Development of Electronic Teaching Materials with the SAVI Approach to Enhance Students' Problem-Solving Skills

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***Abstract** – Students' problem-solving skills are still considered low. Teachers can motivate students to learn by using interactive teaching materials. This study aims to analyze the feasibility of electronic teaching materials with the SAVI approach to improve students' problem-solving skills in static fluid material. The electronic teaching materials consist of lesson plans, teaching materials, student worksheets, and problem-solving tests. This study was included in research and development using the ADDIE model, and tests were carried out on 19 class XI MIPA MA Sultan Sulaiman students. Data collection used electronic teaching material validation instruments and response questionnaires. The data analysis technique was carried out in a quantitative descriptive. The results showed that: (1) the result of the validation of electronic teaching materials, including lesson plans, teaching materials, worksheets, and problem-solving tests, were in the valid category, and (2) student responses in terms of understanding the contents of electronic teaching materials, clarity of study instruction and information, suitability of electronic teaching material appearance, motivation, interest, curiosity, asking and responding to questions, and problem- solving have fulfilled the practical category. It is concluded that the electronic teaching materials developed with the SAVI approach are feasible to improve students' problem-solving skills on static fluid material. This teaching material can be an alternative for educators in equipping students with 21st-century competencies, especially problem-solving skills.*

***Keywords**: Electronic Teaching Materials; Static Fluid; Problem-Solving Ability*

INTRODUCTION

The development of information technology innovation can be utilized to support learning activities. One form of applying information technology is through multimedia and the web. Haryanto (2016) explains that this advancement in information technology enables teachers to conduct learning activities with various conveniences.

As facilitators, teachers must always be ready to cater to the learning needs of students. Teachers must create a pleasant learning atmosphere that encourages motivation and interest in learning (Ekasari et al., 2016). The use of engaging teaching materials can motivate students in their learning.

Buchori (2019) reveals that using technology in the learning process, with students directly involved, can create an enjoyable learning environment. Consequently, students are motivated to solve problems. Problem-solving can be achieved if students master the necessary concepts beforehand and then apply them in problem-solving (Thersia et al., 2019).

In reality, the initial study results from a problem-solving test given to 35 students showed that approximately 1.52% of students could visualize the problem, 10.48% could describe physics concepts based on the problem, 12.76% could plan a solution to the problem, 8.38% could implement the solution plan, and an average of 0.57% of students could evaluate the problem. It indicates that students have low problem-solving abilities.

Based on observations and interviews by Tuqalby et al. (2017) with physics students and teachers in grade XI at SMAN 3 Mataram, physics is often considered difficult and tedious. The observations by Sriwahyuni, Risdianto, & Johan (2019) show that students nowadays are enthusiastic about learning using laptops and smartphones.

Teaching materials are developed based on the needs and motivation of students. The researcher distributed questionnaires to determine students' needs for teaching materials. The questionnaire found that 50% of grade XI MIPA MA Sultan Sulaiman students considered the learning resources used in Physics to be average, and 85.7% of students had difficulty understanding learning resources during physics lessons. According to the questionnaire, students need interactive teaching materials with concise, clear explanations, easy-to-understand, color variations or images, and relevant links to avoid boredom in learning.

Noviatika et al. (2019) explain that teaching less attractive instruments is suspected of hindering students' problem-solving skills. According to Miftahurrahmi, Oktavia, & Desnita (2021), physics teaching materials are needed so that students can learn and get information from teachers and other related reference sources. Similarly, Fatihah et al. (2020) explain that students' understanding derived solely from teacher explanations and textbooks will be limited, negatively impacting learning outcomes.

Jannah et al. (2015) explain that problem-solving skills are a combination of understanding concepts to be applied to find a way out of a problem. According to Polya (1973), the problem-solving stages are divided into four stages: understanding the problem, planning the problem-solving, implementing the problem-solving plan, and checking the solution. These stages are considered more straightforward and more systematic.

Problem-solving skills can be achieved in various ways (Ulvah & Afriansyah, 2016). One effective learning model for improving problem-solving skills is the direct instruction model. According to Zaini et al. (2015), direct instruction is a learning model related to declarative and procedural knowledge.

Arends (2012) explains that the direct instruction model is specifically designed to facilitate students in mastering the procedural knowledge needed to perform various skills. According to the study by Amrita et al. (2016), direct instruction can enhance students' problem-solving skills and problem-solving ability.

Direct instruction lets students directly see, touch, and observe an object (Vernisari et al., 2015). Students can understand concepts without misconceptions because the teacher will directly guide the students' learning material (Arianti et al., 2019). This teaching method can be combined with a learning approach that determines learning activities. Wijaya (2016) explains that the SAVI approach is a student learning process that combines physical movement with intellectual activities. In the SAVI approach, there are four ways students learn: learning through movement (Somatis), learning through speaking and listening (Auditori), learning through images (Visual), and learning through problem-solving (Intellectual) (Putri et al., 2017). Masnaiyah & Dini (2020) have explained that developing the SAVI approach through distance learning is considered quite effective in improving problem-solving skills. The research by Muanifah & Sa'diyah (2018) also states that the SAVI approach is one of the alternative learning approaches for teachers to enhance students' skills. According to Sari et al. (2017), learning with the SAVI approach makes students more interested and active in learning due to the combination of sensory and intellectual tools.

Several studies show that the SAVI approach and direct instruction are effective in helping students practice problem-solving skills. Therefore, this research aims to analyze the feasibility of electronic teaching materials with the SAVI approach to improve students' problem-solving skills in static fluid material. Electronic teaching materials with the SAVI approach are made interesting and interactive, using language students easily understand. According to Fitria & Asrizal (2021), electronic teaching materials are more affordable and can be accessed anytime. The learning material will be created with the help of visualizations such as images, videos, and relevant link references. Thus, students can effectively solve the physics problems presented.

RESEARCH METHODS

This research falls under the category of research and development (R&D). The model applied is the *ADDIE* development design model. *The ADDIE* development design model is an abbreviation for Analysis, Design, Development, Implementation, and Evaluation.

The analysis stage is the researcher's step in identifying the causes of learning problems. Based on the student's needs questionnaire, it was found that some students rated the teaching materials commonly used during learning as average. The subtopic of static fluid contains course material and can be conducted through experimental simulations to train students' problem-solving skills. The design stage in this research involves designing learning activities and developing learning tools and assessment instruments for the product developed using the SAVI approach through the direct instruction model.

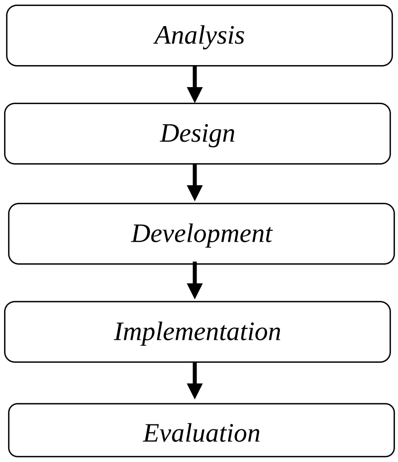

Figure 1. *The ADDIE* development design model

The development stage involves transforming the previously designed teaching materials into tangible form. Firstly, validators assess the developed electronic teaching materials for their validity. The validation process involves four validators, two practitioner validators (physics subject teachers), and two academic validators (physics education lecturers). The assessment results will be analyzed and revised according to the validators' suggestions. The electronic teaching materials are ready for testing if they have been validated.

The implementation stage involves applying the developed teaching materials to determine their feasibility in learning activities. The developed electronic teaching materials are distributed to students as a link. After receiving the link, students can start accessing and reading the outlined material. Students can understand and try examples of problems along with their solution steps. Students who have finished reading and understanding the electronic teaching materials can fill out a response questionnaire to understand the impressions or responses of the students after trying to use the electronic teaching materials. The evaluation stage is a reassessment to determine whether the developed product meets expectations, including formative and summative evaluations. The electronic teaching materials developed will be revised if necessary.

The research subject is electronic teaching materials, while the object of this study is the feasibility of electronic teaching materials. The trial subjects are 19 students of grade XI MIPA at MA Sultan Sulaiman. This research was conducted at MA Sultan Sulaiman in the second semester of the 2022/2023 academic year in April 2023.

Data analysis is performed using quantitative descriptive methods. The analyzed data include validation results from validators and responses from students. Data collection instruments in this study include validation sheets and student response questionnaires.

The validation results from the four validators are calculated using the average total score for each assessment aspect, and the results are adjusted to the assessment criteria according to Widoyoko (2016), as stated in Table 1.

Table 1. The criteria for validating electronic teaching materials

Score Interval	Category
$X > 3,4$	Very Valid
$2,8 < X \leq 3,4$	Valid
$1,6 < X \leq 2,2$	Quite Valid
$X \leq 1,6$	Less Valid
$\leq 1,8$	Very Less Valid

The reliability of the validation results is calculated using Cronbach's Alpha equation (Widoyoko, 2016) and then adjusted according to the reliability criteria outlined by Arikunto (2012), as shown in Table 2.

Table 2. The criteria for reliabilities

Coefficient of reliability	Criteria
$0,80 \leq r \leq 1$	Highest
$0,60 \leq r < 0,80$	High
$0,40 \leq r < 0,60$	Sufficient
$0,20 \leq r < 0,40$	Low
$0,00 \leq r < 0,20$	Lowest

The practicality of the electronic teaching materials is assessed based on the questionnaire responses from students. The practicality assessment is calculated by averaging the scores obtained from the questionnaire results and adjusting them according to the practicality criteria for electronic teaching materials adapted from Widoyoko (2016), as shown in Table 3.

Table 3. The criteria for the practicality of electronic teaching materials

Interval	Kategori
$\bar{x} > 3,4$	Sangat Praktis
$2,6 < \bar{x} \leq 3,4$	Praktis
$1,8 < \bar{x} \leq 2,6$	Cukup Praktis
$\bar{x} \leq 1,8$	Kurang Praktis

RESULTS AND DISCUSSION

Teaching materials for static fluids in electronic form are emphasized to support physics learning in the classroom. The electronic teaching materials developed include:

1. Lesson Implementation Plan (LIP)

The LIP is a plan prepared by teachers as a guide to carry out teaching and learning activities. The developed LIP in this research refers to the syllabus and the 2013 curriculum used at MA Sultan Sulaiman. In the static fluid chapter, there are three meetings; (a) Hydrostatic pressure, (b) Pascal's law, and (c) Archimedes' principle. Therefore, three LIPs were developed to support teaching and learning activities during these meetings. The time allocation for each meeting is two teaching hours (JP), supported by electronic teaching media used during the learning process. The developed

LIP uses the direct teaching model with the SAVI approach. Based on the three LIPs developed, different questions and problems are provided according to the indicators and learning objectives.

2. Teaching Material

Teaching material is a teaching tool that contains information and is organized mathematically to help students learn. In this learning activity, the teaching material prepared is about static fluids. The teaching material is equipped with worksheets (LKPD) and guided exercises to enhance students' knowledge and problem-solving skills. The teaching material is created using the Flip PDF Professional application in html format. The developed electronic teaching material is grouped into three sections: introduction, content, and conclusion. The introduction section includes the front cover, preface, table of contents, user instructions, concept map, and keywords. The content section consists of material for three meetings: hydrostatic pressure, Pascal's law, and Archimedes' principle. The conclusion section includes a summary, bibliography, glossary, and author's biography.

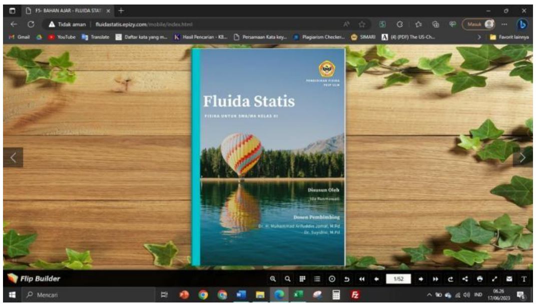

Figure 2. The initial display of electronic teaching material

The Flip PDF Professional application can create more varied electronic teaching materials. The application can insert links to sites related to the material that, when clicked, will be directed to that site, as well as pop-up displays on images or videos to attract the attention of students. This electronic teaching material can be accessed through the link: fluidastatis.epizy.com.

3. Student Worksheets (LKPD)

LKPD is a learning tool and a guide for students to conduct investigations. Based on its objectives, the LKPD developed for static fluid material is divided into two parts: (a) to practice scientific process skills and (b) to develop problem-solving skills. For each meeting, there are developed LKPDs: LKPD 1a and 1b designed for hydrostatic pressure, LKPD 2 designed for Pascal's law, and LKPD 3a and 3b designed for Archimedes' principle.

4. Problem-Solving Test (TPM)

TPM is structured based on learning indicators and follows the steps of problem-solving. The TPM developed in this research consists of 6 essay questions tailored to the learning objectives. The developed TPM includes instructions for solving the problems, relevant images, and answer columns provided according to the problem-solving stages. The developed TPM is aligned with the main topics of static fluid material, which include hydrostatic pressure, Pascal's law, and Archimedes' principle.

Validity of Electronic Teaching Materials

The validation test for LIP, teaching material, LKPD, and TPM covers several assessment aspects, as displayed in Tables 4 to 7.

Table 4. The validity results of LIP

Assessment Aspect	Validity		Reliability	
	Score	Category	r	Category
Format LIP	3,36	Valid	0,85	Highest
Language	3,13	Valid		
Content	3,19	Valid		

Table 5. The validity results of Electronic Teaching Materials

Assessment Aspect	Validity		Reliability	
	Score	Category	r	Category
Software engineering	3,25	Valid		
Organization	3,50	Very valid		
Language	3,31	Valid		
Visual communication	3,33	Valid	0,80	Highest
Format	2,75	Quite Valid		
Attractiveness	3,06	Valid		
Font style and size	3,17	Valid		

Table 6. The validity results of the Student Worksheet

Assessment Aspect	Validity		Reliability	
	Category	r	Category	Category
Format LIP	3,29	Valid		
Language	3,13	Valid	0,75	High
Content	3,33	Valid		

Table 7. The validity results of PST

Item	Validity		Reliability	
	Category	r	Category	Kategori
1	3,15	Valid		
2	2,90	Valid		
3	3,12	Valid		
4	3,00	Valid	0,87	Highest
5	3,12	Valid		
6	3,12	Valid		

Practicality of Electronic Teaching Materials

The results of the assessment of student responses are presented in Table 8.

Table 8. The results of the students' response assessment.

Assessment Aspect	Score	Category
Understanding the content of electronic teaching materials	3,27	Practical
Clarity of learning instructions and information	3,19	Practical
Suitability of the display of electronic teaching materials	3,08	Practical
Motivation	3,08	Practical
Attractiveness	3,10	Practical
Curiosity	3,18	Practical
Asking and responding to questions	2,80	Practical
Problem-solving	3,23	Practical

Discussion

Validity of Electronic Teaching Materials

The developed Lesson Implementation Plan (LIP) has been organized accurately and systematically based on the 2013 curriculum. The components of the developed LIP have been adjusted in accordance with applicable policy rules. According to Permendiknas No. 41 of 2007, the components of the LIP consist of (a) subject identity, (b) competence standards, (c) essential competencies, (d) competency achievement indicators, (e) learning objectives, (f) teaching materials, (g) time allocation, (h) teaching methods, (i) learning activities including: introduction, core, conclusion, (j) learning resources, and (k) assessment of learning outcomes (Panigoro, 2018).

The LIP is divided into three activities: introduction, core, and conclusion. Direct teaching LIP combined with the SAVI approach is divided into five phases according to the syntax of the direct teaching model, and the time allocation in this developed LIP has been adjusted to the applicable teaching hours. Hanum (2017) explains that the time allocation is determined according to the needs for achieving basic competencies and the learning load by considering the available teaching hours.

Refiana et al. (2016) explain that direct teaching models for teaching problem-solving are models that allow students to learn directly from demonstrations conducted by teachers. The advantage of learning using the SAVI approach is that students do not easily forget because they construct their own knowledge.

The use of direct teaching models with the SAVI approach in learning is considered an alternative for teachers to build enjoyable learning and provide opportunities for students to use their sensory tools, making students' mathematical representation skills better (Istiqomah et al., 2021). The validity of the developed LIP is considered valid/very valid with very high reliability, making it suitable for use as a planning foundation in learning activities.

The developed teaching material contains information that will be discussed during the learning process, whether in the form of images, videos, or text. Hanum (2017) explains that teaching materials must be prepared as well as possible so that the implementation of learning activities can achieve the objectives and support the achievement of basic competencies and specified indicators.

The influence of the form and appearance of teaching material is crucial. It is supported by Ambarwati (2019), who explains that the graphic aspect of teaching material is marked by the use of letter shapes, letter sizes, colors, as well as images or videos that will make the appearance of the developed teaching material more attractive and easy to read. Based on the validation results, the teaching material receives a category of sufficient validity/valid/very valid with very high reliability.

The validation results of the Student Worksheets (LKPD) show that the validity of the LKPD is in the valid category. Widoyoko (2019) explains that good assessment data is data that is in accordance with the actual conditions and is permanent and reliable. The developed LKPD is considered valid and reliable for use in learning activities to train the problem-solving skills of students.

The developed LKPD contains images and links related to experimental activities. Eled et al. (2021) explain that LKPD includes problems related to the material to achieve the specified basic competencies. These problems will stimulate and develop the insight and understanding of students in solving given problems.

Teachers use the Problem-Solving Test (TPM) that meets the learning indicators and objectives to determine the level of achievement of students in each related subtopic. According to Hulu & Telaumbanua (2022), TPM is used as a tool to measure the level of understanding of students. TPM contains questions tailored to the main topic, namely static fluids, and is related to problems that occur in daily life. TPM is also equipped with answer columns arranged according to the stages of problem-solving.

The developed TPM is in the form of essay tests. Putri et al. (2022) explain that one of the advantages of essay tests is that they provide an opportunity for children to compose answers according to their own thoughts. This certainly stimulates students to be able to express their opinions or thoughts in an organized and precise manner. The validation results of the developed TPM have been declared valid and reliable, so TPM can be used as a tool to measure the level of understanding of students.

Practicality of Electronic Teaching Materials

The validated electronic teaching materials were then tested in the classroom. Students were given a response questionnaire consisting of 25 statements related to the use of electronic teaching materials. The trial was conducted to determine the practicality of electronic teaching materials, measured based on the scores obtained through the response questionnaire.

Students' responses to the aspect of understanding the content of electronic teaching materials fall into the practical category, meaning that this aspect has yielded good results. This is because the teaching media used during the learning process, namely electronic teaching materials, can help students understand the static fluid material and enhance knowledge insight.

Students' responses to the clarity of learning instructions and information fall into the practical category, meaning that this aspect has obtained good results. This is observed from the presence of instruction sheets on how to use electronic teaching materials, containing guidance and information to facilitate students in accessing and using them. According to Dayanti et al. (2021), guidance is needed to use electronic teaching materials so that readers do not easily feel confused in accessing or using them.

Students' responses to the third aspect, the suitability of the appearance of electronic teaching materials, fall into the practical category, meaning that this aspect has received good results. Electronic teaching materials that use a background display with bright and soft colors, as well as the type, size, and color of the font used, are easy to understand and attract students' attention. Consistent with this, Dayanti et al. (2021) explain that the display design of electronic teaching materials should be attractive and able to facilitate students in reading and understanding the material and information presented.

Students' responses to the motivation aspect fall into the practical category, meaning that this aspect has obtained good results. This is evident from the electronic teaching materials that not only contain text/writing but also insert images, videos, and even links related to the topic. The use of electronic teaching materials is quite flexible as it can be accessed anytime and anywhere. According to Pratiwi & Listiadi (2021), independent learning activities carried out by students using electronic teaching materials need to be accompanied by real motivation related to the surrounding environment.

Students' responses to the attractiveness aspect fall into the practical category, meaning that this aspect has obtained good results. This is observed from the colorful design of electronic teaching materials used, so students feel interested and not easily bored. Sriwahyuni et al. (2019) explain that electronic teaching materials developed with the help of the Flip PDF Professional application are presented with an attractive and clear appearance.

Students' responses to the curiosity aspect fall into the practical category, meaning that this aspect has obtained good results. This is seen from students' curiosity about the electronic teaching materials used as a supporting medium for learning physics. According to Yulaika et al. (2020), the use of flip book-based electronic teaching materials as a teaching medium can be accessed anytime and anywhere according to the needs and curiosity of students, and is more effective and practical for students.

Students' responses to the asking and responding to questions aspect fall into the practical category, meaning that this aspect has obtained good results. The use of electronic teaching materials during learning activities makes students tend to be more active in asking questions and expressing their opinions in understanding physics material. Yulaika et al. (2020) state that the results of observations of students' activities during learning activities using flip book electronic teaching materials obtain a very high percentage category.

Students' responses to the problem-solving aspect fall into the practical category, meaning that this aspect has obtained good results. This is evident from the examples of problems in electronic teaching materials that include predetermined problem-solving steps. Dayanti et al. (2021) in their research explain that each material topic requires problem-solving exercises so that students can understand the material presented.

Based on the above elaboration, it can be stated that the developed electronic teaching materials fall into the practical category. Thus, the implication of the developed electronic teaching materials for learning activities is to provide positive points in the use of gadgets for students.

CONCLUSION

The developed electronic teaching materials, including instructional materials and worksheets (LKPD) in electronic form, were created using the Flip PDF Professional application. Videos, images, and links were added to make the instructional materials and worksheets interactive, engaging, and helpful for students in their learning. These teaching materials meet the criteria for suitability because the validation results for lesson plans (LIP), instructional materials, worksheets, and problem-solving tests (PST) fall into the valid category, and student responses fall into the practical category. Further research is needed to test the effectiveness of these electronic teaching materials in multiple classes or schools.

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