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**THE DESIGN OF ANALOG ELECTRONIC INSTRUCTIONAL VIDEO
AT VOCATIONAL SCHOOLS IN MANADO**

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This research is a learning media development research with a research and development model. The long-term goal of this research is to design basic electronics instructional videos for Vocational School students in Manado. Video is a device used for learning activities in the process of presenting material in the form of images and sound. So that students will be able to receive visual and auditory Basic Electronics information factually. This subject matter discusses electronic components, including passive and active components. The research was held in 3 years; the first year was to carry out field observations by observing the learning process in SMK, the second year was to specifically design and test the products, and the third year was to produce products and applications, as well as product publications. All was done in Vocational School in Manado.

Keywords: Instructional videos, Basic Electronics

INTRODUCTION

Learning media basically serves as a tool to achieve goals. It can improve student's achievement as it is one of the indicators of how qualified an education process is. Learning achievement can picture the abilities that have been achieved during the educational process. The good and the poor of the media is determined by the objective criteria and the criteria of the students, the situation, the ability of the teacher, and the selection of the right media on the appropriate material. Basic Electronics, as one of the subjects in Vocational High School, is different to any other subjects. Most of the objects studied in this course contain concepts and formulas that support these issues.

One thing that is unique and needs attention is that most of the material taught is abstract, therefore students must begin to develop their imagination in order to understand the basic concepts. Teachers must have high creativity so that the knowledge to be transferred is more logically acceptable to students. Besides increasing students' learning motivation, learning media also plays a role in increasing learning achievement.

Currently, technology, especially computer, develops rapidly. It is no longer a luxury item as it is found in almost every home. This fact has encouraged the authors to utilize this media as a learning tool. Through this, students are expected to have higher motivation to increase learning outcomes. Generally, the use of instructional videos in learning is seen as more attractive option, compared to textbooks. Therefore, the mastery of multimedia technology is beneficial for the teachers as they make the learning more interesting with more variety of tools. The use of instructional videos fits even more for teaching Basic Electronics course as it shows how the application of the concepts of passive and active electronic components, its characteristics, and rectifier/amplifier circuits.

Based on the observations at Vocational Schools in Manado, it is found that the teaching and learning process in the classroom lacked variation of instructional medias. The students were not exposed to adequate use of medias that affected the students' understanding of the subject taught, in this case, Basic Electronics. It was not in line with what was believed that media can assist students in visualizing the work of electronic components, such as resistors, capacitors and other abstract ones. It limits the students' imagination and could limit their creativity as well.

Based on the description above, the researcher intends to design a learning media that can meet the needs of the teaching and learning process in these schools, which is able to provide a deeper understanding of basic electronics as well and can increase student interest in learning. The long-term goal of this research is to design Basic Electronics instructional videos for Vocational Schools students in Manado. In details, the first year aims to carry out field observations by observing the learning process at Vocational Schools located in the city of Manado, the second year aims to design and test instructional video products that are in accordance with basic electronics subject matter, and the third year aims to produce products and application, as well as product publications.

The research problem is formulated as follows: "How to design instructional videos to be used in basic electronics learning at SMK? How to design an assessment instrument for media experts and material experts?"

LITERATURE REVIEW

Learning Outcomes and Learning

Learning is an activity to gain knowledge. It is a process that must be carried out by a person to acquire knowledge, attitudes and skills, which distinguishes one from other creations. Through the learning process, people who learn can experience for themselves, explore and obtain for themselves what they want to learn. (Dimiyati and Mudjiono in Sagala, 2012: 13)

Sagala further defines that students are the determinant of whether the learning process occurs. In this context, a person is said to learn when there is a change, from not knowing something, to knowing (Gredler in Aunurrahman, 2010:38). Therefore, learning is a complex process that occurs in every individual during his life according (Ponto, 2016: 58).

As learning helps someone to acquire skills and abilities, the effect of it can be seen through behavior changes in individuals. This change is not because of one's physical maturity or growth or mental maturity. Furthermore, it is said that this learning process is categorized into two elements, which are containing elements of coercion and self-awareness, resulting in changes in students' behavior in the realm of knowledge (cognitive), skills (psychomotor), and attitudes (affective).

The learning process occurs intentionally or contains elements of coercion or self-will, which can be explained as follows:

- 1) The learning process contains elements of coercion.
This aspect is divided into 2 categories. First, a learning process is carried out formally by educational units (schools). This learning process is driven by the desire of the parents

or other parties to provide education to their children as students so that they have knowledge and skills. And in this case, the students go through schools for the sake of their parents' order.

- 2) The learning process is based on one's willingness, through a self-taught (independent) learning process, in which an individual learns because of an inner urge (motive) about a knowledge or skill needed in his life.

Winataputra (2007: 1) states that the meaning of learning is an activity carried out to initiate, facilitate and increase the intensity and quality of learning in students which according to Aqib (2013: 66) is characterized by a learning process in the form of systematic efforts by the teacher to realize learning process so that it can run effectively and efficiently, starting from the process of planning, implementing and evaluating. And learning is conditioned to be able to encourage children's creativity as a whole, make students active, achieve learning goals effectively and take place in pleasant conditions. (Munandar in Suyono and Hariyanto, 2011:207)

Learning process will produce learning outcomes. It is a final assessment of the whole process and recognition that has been done repeatedly. It then will be stored for a long time, may be for forever, because learning outcomes participate in shaping individual personalities who always want to achieve even better results so that they will change the way of thinking and produce better work behavior (Munawar (2009). As Ponto (2016: 62) said, learning outcomes are abilities possessed or mastered by students after participating in learning or learning activities/processes for a certain period of time. These abilities can be identified after an evaluation is carried out. These learning outcomes are important data to inform the individual's ability to follow the learning process.

Learning outcomes are marked by changes that cause humans to change their attitudes and behavior (Winkel in Purwanto; 2010), can be in the form of abilities possessed by students after they receive learning experiences, (Sudjana; 2010), and also in the form of behavior patterns, values, notions, attitudes, appreciation and skills (Suprijono; 2009). The same thing was stated by Arif Gunarso in Sunarto (2012), that learning achievement is the maximum effort achieved by a person after carrying out learning efforts. Achievement can be measured through tests that are often known as learning achievement tests.

Bloom in Sunarto, (2012) states that learning outcomes are divided into three aspects; Cognitive, Affective and Psychomotor. And the results achieved by an individual are the result of interactions between various influencing factors, both within and outside the student. The factors that affect learning achievement according to Muhibbin Syah (2008: 132) are as follow:

1. Internal factors (factors from within the individual), including the state or condition of the physical and spiritual students,
2. External factors (factors from outside the individual), including environmental conditions around students,
3. The learning approach factor (approach to learning) is the type of student learning effort (habits) which includes the strategies and methods used by students to carry out learning activities on the subject matter.

The above factors interact directly with each other in influencing student achievement, so a good environment and readiness in students is needed, which includes strategies, methods and learning styles, so that they can influence the learning achievement that will be produced. According to Gagne quoted by Aunurrahman (2010:176) learning outcomes include:

1. Intellectual skills, or procedural knowledge. It includes learning concepts, principles and problem solving obtained through presenting material at school
2. Cognitive strategy. The ability to solve new problems by managing the internal processes of each individual in paying attention, learning, remembering and thinking
3. Verbal information. The ability to describe something in words by organizing relevant information
4. Motor skills. The ability to carry out and coordinate movements related to the muscles
5. Attitude. Internal ability that influences a person's behavior based on emotions, beliefs and intellectual factors.

Mukhtar and Iskandar, (2010: 82), explain the learning process is categorized into three parts. First, learning shows an activity in an individual that is conscious or intentional, second, learning is an individual interaction with their environment, and third, learning outcomes are marked by changes in behavior. Below are what these categories are:

1. Learning shows an activity in an individual that is intentional. The understanding is that learning activities should be intentional or planned by the learner himself in the form of a particular activity. The activity refers to the activeness of a person in carrying out certain activities, both in the physical and mental aspects that allow for changes in himself. Thus, it can be understood that a learning activity is said to be getting better when the intensity of a person's physical and mental activity is getting higher. On the other hand, even though someone is said to be studying, if the physical and mental activity is low, it means that the learning activity is not carried out intensively.
2. Learning is an individual interaction with the environment. The environment in this case can be in the form of people or other objects that allow individuals to gain experiences or knowledge, both new or something that has been discovered before. The existence of individual interaction with this environment can encourage a person to increase physical activity (body movement) and mentality to further explore something that has become a concern. For example, when students pay attention to their friends doing an activity about connecting cables to electrical installations; the stronger the student's interaction with the object of the activity is, the greater the attention and encouragement of the student to understand the activities is carried out by his friend.
3. Learning outcomes are marked by behavior changes. Although not all changes in behavior are the result of learning, learning activities are generally accompanied by changes in behavior. In general, changes in behavior that occur are changes that can be observed (observable). However, not always changes in behavior that are intended as learning outcomes can be observed.

Based on this opinion, it can be concluded that learning outcomes can be in the form of intellectual skills, cognitive strategies, verbal information, motor skills, and attitudes. And the

learning outcomes in this study are Basic Electronics Learning Outcomes of students at Vocational Schools in Manado.

According to Kurikulum 2013 (the 2013 Curriculum of Indonesia), Basic electronics course is a subject taught in class X, Electronics Engineering Study Program for the Audio Video Engineering skill package during semesters 1 and 2, and Technology and Engineering Electronics Engineering expertise study program basic electronics engineering subjects. The materials discussed are passive and active components. Passive components are electronic components that can operate without the need for electric current and voltage such as resistors, capacitors, inductors and transformers, while active components are electronic components that require current or voltage to operate such as diodes, transistors, FETs and thyristors.

Instructional Video

The word video comes from the Latin, video-vidivisum which means to see (to have the power of vision), to be able to see. According to the Big Indonesian Dictionary, video is a live image recording or television program to be broadcasted via a television set, or in other words, video is a moving image display accompanied by sound. Video is a picture in a frame, where frame by frame is mechanically projected through a projector lens so that a live image appears on the screen. Azhar Arsyad (2011: 49) stated that the ability of video to depict live images and sound provides its own charm. Videos can present information, describe processes, explain complex concepts, teach skills, shorten or lengthen time, and influence attitudes. Video can increase students' interest in learning because students can listen and see pictures at the same time. As it is a type of audio-visual media, and the senses of hearing and sight are involved when it is processed, what is shown can be captured completely in student's memory.

Based on the understanding of the experts above, it can be concluded that video is a type of audio-visual media and can depict an object moving together with a natural sound or appropriate sound. Videos present information, describe processes, explain complex concepts, teach skills, shorten, or lengthen time, and influence attitudes.

According to Riyana (2007: 2) instructional video media is media that presents audio and visuals that contain learning messages both containing concepts, principles, procedures, theories, applications to help understand a learning material. From the opinion above, it can be concluded that instructional videos are learning media that convey messages to students in the form of audio and visuals in which there is learning material so that students can study independently without being limited by place. The existence of instructional video media in the classroom is very useful because with videos, students can witness an event that cannot be witnessed directly, as well as past events that cannot be brought directly into the classroom. Students can play back the video according to their needs and requirements.

According to Andi Prastowo (2012: 302), the benefits of video media are:

1. Provide unexpected experiences to students,
2. Showing in real terms something that was impossible to see at first,
3. Analyzing changes in a certain period of time,
4. Give experience to students to feel a certain situation, and

5. Presenting case study presentations about real life which can trigger student discussion.

Therefore it can be concluded that learning with video media can foster a pleasant feeling considering that the experiences that occur in the learning process in class are difficult to erase in memory so that they can stimulate interest and motivation for students to learn.

Furthermore, the purpose of learning using video according to Ronal Anderson, (1987: 104) includes 3 elements, namely cognitive, affective, and psychomotor. These three objectives are explained as follows:

1. Cognitive Objectives. It can develop cognitive abilities that involve the ability to recognize and provide stimulation in the form of motion and sensation. It can also show a series of still images without sound like photo media and frame films, although they are less economical. Video can be used to show examples of how to behave or act in an appearance, especially regarding human interaction.
2. Affective Purpose. By using effects and techniques, video can be a very good medium in influencing attitudes and emotions.
3. Psychomotor Objectives. Video is the right medium to show examples of skills related to movement. With this tool it is clarified either by slowing down or speeding up the displayed movement. Through video students immediately get visual feedback on their abilities so that they are able to try skills related to the movement earlier.

Seeing some of the objectives described above, it is clear that the role of video in learning is very important. Because videos can also be used by almost all topics, learning models, and every domain: cognitive, affective, and psychomotor such as:

1. Cognitive. Students can observe dramatic recreations of past historical events and actual recordings of current events because the elements of color, sound and motion here are able to make the characters feel more alive. Besides, watching videos, after or before reading, can strengthen students' understanding of teaching materials.
2. Affective. Videos can strengthen students in feeling the emotional elements and attitudes of effective learning.
3. Psychomotor. Videos have the advantage of showing how something works, learning videos that record motor/movement activities can provide opportunities for students to observe and re-evaluate these activities. Apart from that, as non-printed teaching materials, videos are rich in information to be informed in the learning process because learning can reach students directly which can add a new dimension to learning. Students don't only see images from printed teaching materials and sound from audio programs but can also get both moving images and accompanying sound. This video can be played using a computer, laptop or via a mobile phone.

According to Gerlack and Ely in Asyhar (2012: 83-84) provides five principles. In general, the principles of media selection are suitability, clarity of presentation, ease of access, affordability, availability, quality, alternatives, interactive, organization, novelty, and student-

oriented. So to make good and effective learning media for students, they must pay attention to the criteria of good media and have principles. According to Sudjana (1990: 4-5), the criteria that need to be considered by teachers or educators in choosing learning media are: (1) The accuracy of the media with the purpose of teaching, (2) Support for the content of learning materials, (3) Ease of obtaining media, (4) Teacher skills in using it, (5) There is time to use it, (6) In accordance with the child's level of thinking

In this study, instructional videos designed by researchers themselves using video editing, sound recorders and action script programming will produce animations/videos about the subject matter about active electronic components.

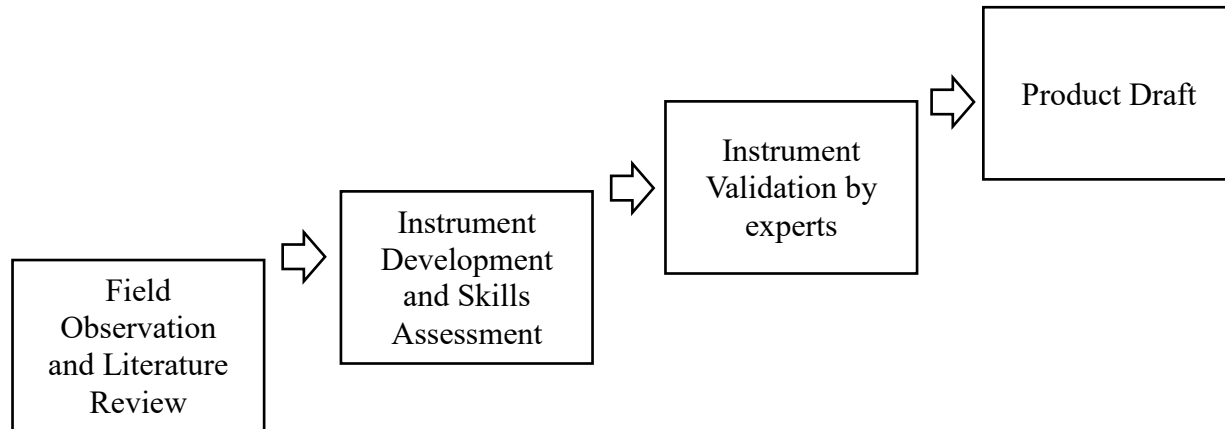


Figure 1: The Research Timeline

RESEARCH METHODOLOGY

The research design and stages in the first year follow the research procedure which refers to the Borg and Gall R&D (Research and Development) development method which has been adapted by Anik Ghufon into several stages. Broadly speaking, the flow of the author's framework in developing instructional video research is illustrated in Figure 2 below:

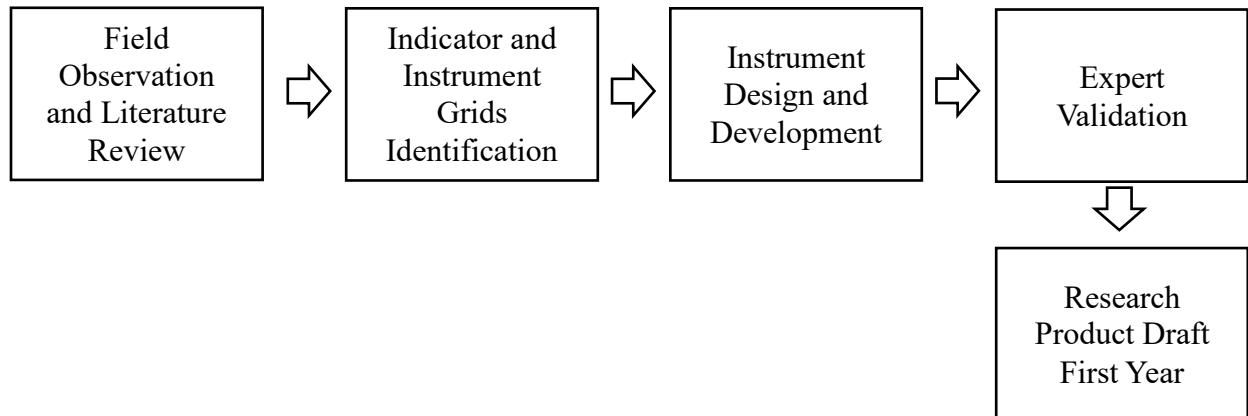


Figure 2: The Research Timeline

The results of the research are: First, based on field observations it was found that teachers who teach Basic Electronics subjects do not have variations in teaching Basic Electronics subjects. This means that they do not use a variety of models or media in teaching so that students are less interested in learning which results in their learning outcomes being less good.

Second, the literature study shows that the existence of video media in the classroom is very useful because with videos, students can witness an event that cannot be witnessed directly, is dangerous, or past events that cannot be brought directly into the classroom. Students can play back the video according to their needs and requirements. The benefits of video media according to Andi Prastowo (2012: 302), are: 1) Providing unexpected experiences to students, 2) Analyzing changes over a certain period of time, 3) Providing experience to students to feel a certain situation, 4) Showing something that is actually impossible to see at first, and 5) Presenting case study presentations about real life that can trigger student discussion. This means that by teaching electronic components such as resistors, capacitors, diodes and others through instructional videos, it can provide a real picture of what is learned, clearly witness the process of changing currents and voltages that occur in a circuit that is connected to the components. according to the function and work characteristics of each component. Gives a distinct impression to each student about the material being taught according to the experiences they have had during the teaching and learning process. Students get a real picture of something abstract, and arouse deep curiosity so that further discussions occur outside of class hours or outside the classroom about the material being taught.

Third: The purpose of learning using video according to Ronal Anderson, (1987:104) which includes 3 cognitive, affective, and psychomotor elements. It means that: 1. Cognitive Objectives, 1) Being able to develop cognitive abilities which involve the ability to recognize again and the ability to provide stimulation in the form of motion and sensation through the images and sounds shown in the video. 2) It can display a series of still images without sound as photo media and frame film although it is less economical. 3) Video can be used to show examples of how to behave or act in an appearance, especially regarding human interaction. 2. Affective Purpose, By using effects and techniques, video can be a very good medium in influencing attitudes and emotions. 3. Psychomotor objectives, 1) Video is the right medium to

show examples of skills related to movement. With this tool it is clarified either by slowing down or speeding up the displayed movement. 2) Through video students immediately get visual feedback on their abilities so they are able to try skills related to the movement earlier.

Fourth: According to the concept of Bloom's Taxonomy in the cognitive domain, video learning is a thought process using the brain in analyzing shapes, colors and placement of electronic components. The affective domain concerns the character of students including feelings which include aspects of learning attitudes, interest in learning (desire and willingness), self-concept or belief or confidence in carrying out an activity, having academic values (such as recognizing the strengths of friends, being able to work together), and morals such as honesty.

This domain will determine the attitude in learning for each student in carrying out learning activities. The psychomotor domain has the advantage of showing how something works, learning videos that record motor/movement activities can provide opportunities for students to observe and re-evaluate these activities. Apart from that, as non-printed teaching materials, videos are rich in information to be informed in the learning process because learning can reach students directly which can add a new dimension to learning. Students not only see images from printed teaching materials and sound from audio programs, but in the video, students can get both, namely moving images and accompanying sound. This video can be played using a computer, laptop or via a mobile phone.

Fifth. So that the material can be conveyed properly, the instructional videos, with the stages of developing instructional videos as shown in table 4 (Appendix 1). And the Draft of Assessment of Analog Electronics Learning Outcomes as in table 5 (Appendix 2)

Table 4
Learning Outcomes Instrument Grids

No	Basic Competence	Indicator	Items
1	Master the theory of Basic Electronics	Explain the theory of Basic Electronics	
2	Identify the components of Electronics	Identify resistor components	
		Calculate the resistance value of the resistor circuit	
		Identify the capacitor components	
		Calculating the capacitance value of a capacitor circuit	
		Identify diode components	
		Identify transistor components	

Assessment of Basic Electronics learning outcomes using the following grid:

Table 5
Learning Outcomes Instrument Grids

No	Basic Competence	Indicator	Items
1	Master the theory of Basic Electronics	Explain the theory of Basic Electronics	
2	Identify the components of Electronics	Identify resistor components	
		Calculate the resistance value of the resistor circuit	
		Identify the capacitor components	
		Calculating the capacitance value of a capacitor circuit	
		Identify diode components	
		Identify transistor components	

CONCLUSION

1. In the field it was found that teachers who teach Basic Electronics subjects do not have variations in teaching Basic Electronics subjects. Therefore, it is necessary to make appropriate media for teaching Basic Electronics, such as Instructional Videos.
2. The literature study shows that the existence of video media in the classroom is very useful because with videos, students can witness an event that cannot be witnessed directly, as well as past events that cannot be brought directly into the classroom. This means that by teaching electronic components such as resistors, capacitors, diodes, and others through instructional videos, it can provide a real picture of what is learned, clearly witness the process of changing currents and voltages that occur in a circuit that is connected to these components according to their function. and the working characteristics of each component. Gives a distinct impression to each student about the material being taught according to the experiences they have had during the teaching and learning process. Students get a real picture of something abstract and arouse deep curiosity so that further discussions occur outside of class hours or outside the classroom about the material being taught.
3. Produced a draft for the development of an Electronics instructional video according to Vocational School materials.
4. Produced a draft for the development of the Basic Electronics Assessment Instrument

As a suggestion in this research First, this research needs to be continued in order to obtain instructional videos that are in accordance with the needs of Basic Electronics learning, so it is necessary to test the instrument in order to obtain suitable and reliable learning media to use in Basic Electronics learning in Vocational High Schools. Second, additional data is needed in the context of publication of scientific papers and registration of IPR.

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