

## DESIGNING INTERACTIVE MEDIA ON TEACHING MATERIALS USING ELECTRICAL AND ELECTRONIC MEASURING INSTRUMENTS BASED ON ADOBE FLASH CS6 AUDIO AND VIDEO ENGINEERING DEPARTMENT AT SMK N 1 SUMBAR

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### INTISARI

Tujuan dari penelitian ini untuk mengetahui kelayakan perancangan materi ajar penggunaan alat ukur listrik dan elektronika berbasis adobe flash CS6 dan kenaikan hasil belajar siswa pada mata pelajaran dasar listrik dan elektronika (DLE) di jurusan teknik audio dan video di SMK N 1 sumatera barat. Metode yang digunakan pada penelitian ini menggunakan model waterfall. Model waterfall terdiri dari 1) Define, 2) Design, 3) Development, 4) Testing. Penelitian dilakukan di SMK N 1 Sumbar. Teknik pengambilan data yaitu validasi dari ahli materi, ahli media, uji praktikalitas guru dan siswa, kemudian untuk mengetahui hasil belajar siswa dilakukan ujian tes untuk siswa. Hasil validasi materi mendapatkan skor rerata 4,8 dengan kategori sangat layak, hasil validasi ahli media mendapatkan skor rerata 4,83 dengan kategori sangat layak, hasil uji praktikalitas guru mendapatkan skor 4,7 dengan kategori sangat praktis dan presentasi 94 %, hasil uji praktikalitas siswa mendapatkan skor rerata 4,04 dengan kategori praktis dan presentasi 80,8%, dan hasil belajar siswa X TAV mendapatkan skor rerata 75,6 dengan presentasi 83,7 % dan kategori sangat baik. Data yang diperoleh menunjukkan bahwa perancangan materi ajar penggunaan alat ukur listrik dan elektronika berbasis adobe flash CS6 yang dihasilkan valid, praktis dan terjadi kenaikan hasil belajar pada siswa.

**Kata kunci** : penggunaan alat ukur listrik dan elektronika, waterfall, adobe flash cs6

### ABSTRACT

The purpose of this study was to determine the feasibility of designing teaching materials using adobe flash CS6-based electrical and electronic measuring instruments and the increase in student learning outcomes in basic electricity and electronics (DLE) subjects in the audio and video engineering department at SMK N 1 West Sumatra. The method used in this study uses the waterfall model. The waterfall model consists of 1) Define, 2) Design, 3) Development, 4) Testing. The research was conducted at SMK N 1 West Sumatra. Data collection techniques are validation from material experts, media experts, practicality tests for teachers and students, then to find out student learning outcomes, test tests are carried out for students. The results of the validation of the material get a mean score of 4.8 with a very feasible category, the results of the validation of the media expert get a mean score of 4.83 with a very feasible category, the results of the practicality test of the teacher got a score of 4.7 with a very practical category and a 94% presentation, the results of the practicality test of the students got a mean score of 4.04 with the practical category and 80.8% presentation, and the learning outcomes of X TAV students got a mean score of 75.6 with a presentation of 83.7% and very good category. The data obtained shows that the design of teaching materials using electric and electronic measuring instruments based on Adobe Flash CS6 is valid, practical and there is an increase in student learning outcomes.

**Keywords**: use of electric and electronic measuring instruments, waterfall, adobe flash cs6



**PRELIMINARY**

Education is held in the form of efforts to develop human education into a more righteous and more useful human being. Awareness of the importance of education as a form of improving the quality of Human Resources (HR) in society to improve the quality of education. The purpose of education is to develop the potential of students which can be done through educational services starting from basic education to tertiary education levels. In the learning process to achieve graduation standards regarding attitudes, knowledge and skills according to the characteristics of students in primary and secondary education units, which are listed in PERMENDIKBUD No. 22 of 2016 concerning Basic and Secondary Education Process Standards.

National Education Standards are used to improve the quality of education. The existence of standards or results that must be achieved can increase the input component and the learning process carried out will be more effective so that the results are more optimal because learning is more focused. To assess student learning outcomes, educational units must establish Minimum Completion Criteria (KKM) for each subject. Efforts made by the government to achieve educational goals include improving the quality of education personnel through teacher certification in the context of mapping and equitable distribution of teachers in Indonesia.

Vocational High Schools (SMK) is a form of formal education unit that organizes vocational education at the secondary level of education as a continuation of SMP, MTs, or other equivalent forms. Vocational education is secondary education that prepares students especially to work in certain fields. Vocational High School (SMK) equips students with the development and advancement of technological knowledge, thus preparing students to be able to enter the world of work and create jobs. The results of graduates from SMK are expected to have special skills that are ready to be applied and developed in entering the world of work and continuing to the next level of education in accordance with their field of expertise.

West Sumatra 1 Vocational Middle School determines the minimum completeness criteria (KKM) for each basic subject in assessing the achievement of student competencies is 65. This means that the assessment is based on a predetermined measure of competency

achievement. Students are said to be complete if the learning outcomes reach the KKM. The following is data on student learning outcomes in the odd semester of class X audio and video engineering for the electronic engineering expertise program of SMK N 1 Sumbar for the 2019/2020 academic year based on the minimum completeness criteria (KKM).

Table 1. The scores of the final semester examinations for basic electricity and electronics for class X audio and video engineering at SMK N 1 Sumbar in the odd semester of 2019/2020

Class	The number of students	<65		≥ 65		Class average
		Students	Percentage	Students	Percentage	
X TAV 1	16 students	10 students	62.5%	6 students	37.5%	61.1
X TAV 2	16 students	12 students	75%	4 students	25%	57.8
total	32 students	22 students	68.75 %	10 students	31.25 %	

In table 1, the average value of class X TAV is below the minimum completeness criteria set by the SMK N 1 West Sumatra school. This data shows that the elements of the complexity of teaching or learning are not in accordance with the process standards regulated in the 2016 PERMENDIKBUD, which consists of learning media learning models, learning evaluation and classroom management.[1] the main goal sentence of technology in learning is to solve learning problems and facilitate these learning activities.

Learning media is something that can convey and channel messages from sources in a planned manner so as to create a conducive learning environment where the recipient can carry out an effective and efficient learning process [2].

Basic electronic electricity subject is one of the productive subjects that must be taken by grade X students majoring in audio and video engineering at SMK Negeri 1 West Sumatra. There are twelve basic competencies in basic electrical electronics that must be achieved in semester 1 (odd). The learning material to be designed takes the basic competencies of using electrical and electronic measuring instruments. In the basic subjects of electronic electricity at SMK N 1 Sumbar students are led to be active and enthusiastic in the learning process because this subject is the basis in the world of electronics or electronics such as measuring

components and electronic tools. Then a learning period is needed to increase student motivation to be active in learning, suitable media is media that has running text,

With the existence of learning media based on animation or flash, it is hoped that this learning media can provide interesting and not boring learning and can make it easier for students to understand the teaching material for the use of electric and electronic measuring instruments for class X TAV SMK N 1 Sumbar.

Learning media is something that can be used to transmit messages (learning materials), so that it can stimulate attention, interest, thoughts, and the role of students in learning to achieve learning goals. According to [3] states that the media is a means or tool for the teaching and learning process. In general, it is natural that the role of teachers who use learning media is very different from teachers who do not use media in learning. Media created by the teacher is used to convey material to students. The teacher better understands the character and condition of the students, so the work that is made will be adjusted to the understanding of the students. Media development tries to provide a way and space for students to facilitate learning with media,

*Adobe flash* is an application that provides data processing features in the form of words or sentences, numbers, images, symbols, lines, sound forms, videos, and animations. The flash animation function can foster student attraction, response and interaction. Apart from being used in making animation, nowadays flash is also widely used for other purposes such as in making games, presentations, building webs, learning animation, and even being used in making movies. Animation produced by flash is an animation in the form of a movie file. The resulting movie is in the form of graphics or text. The graphic referred to here is a vector-based graphic, so that when accessed via the internet, the animation will be displayed faster and look smoother.

[4] argues that "there are three types of animation formats, namely animation without a control system, for example by pause, slowing down the speed of changing frames, zooming in, zooming out and so on, animation with a control system and direct manipulation animation, where the teacher can interact directly with the controls. navigation".

## METHOD

The research method used is the waterfall development model (waterfall). This model is a learning design model arranged programmatically with sequences of systematic activities. The waterfall model consists of 5 stages as follows: 1) Define, 2) Design (design), 3) Development (development), 4) Testing (testing), 5) Maintenance (improvement).

The steps in designing teaching materials are needed as a design for teaching materials based on Adobe Flash CS6 as follows.

### 1. Define Stage (definition)

#### a) Front end analysis

The current curriculum at SMK N 1 Sumbar is the 2013 curriculum (K-13). This analysis was carried out by analyzing the 2013 class X curriculum syllabus related to basic competencies. In this study, the basic competencies discussed were explaining the use of electrical and electronic measuring instruments.

#### b) Student analysis

Just like an educator will teach, education must recognize the characteristics of students who will use learning media, this is important because all learning processes must be adjusted to the characteristics of students. Things that need to be considered to determine student characteristics include academic ability, learning motivation and previous learning experiences. In relation to the development of learning media, student characteristics need to be known to compile learning media that is in accordance with their academic abilities, for example, if the level of student education is still low, the making of learning media must use simple language and words that are easy to understand.

#### c) Task analysis

Task analysis includes analysis of subjects, basic competences in class X TAV at SMK N 1 Sumbar. In designing and developing learning media, aspects of the curriculum cannot be ignored because in essence the use of Adobe Flash CS6-based learning media which aims to enable students to achieve learning objectives based on competency standards and basic competencies in accordance with the 2013 curriculum.

2. Design Stage (design)

The purpose of this stage is to prepare a prototype for designing teaching materials based on Adobe Flash CS6 P on the use of electrical and electronic measuring instruments based on competency standards (SK), basic competencies (KD) and indicators according to the 2013 curriculum.

3. Development Stage (development)

The purpose of this stage is to produce adobe flash cs6 based teaching materials, the development stage includes:

a) Validation assessment

Before the flash-based learning media produced is used by teachers and students, it is validated first. The validation test aims to check the conformity with the applicable curriculum, the correctness of the concepts, the grammar of the form and appearance of adobe flash cs6 based teaching materials. Validation was carried out by education experts and experts in accordance with the study midwife. Criticism, input, and suggestions from the validators will be used as material for revising learning media based on Adobe Flash CS6.

b) Practicality assessment

After being validated and revised, the Adobe Flash CS6-based teaching materials were tried out in schools. Practicality is the level of practicality of research products used by teachers and students. This activity was carried out to determine the extent of benefits, ease of use, and time efficiency using Adobe Flash CS6-based learning media by teachers and students.

c) Student learning outcomes test

The data collected is a test of student learning outcomes obtained from the results of working on test sheets by students after all the material is given. Data in the form of grades / scores of student work is used to determine the effectiveness used to determine the effectiveness of Adobe Flash CS6-based teaching materials designed on teaching materials using electrical and electronic measuring instruments.

**DATA COLLECTION**

The method used at this stage is by providing / showing the learning media developed

in the form of an application along with the validation sheet that has been given to the validator, then the validator is asked to give an objective assessment score on each aspect by ticking (√) in the column on the validation sheet revision or not. Each aspect is rated on a rating scale (1 = very poor, 2 = poor, 3 = good enough, 4 = good, 5 = very good). The rating scale on the validation table was adopted from [5].

a. Instruments for material experts

Research instruments for learning material experts in terms of material quality, material design, and benefits. Expert grid for material experts can be seen in table 2 below.

Table 2. Instrument material experts

No.	Variable	Indicator	Item number
1	Quality of material	The suitability of the content of the teaching material with the indicators to be achieved	1,2,3,4,5,6,7,8,9,10,11,12,13,14
		Material clutter	15,16,17
2	Material design	Presentation of teaching materials	18,19,20
		The truth of the material content	21,22,23
3	Benefits	Material benefits	24, 25

b. Media expert instruments

Research instruments for media experts are used to assess the design of teaching materials using electrical and electronic measuring instruments in terms of the variables of media quality, use, and navigation. The instrument grid for media experts can be seen in table 3 below.

Table 3. Media expert instrument grid

No.	Variable	Indicator	Item number
1	Media quality	Presentation of teaching materials	1,2,3,4,5,6
2	Use	Ease of use	7,8,9
		Text / language clarity	10,11
3	navigation	Navigation button	12,13,14,15

c. Teacher practical instrument

Research instruments for teachers are used to assess the design of teaching materials using electric and electronic measuring instruments in terms of two variables, namely the presentation of teaching material and text /

language, the practicality instrument lattice can be seen in table 4.

Table 4. Teacher practicality instrument grid

No.	Variable	Indicator	Item number
1	Presentatio n of teaching materials	Material suitability	1,2,3,4,5
2	Text language	/ Use of language	6,7

d. Student response questionnaire

Questionnaire sheets given to students after the learning process were made by researchers to determine student responses to teaching materials using adobe flash cs6-based electrical and electronic measuring instruments. Students can put a check mark (√) in the available column on the questionnaire with the choice of column strongly disagree (STS), disagree (TS), disagree (KS), agree (S), and strongly agree (SS) so that can be used to determine the effectiveness of the media.

Table 5. Student response instrument grid

No.	Variable	Indicator	Item number
1	Presentatio n of teaching materials	Material design	1,2,3,4,5,6,7
2	Text language	/ Use of language and language	8,9,10

e. Student learning outcomes test

The data collected is a test of student learning outcomes obtained from the results of working on test sheets by students after all the material is given. Data in the form of grades / cur students' work is used to determine the effectiveness of instructional media designed on teaching materials using electrical and electronic measuring instruments.

The final step of the teaching material design will be stored in a storage, in the form of a CD or flashdish. The results of the validation of teaching materials, media validation and practicality of teachers and students can be used as suggestions and input.

After testing the validation and practicality, then a written test was carried out to determine the learning outcomes of X TAV students, the data obtained from material experts and media experts were then processed with the formula from [5] as follows:

$$\text{average score} = \frac{\text{total score}}{\text{many grains}} \quad (1)$$

$$\text{overall average score} = \frac{\text{overall total score}}{\text{overall many grains}} \quad (2)$$

After the average quantitad data is calculated, then it is converted into a five-scale

qualitative value using an adapted value conversion formula [5]

$$X_i = \frac{1}{2} \times (\text{skor maksimal ideal} + \text{skor minimal ideal}) \quad (3)$$

$$S_{bi} = \frac{1}{6} \times (\text{skor maksimal ideal} - \text{skor minimal ideal}) \quad (4)$$

Table 6. Conversion of quantitative data to qualitative data on a scale of five

Formula	category
$X > X_i + 1.8 \times S_{bi}$	Very worthy
$X_i + 0.6 \times S_{bi} < X \leq X_i + 1.8 \times S_{bi}$	Well worth it
$X_i - 0.6 \times S_{bi} < X \leq X_i + 0.6 \times S_{bi}$	Pretty decent
$X_i - 1.8 \times S_{bi} < X \leq X_i + 1.8 \times S_{bi}$	Not worth it
$X \leq X_i + 1.8 \times S_{bi}$	Very less feasible

Information:

X = empirical score

X<sub>i</sub> = ideal mean

S<sub>bi</sub> = ideal standard deviation

The practicality data is calculated by the formula,

$$\text{level of practicality} = \frac{\text{average score}}{\text{minimum score}} \times 100\% \quad (5)$$

After students answer the test questions, the results are used to determine student learning outcomes. Data is calculated by calculating the average value or percentage of learning outcomes to determine the increase in learning outcomes. Finding the student's average score according to [6] can be used as follows:

$$M = \frac{\sum x}{N} \quad (6)$$

Information :

M: average (mean)

∑x : the total number of students

N: the number of students who took the test.

## RESULTS AND DISCUSSION

The results of this study are the design of teaching materials using electrical and electronic measuring instruments, the results of the feasibility of material experts and media experts, teacher practicality and student responses, and increased student learning outcomes.

### RESULTS OF MATERIAL EXPERT VALIDATION

The design of teaching materials is validated by material experts carried out by teachers who teach basic electricity and electronics subjects at SMK N 1 West Sumatra, the variables that will be assessed by material experts are material quality, material design and benefits. The data generated on the scoring done by material experts, most of them

gave a decent and very decent score. The results of the material expert validation are as follows.

Table 7. The mean results of material expert validation

No.	Variable	Average score	category
1.	Quality of material	4.76	Very worthy
2.	Material design	4.92	Very worthy
3.	Benefits	4.75	Very worthy
Average		4,8	Very worthy

**MEDIA EXPERT VALIDATION RESULTS**

The media expert validation was carried out by two electronic engineering teachers at SMK N 1 West Sumatra, the variables that would be assessed by the media expert were media quality, use, and navigation. The data generated on the scoring done by material experts, most of them give a decent and very decent score. The results of the media expert's validation can be seen in the table below.

Table 8. The results of the media expert's validation

No.	Variable	Average score	category
1.	Media quality	4.92	Very worthy
2.	Use	4.80	Very worthy
3	Navigation	4.83	Very worthy
Average		4.83	Very worthy

**TEACHER PRACTICALITY RESULTS**

The design of teaching materials was tested for practicality by one electronic engineering teacher at SMK N 1 West Sumatra, the variables to be assessed by practicality were the suitability of subjects and the use of language / text. The data generated on the scoring carried out by practicality, most of the members scored good and very good. The results of the practicality test got a mean score of 4.7 with a practicality percentage of 94% which according to [7] obtained the very practical category.

**STUDENT PRACTICALITY RESULTS**

The practicality of the design of teaching materials was tested by 36 class X students of audio and video engineering majoring in electronics engineering at SMK N 1 West Sumatra, the variables to be assessed were the suitability of the material, and the use of language / text. The data generated by giving scores by students mostly gave good and very good scores. The result of practicality getting a score of 4.04 and a percentage of practicality of 80.8% in the category according to [7] is practical.

**STUDENT LEARNING OUTCOMES**

according to [8] also states that learning outcomes are the result of interactive learning actions and

teaching levels.[9] suggested the factors that influence learning outcomes, namely internal factors and external factors.

This student learning test is used to determine the increase in student learning outcomes in the use of electrical and electronic measuring instruments. The assessment was carried out at the X TAV class which was taught using the design of the teaching material using adobe flash cs6-based electrical and electrical measuring instruments. Assessment is carried out by giving test questions to X TAV students. Based on the obtained average score for class X TAV is 75.6 with a percentage of 83.7% and the category is very good.

**RESULTS OF THE PRODUCT DESIGN OF TEACHING MATERIALS**

Media is a tool that conveys or delivers teaching messages [10]

Learning material products for learning the use of electric and electronic measuring instruments are packaged in the form of a program (.exe) that can be run on various computer devices. The selection in this teaching material includes material, namely definitions, parts, how to use measuring instruments, and how to calculate measurement results.

1. Opening page

The opening page is the page that first appears when the user opens the learning material application. on this page there are several buttons that are used as navigation that can be accessed by the user. The buttons are material, instructions, syllabus, evaluation, and profile. The opening page is shown in the image below.



Figure 1. Main page view

2. Instructions page

Instructions for the use of teaching materials is a page that contains instructions on key functions available in adobe flash cs6-

based teaching materials. Display the manual page as shown in Figure 2 below.



Figure 2. Display instructions page

### 3. Syllabus

The syllabus is a page of competency standards in which there are basic competencies and learning indicators that must be achieved in learning activities. The competency page displays as shown in Figure 3 below.

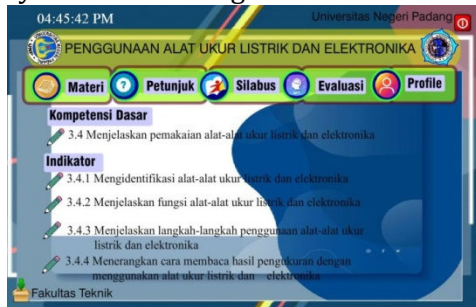


Figure 3. Views of the syllabus page

### 4. Material menu page

The material menu page contains material on the use of electric and electronic measuring instruments that are read in the teaching material, starting from the definition of measuring instruments, parts of measuring instruments, how to use measuring instruments. The first material menu page contains a display of multimeter teaching materials and oscilloscope teaching materials, while sub-material can be accessed by clicking directly on the multimeter image and the oscilloscope image. And the material menu page can be seen in Figure 4 below.



Figure 4. Display of material page

### 5. Researcher's profile

Researcher's profile is a page in which there is a bio of the researcher along with a photo of

the researcher. Research profile display as shown in Figure 5.



Figure 5. Display profile page

### 6. Evaluation

Evaluation is a page in which there are evaluation questions to determine student learning outcomes and students' abilities regarding the use of electrical and electronic measuring instruments. The evaluation questions presented in this Adobe Flash CS6-based teaching material are in the form of multiple choices. The page display of the evaluation questions is shown in Figure 6 below

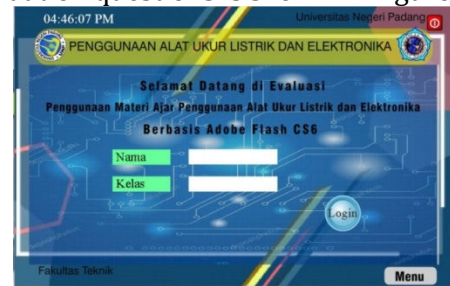


Figure 6. Display evaluation page

## CONCLUSION

The results of research on validation were carried out through material experts and media experts. Practicality test by teachers and students of class X TAV at SMK N 1 West Sumatra. The results of the material expert's analysis on the design of teaching materials using electric and electronic measuring instruments got a score of 4.8, this value is in the very feasible category, while the results of the validation of the media experts for designing teaching materials using electric and electronic measuring instruments get a score of 4.83 this value is in the category called very feasible, while the practical results of the teacher got a value of 4.7 and a percentage of 94% with a very practical category, the results of the practicality of students for the design of teaching materials using electrical and electrical measuring instruments got a score of 4.04 with a percentage of 80.8% and with a practical category, and student learning outcomes get a grade average of 75.6 and a percentage of 83,

## **SUGGESTION**

Based on the research that has been done, the following are some suggestions that researchers can convey: 1) The teacher should use learning media in teaching that can attract students' interest and make it easier for students to learn. The use of learning media will make the learning process more interesting and can foster students' interest in learning. 2) For researchers who are interested in developing similar learning media, especially for competency standards for measuring with electrical and electronic measuring instruments, existing materials need to be further developed by adding materials that have not been included in the design of this teaching material.

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