processes taken to find solutions or answers to the problem situation at hand. Using problem-solving techniques, one can figure out how to get over challenging circumstances and hurdles in order to accomplish a goal [2]. Jonassen [3] and Schunk [4] argues that problem solving is a process that has two important attributes in the representation of the problem and the schema of the problem that functions to find a solution to the problem. Problem solving is a thinking process in which students can develop skills in understanding problems, analyzing them using interpretation and reasoning to find solutions, as well as evaluating the results of the solution achieved and reflecting on it [5]. Problem-solving skills for students can be seen in their ability to create solutions through steps to collect and organize information in a structured manner.

Students' problem-solving skills are still relatively low, when working on physics problems from teachers, students tend to directly apply mathematical equations without first analyzing them, often guessing formulas and memorizing examples of problems that have been solved to answer other problems [6]. In addition, the cause of this low problem-solving ability is learning that only emphasizes understanding concepts without encouraging the application of these concepts in real-world situations. One of the crucial factors that causes students' low ability to solve physics problems is their difficulty in overcoming problems that are not familiar with the material that has been studied [7].

Students are encouraged to take an active role in recognizing and resolving the issues they encounter through the use of the Problem Solving Learning Approach. There are five syntax of the Problem Solving learning model, namely concentrating on the problem, explaining relevant concepts, preparing a problem solving plan, implementing problem solving, and evaluating answers [8]. Implementing problem-solving techniques is necessary since they can assist students in solving problems and give them the improved skills they need during the learning phase. The usage of learning resources that are in line with technology advancements must enable the application of the knowledge model in order for the resources to help the development of physics problem-solving abilities.

A tool or method used in the learning process, media for learning helps students receive knowledge in a more engaging, interactive, and visible manner. Learning media refers to any type of tool or means used to deliver learning materials so that students can be more engaged, fascinated, thinking, and comfortable during the learning process [9]. Implementing the use of digital media in learning, allows educators to train students in a variety of skills and support their learning [10]. Additionally, in the learning process, digital learning materials can adjust to the demands of the pupils [11]. With appropriate digital learning media, educators are hopeful that it can provide assistance deliver material well.

Ispring Suite 9 is a type of digital learning media that is still not widely used. The advantage of this software is that it allows you to change presentation files with various elements. Ispring Suite 9 can help in compiling a learning medium that Students find it easy to comprehend. Another advantage in creating this learning media using Ispring Suite 9 can provide direct feedback through interactive evaluation features, which allow students to receive feedback on their performance, thereby strengthening analytical skills that are essential for problem solving.

Implementing a problem-solving-based learning model in developing digital teaching materials with iSpring Suite 9 software can significantly enhance learning quality. Based on the findings from the interviews conducted at MAN 1 Bukittinggi, schools have used learning media, although limited to resources available on the internet. The media used in schools has not been able to optimally facilitate problem-solving skills and there has been no development of digital physics teaching media in the school environment. Teachers are still focused on the use of print-based learning media. The impact of the limited use of this media is that students become more passive and less skilled in solving physics problems.

The limited use of media also has an impact on the achievement of low physics scores. The last evaluation data of the physics semester for the Phase F class with KKTP was 80, out of a total of 134 students, only 17 students managed to achieve the KKTP. This means that the percentage of physics passing at the Phase F grade level is 12.7%. Meanwhile, as many as 117 students or around 87.3% of students did not reach the KKTP that had been set. The low physics problem-solving ability of students is also strengthened by the results of written tests on dynamic electrical materials to find out how physics problem-solving skills are. Based on the written test results, students have struggled to identify the underlying issues in the problems and have not initially identified the necessary information to solve them. The steps taken by students in solving problems are not appropriate based on problem-solving indicators. The results of this observation show that the ability to solve physics problems on dynamic electrical materials has not been optimally implemented. This is also related to the learning model applied in physics learning.

According to the information gathered and interview results, the learning model has started to be implemented. Some teachers have adopted a model that requires active student participation in the learning process. However, this model has not effectively supported students in solving physics problems. There is a need for a learning model that not only encourages active learning but also helps students address physics-related challenges.

The researcher collected further information related to learning problems in MAN 1 Bukittinggi City by distributing a questionnaire. According to the findings of the questionnaire analysis, the author obtained 62 answers from filling out the questionnaire. The outcomes of completing the survey showed that 62.9% of students had difficulty understanding physics lessons. As many as 71% of students have difficulty solving

physics problems. Students have a curiosity in utilizing media in digital form accompanied by video, animation and audiovisual. This is also supported by the ability of students who are proficient in using technology, 88.7% of students are proficient in using smartphones and computers. As many as 50% of students still feel that they do not actively participate in the learning process. The information obtained also stated that as many as 87.1% of students were asked to study independently. This is also the reason why students need media that can be used to learn independently. The physics learning process in schools is 89.4% already using the teaching media provided by teachers. However, 53.3% stated that the teaching media used by teachers was not enough as a supplement to support physics learning. As many as 92% of students need digital teaching media that can facilitate in solving problems related to physics materials. Furthermore, 93.6% of students need the digital teaching media to be accessible using smartphones or computers.

In creating learning media, the researcher selects the material that will be presented in the media. The selection of material was derived from the findings of interviews that showed that the most difficult physics material to understand was dynamic electricity. Dynamic electricity is quite difficult, in dynamic electricity there are many formulations of formulas and various events that must be associated with everyday phenomena[12]. The importance of learning complex concepts to help learners understand very abstract materials such as dynamic electricity [13]. Therefore, learning media that are able to provide visual and interactive assistance to help students understand dynamic electricity better is needed. By creating digital teaching media and applying the Problem Solving learning model using ispring suite 9 software, it is hoped that an interactive and interesting learning media can be created, which not only helps in understanding the complex concept of dynamic electricity, but also facilitates optimal physics problem-solving skills. Thus, it is hoped that this digital teaching media can be a solution to facilitate problem-solving skills.

Drawing on the context description, Research must be carried out to develop digital learning media based on the Problem Solving model that can facilitate the skill to resolve physical problems, especially in dynamic electrical materials. This research is expected to contribute positively to both students and teachers in the context of physics learning. Therefore, the author is motivated to carry out "Creation of Dynamic Electrical Digital Teaching Media Based on Problem Solving Learning Model to Improve Students' Physics Problem-Solving Skills".

II. METHOD

This research employs the method of R&D, Methods of research utilized to develop a specific product. [14]. Four-D (4D) development model is used for the development procedure. The 4D development model involves four stages, composed of defining, designing, developing, and distributing [15]. Dynamic electricity digital teaching media is the object of this research. This study will investigate how valid and practical the digital teaching media based on the Problem Solving learning model made can facilitate in solving physics problems on dynamic electrical materials. This research is restricted to the phase of development.

The define stage is used to define and explain aspects related to the learning process and collect various information and data related to the product development to be carried out. The define stage includes Learner Analysis, Front End Analysis, Concept Analysis, Task Analysis, and Specifying Instructional Objectives. In the design stage, the researcher designs the digital teaching media to be made. The steps that will be carried out are Orientation Test Construction, Media Selection, Initial Design, and Format Selection. The develop stage is the stage to produce development products that are carried out through the steps of Expert Revision, Appraisal, and Product Trial.

The data collection instruments in this study consist of needs analysis instruments, product validation instruments, and product practicality instruments. Needs analysis instruments include questionnaires and interviews. The aim of using this questionnaire is to collect data related to students' needs for the creation of digital teaching media with the aim of facilitating students' ability to solve physics problems. Interviews involve dialogue and question-and-answer interaction between researchers and respondents, with the aim of obtaining the necessary information, The goal is for researchers to better understand the potential problems they are facing. The product validation instrument uses a product validation assessment sheet, a validation questionnaire is used to evaluate the suitability of the teaching media and the validator's view of the designed product, with the aim of ensuring that the product meets quality and accuracy standards as a high-quality teaching medium. The instrument of product practicality contains statements related to the product that has been developed.

The Data Analysis Technique consists of validity analysis and practicality analysis. Product validity analysis uses the Likert scale and applies Aiken's V formula, which is detailed as follows:

$$V = \frac{\sum s}{[n(c-1)]} \text{ with } s = r\text{-}l_0 \qquad (1)$$

Description:
V = Rater agreement index
n = Number of raters
c = Number of categories that can be selected by raters
The categories of media validity developed can be seen in Table 1

Table 1. Validity Category

Value	Criteria
≥ 0,6	Valid
< 0,6	Invalid

Based on Table 1 for the validity criteria, a product is said to be valid if the value obtained ≥ 0.6 [16]. A product is deemed practical if both teachers and students can effectively use it in the learning process. The practicality of the product was assessed using a Likert scale and the following formula:

$$P = \frac{f}{N} \, x \, 100\% \qquad (2)$$

P = Final score
f = Score gain
N = Maximum Score
The categories for assessing the level of practicality of the product are listed in Table 2.

Table 2. Product Practicality Categories

Percentage (%)	Criteria
80 < P ≤ 100	Very Practical
60 < P ≤ 80	Practical
40 < P ≤ 60	Quite Practical
20 < P ≤ 40	Less Practical
0 < P ≤ 20	Impractical

Based on Table 8 for practicality criteria, a product is said to be practical if the percentage obtained exceeds 60% [17].

III. RESULTS AND DISCUSSION

Findings from the experiment Definition Stage include, Front End Analysis of this study establishes the basic problems of physics learning in MAN 1 Bukittinggi, where the digital learning media used is still limited and passive. Educators apply an active learning model, but students still have difficulty in solving physics problems, especially in dynamic electrical materials. Learner Analysis shows that most students find physics difficult, taking a long time to master the material. Students are proficient in using technology and prefer digital media. Task Analysis and Concept Analysis based on the independent curriculum include the basic concepts of dynamic electricity, electrical circuits, Kirchhoff's law, measuring instruments, and electrical energy and power. Specifying Instructional Objectives includes an analysis of the concept of electricity and its application as well as the properties of direct current electrical circuits in technology.

The results of the Design Stage include, the Orientation Test Construction aims to measure the feasibility of learning media through validity and practicality instruments, including validation questionnaires for content, language, presentation, and graphic components as well as teacher and student response questionnaires. Media Selection and Format Selection are carried out by selecting PowerPoint iSpring Suite 9 which is converted into an Android application using website 2 APK Builder 5.3, so that it can be accessed through various devices. iSpring Suite is a media that can help students in solving problems and can be accessed independently by students [18]. The advantages of this software make iSpring Suite one of the software that can be used as an interactive digital learning medium [19]. This media is based on the Problem Solving model and is designed according to the independent curriculum with attractive layouts, colors, letters, and sizes. In the designed media, there are also steps in problem-solving skills based on the indicators presented by Polya (understanding the problem, planning problem solving, solving problems as planned, and re-examining procedures and solving results [20]. Initial Design includes covers, main menus, instructions for use, learning achievements and objectives, achievement indicators, learning activities, evaluations, references, and developer profiles, all set up to facilitate abilities of students to solve physics problems.

The results of the Development stage include, Expert Appraisal of Teaching Media that has been designed and then validated by experts. Table 3 is the result of the validation of teaching media.

Table 3. Results of Teaching Media Validation

Components	Average Aiken's V	Criteria
Content	0,75	Valid
Linguistics	0,72	Valid
presentation	0,74	Valid
Graphics	0,70	Valid

After passing the validation stage, the validator declares that the product is fit to use. However, during the validation process there were several revisions suggested by the validators. Comments and suggestions from validators are revision material for researchers. Product trials are executed once the item is deemed legitimate and suitable for use in the field. The researcher conducted a trial on June 15, 2024, in the Phase F class at MAN 1 Bukittinggi. The trial was carried out in a small group consisting of 9 students, who had been selected by the teacher of the field of study, namely 3 people with high ability, 3 individuals with average skill level and 3 individuals with below-average skill level. In this stage, students are asked to use dynamic electric digital teaching media products based on the Problem Solving learning model that has been installed on each student's smartphone. Students are asked to fill out a questionnaire on students' responses to the products used. The results of the practicality of students' responses to the media Table 4 displays this information.

Table 4. Results of the Practicality of Student Responses

No	Assessment Indicators	Average Value (%)	Criteria
1	Easy to Understand	85,8	Very Practical
2	Interesting	90,2	Very Practical
3	Efficient	87,4	Very Practical

Two physics teachers also carried out the product trial. A teacher response questionnaire was given to find out how physics teachers responded to the media products that had been made. The results of the practicality of teachers' responses to the media can be seen in Table 5

Tabel 5. Results of the Practicality of Teacher Response

No	Assessment Indicators	Average Value (%)	Criteria
1	Easy to Understand	98,6	Very Practical
2	Interesting	95,8	Very Practical
3	Efficient	97,5	Very Practical

The outcomes regarding the validity of digital teaching media show that the media that has been created is already on the valid criteria. Validity is an assessment of a product development, product validation is developed by experts who can assess the shortcomings and advantages of a product [21]. Dynamic electricity digital teaching media products based on problem solving learning models are said to be valid based on the results of the assessment with the Aiken's V formula. If the ≥ value is 0.6 it is declared valid and if the < value is 0.6 it is declared invalid.

The validation results on the content feasibility component were obtained with an average Aiken's V score of 0.75 with valid criteria. This data shows that the learning aspect and the content aspect of the material in the media are appropriate and relevant based on CP and TP and indicators of achievement of learning objectives. Likewise, learning activities on digital teaching media that are arranged based on the syntax of the Problem Solving learning model and examples of questions on media designed based on problem-solving ability indicators can facilitate students' physics problem-solving skills. This is consistent with the research that has been carried out [22] that the development of digital media based on Problem Solving has a potential effect on the capacity for resolving tangible issues.

The validation results in the language component were obtained with an average Aiken's V score of 0.72 with valid criteria. This demonstrates that the language used in the teaching media is quite clear, precise, and in accordance with the education level of the students. The validation results in the presentation component were obtained with an average Aiken's V score of 0.74 with valid criteria. This demonstrates that the presentation in the teaching media is quite structured, clear, and interactive. The validation results on the graphic component obtained an average Aiken's V score of 0.70 with valid criteria.

Validators provide critical assessments of products to ensure that they meet the expected quality standards. The average validity of all components proves that dynamic electric digital teaching media based on a problem solving learning model to facilitate physics problem-solving skills is a valid teaching medium to be used in the learning process.

The results of practicality show that the media that has been created is already on practical criteria. Product practicality analysis involves responses from teachers and students [23]. Based on calculations with a percentage formula, the results of the practicality of students' responses to the developed digital teaching media were obtained very practical criteria. The usefulness of a media is determined by the results of user assessments of the

products developed [24]. The product is said to be practical if the percentage obtained exceeds 60%. In the easy-to-understand indicator, an average percentage value of 85.8% was obtained, in the attractive indicator an average percentage value of 90.2%, and in the efficient indicator an average percentage value of 87.4% was obtained. From the three assessment indicators, the results were obtained that digital teaching media based on the problem solving learning model to facilitate physics problem-solving skills is very practical for students.

The outcomes of the feasibility experiment of the teacher's response on the easy-to-understand indicator were obtained with an average percentage value of 98.6%, on the interesting indicator the average percentage value was obtained 95.8% and on the efficient indicator the percentage value was obtained 97.5%. From the three assessment indicators, the results of the teacher's response were also obtained which stated that digital teaching media based on the problem solving learning model to facilitate physics problem-solving skills is very practical to use. The product developed is said to be practical if the practitioner states that the product that has been developed can be applied in schools and the product is in the "good" category [25].

IV. CONCLUSION

Concluding from the findings and conversations held during the research, it can be stated that dynamic electricity digital teaching media based on the problem solving learning model to facilitate students' problem-solving skills is declared valid with an average score of Aiken's $V \geq 0.6$. In the content feasibility component, a value of 0.72 was obtained. In the linguistic component, a value of 0.72 was obtained. In the presentation component, a value of 0.74 was obtained and in the graphic component, a value of 0.70 was obtained. Furthermore, the dynamic electricity digital teaching media based on the problem solving learning model to facilitate students' problem-solving skills was declared practical with the percentage obtained exceeding 60%. The students' responses to each assessment indicator were obtained on average 85.8%, 90.2%, and 87.4% with very practical criteria. The teachers' responses to each assessment indicator were obtained on average 98.6%, 95.8%, and 97.5% with very practical criteria.

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