



Design of Semiconductor Diode Learning Video

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Abstract. Electrical and electronic engineering practicum classes frequently run into issues, namely when students don't follow the proper procedures, which results in inaccurate data being collected. The 4-D (Design – Design – Develop and Disseminate), Research and Development approach is employed in this study. Media professionals and subject matter specialists validated the created instructional videos. A successful experiment was conducted using a semiconductor diode movie as a teaching tool with 120 students who will be majoring in automotive engineering in 2021 as respondents. The study findings from the subject matter authorities were given an average rating. The data was obtained from the validation results of media experts, material experts and students of the Department of Automotive Engineering in 2021. Due diligence by material experts obtained an average score of 3.25 (very good) and media experts obtained an average score of 3.327 (very good). The Effectiveness Test obtained an average value of 92.40 (very good). Based on feasibility and effectiveness tests, video semiconductor diodes are very feasible and effective for use as learning media. The purpose of this study is to discuss the validity and efficacy tests of creating semiconductor diode videos as a different type of learning medium and as a useful reference for courses in electricity and electronics.

Keywords: Video Learning · Diode Semiconductor · Medium Learning

1 Introduction

The improvement of science and innovation (Science and Innovation) has suggestions for each era in different areas of science. Particularly within the field of instruction which requests a learning framework that can be executed successfully and effectively. The utilize of data and communication innovation in instruction is known as e-education, which is an electronic-based instruction framework. Seeing the condition of education during this pandemic, it requires an online (online) learning process, so that the student learning process is less effective and limited. This can be seen from the student practicum learning, even though actually the practicum is presented to visualize all the theories that students learn at class for understanding related to the concepts being studied. Based on data information from the Department of Automotive Engineering, FT UNP, it was revealed that since the last 2 years the learning process has been carried out online, the

practicum has also been limited. This can be seen from the student learning process which tends to decrease.

The decline in student learning outcomes did not only occur during the covid period, even though in 2022 the covid period is over, student abilities are still declining. This can be seen from the July–December 2022 practicum activities for the Electrical and Electronics courses. The material has been explained and demonstrated twice, there are still students who do not carry out practicum procedures as instructed, even detailed instructions through the practicum module are also carried out but deviations from measurement data with data that should be still high. Data with an error rate of more than 20% indicates that the practicum was not carried out as it should. Based on observations so far, repetition of material more than twice by the lecturer will disrupt the activities of students who are already able to carry out practicum, because student concentration will be divided between working and listening to the lecturer's demonstrations again. For this reason, by making practicum learning videos, it is predicted that students will be able to better understand theory and be able to visualize practicum properly and correctly.

Learning media are apparatuses, strategies and methods utilized to form communication and interaction between instructors [1] The benefits of media in learning incorporate: making a difference a ceaseless learning prepare between teachers [1] The benefits of media in learning include: helping a continuous learning process between educators and students, increasing student interest and enthusiasm within the learning handle, expanding understudy interest and excitement, as well as intuitive between understudies, teachers and learning assets. Interact interactively and can overcome the limitations of space, time, energy, and sensory power. Research conducted by [2] disclose the use of video in learning can increase interest, attention, creativity, motivation, understanding of concepts and memory of PGSD students by 81.5%. The same thing was also researched by [3] which reveals the impact of using video is very positive in learning activities. Research by [4–6] explains video-assisted probing-prompting learning has a significant impact on the teaching and learning process.

In spite of the fact that learning recordings are exceptionally simple to discover on the web, learning recordings that are truly in agreement with the Semester Learning Plan (RPS) for the Electrical and Electronics course in the Department of Automotive Engineering are very difficult to find, for this we need learning videos that are relevant to the RPS. To make learning videos, validity and effectiveness tests are needed, to find out if the videos made are feasible and effective as learning media. Research conducted a feasibility test to determine the feasibility of using Canva learning media in basic electricity and electronics subjects using a research instrument in the form of a questionnaire with respondents from expert teachers and students. Test the validity of the reliability and practicality of the media. Based on the research results, learning media is categorized as very practical and appropriate to use. [7, 8] in his research entitled Development of Android-Based Learning Media in Electronic Fuel Injection (EFI) Learning. This study aims to determine the feasibility and effectiveness of android-based learning media in the learning process, with the overall assessment results of “very good” and effective learning media applied. Thus in this study the author will make a practicum learning video on the subject of electricity electronics [9]. Video is the part that broadcasts images on television, recording live images or television programs for broadcast. Video is an

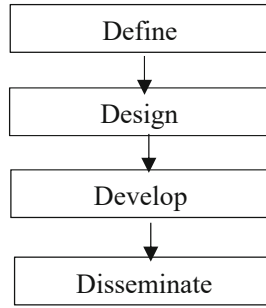


Fig. 1. 4-D Model of R&D

electronic media capable of combining audio and visual technologies together to produce a dynamic and interesting presentation [10, 11]. Video or film is a series of many image frames that are played quickly. Each frame is a recording of the stages in a movement. Learning video media is media that presents sound and visual which contains learning messages both containing concepts, standards, strategies, application hypothesis to assist get it a learning media [12]. Video tutorials are interactive in nature guiding students to understand a material through visualization [13, 14]. Videos are available for almost all types of topics and for all types of learners in all domains of teaching cognitive, affective, motor skills, interpersonal [15]. The development and creation of learning videos must consider the following criteria namely the Type of Material, Time Duration, Video Presentation Format and Technical Terms.

2 Research Methods

This study uses a 4-D model and is classified as Research and Development (R&D) (Fig. 1).

2.1 Research Procedure

Four D model development steps consisting of [16]:

1. Define

The define stage is carried out by establishing and defining development requirements. Learning videos are made with the aim of improving the quality of the teaching and learning process, especially to overcome errors in measurement data and practicum procedures carried out by students.

2. Design (Design)

This stage the researcher makes the initial product or product design. in the context of developing teaching materials, this stage is carried out to make story boxes related

to the practical stages of rectifier diodes, zener diodes and leds. Design a video story box by outlining the steps that will be carried out when making a semiconductor diode learning video.

3. Development

Development activities consist of media production, validation or evaluation of product designs and testing the effectiveness of product designs on subjects. Validation was carried out by 2 media experts and material experts. Media experts focus more on reviewing related to color, sound, and the clarity of the information conveyed. While the material experts will review the material that is made into learning videos referring to legal literature reviews, so that incorrect information is conveyed in the video is not examined.

4. Disseminate (Dissemination)

While valid is declared valid by media experts and material experts, then the learning video will be tested for its effectiveness, through the application of semiconductor diode videos as practical learning media in electrical and electronics courses. The effectiveness test was carried out on 8 electrical and electronics practicum classes. In practice, students are asked to view the semiconductor diode video that has been uploaded on e-learning before the practicum lecture schedule begins. Lecturer practicum learning uses demonstration learning methods related to the semiconductor diode practicum stages, then students will be asked to do practicum in small groups, where 1 group consists of 2–3 people. Students who are still unsure about practicum procedures, they will watch semiconductor diode videos, so that the student learning process is independent and active.

2.2 Research Instruments

Information collection strategy by giving a set of composed questions to respondents. The survey inquire about instrument was filled in by fabric specialists, media specialists, and understudies [18]. Surveys for media specialists and fabric specialists are utilized as a direct in item advancement and refinement. Elective answers employing a Likert scale are given with five elective answers, to be specific exceptionally great, great, sufficient, less and exceptionally awful. The criteria for scoring things within the survey can be seen within the Table 1.

2.3 Data Analysis Techniques

The data collection steps in this study used learning videos and video feasibility tests for students. Respondents who were included in this study were: (1) material experts, (2) media experts (3) students.

$$X = \left(\sum X \right) / n \quad (1)$$

Table 1. Criteria for Scoring Items in a Questionnaire with a Likert Scale

Criteria	Score
Very Good	4
Good	3
Enough	2
Exceptionally awful	1

Table 2. Media Expert Assessment Results

Aspect	Average Score	Category
Compatibility of Material with RPS	3	Very good
Material Presentation	4	Very good
Accuracy in using tools and materials	3	Very good
Systematic Practicum Procedure	3	Very good
	3.25	Very good

- X = Score average;
- $\sum X$ = Amount score;
- N = Amount evaluator.

3 Results and Discussion

The product produced in this study is in the form of a diode practicum learning video. This diode practicum learning video on electronics electricity subjects has a total duration of 64.26 min with a capacity of 500MB. Practical learning videos can be viewed using laptops and cellphones with an internet connection, or download them for use without an internet connection. This diode practicum learning video is structured to cover material according to the Jobsheet, namely diode measurements using a multimeter, rectifier diode circuits with forward bias and reverse bias, LED circuits with forward bias and reverse bias, and forward bias and reverse bias zener diode circuits.

Test the validity of the diode learning video in the electrical electronics subject including the media and semiconductor diode material displayed. The results of the evaluation of the diode learning video by media experts and material experts can be seen in Table 2 and 3.

The validity test by material experts is focused on the appearance of the videos that have been made. The assessment indicators by media experts can be seen from Table 3.

Based on the description, the average value (X) can be obtained using the equation. Value X is the result of dividing the total score ($\sum X$) by the number of assessors (n). In the study, the value n = 4, namely the relevance of the material, presentation of the material, language and appearance, while it $\sum X$ is the sum of the values obtained for each aspect of the assessment. From the calculation results the average value obtained from material experts is X = 3.25 and the value from media experts is equal to X = 3.327, so that the learning videos that are made valid are used as learning media for semiconductor diode material.

Table 3. Media Expert Assessment Results

Aspect	Average Score	Category
Conformity of impressions with the flow of learning practices	3,4	Very good
Complete information in the form of text on each activity	3,5	Very good
Image composition (dot layout)	3,6	Very good
Audio mixing quality (match between audio and picture)	3,3	Very good
Audio clarity (no noise)	3,4	Very good
Clarity of articulation	3,3	Very good
Lighting quality	3	Very good
Accuracy of Duration (balance of time between preliminary, core and closing activities)	3,5	Very good
Audio clarity (no noise)	3,25	Very good
Audio clarity (no noise)	3,327	Very good

Table 4. Effectiveness Test

Observedaspects	Score Percentage (%)	category_
Studying material in learning videos	92	Very good
Follow Practicum Procedures	90	Very good
Data error rate <5%	90	Very good
Liveliness/ Enthusiasm	94	Very good
Collaboration and peer tutoring	96	Very good
Average	92.40	Very good

The effectiveness test was carried out on 106 students who were members of 8 different practicum groups. The use of semiconductor diode video as a supporting medium in conducting particums can improve the quality of learning. The aspects that are assessed to see the effectiveness of learning videos can be seen in Table 4.

4 Conclusion

Due diligence by content experts obtained an average score of 3.25 (very good) and media experts obtained an average score of 3.327 (very good). The Effectiveness Test obtained an average value of 92.40 (very good). Based on the feasibility test and effectiveness test, the semiconductor video diode that was made was very feasible and effective to be used as a learning medium. The limitation of this video is that it only discusses the basic concept of semiconductor diodes, while semiconductor diode application videos have not been discussed, and this becomes development material for further research.

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