Development of Online Learning Videos: An Innovation for Higher Education Students in Electromagnetic Experiment Course During a Pandemic COVID 19

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Abstract. The ongoing COVID-19 pandemic has led to government decisions regarding the continuation of online lectures. This transformation becomes a problem in the ongoing compulsory course for students, namely electromagnetic experiment. Until finally the researchers chose video media as the answer to these problems. In the process, video development was carried out in two cycles. Through this development, the researcher wanted to know the ability of video in presenting data and its feasibility. The subjects of this study were students of S1 Physics Education, Universitas Negeri Malang in batch 2019 with a total of 100 people. This video was developed using the Four-D method which consists of defining, designing, and developing stages. The first cycle video acts as the preceding video and the second cycle video acts as the development result video. Practical reports and student assessment questionnaires are used as a review of development results. As a result, students obtained an average experiment report score of 93 in the first cycle and 96 in the second cycle. Student assessments related to the first cycle of media showed that 70.57% stated that they were feasible and became 79.86% in the second cycle.

1. Introduction
As it is known that during the COVID-19 pandemic lectures were conducted online [1][2]. Online learning is one manifestation of the application of information technology developments that have brought major changes to education. This technological development is manifested in its use in the teaching and learning process from conventional methods to more modern ways [3]. With advances in technology and communication, online lectures can be well planned. One of the technological media that can be used is video learning [2]. Video is all things related to what is seen, especially moving images which in the process require a recording process and the display requires technological assistance [4].

Electromagnetic experiment is one of the subjects that must be taken by students majoring in physics at FMIPA UM. The learning process consists of experiment activities, report generation, and presentations. However, during the pandemic student activities are carried out online. To know the expected student competencies, it is necessary to strive for learning media that can represent students in reviewing the data obtained related to experiment material. Through these considerations, the video becomes one of the solutions to overcome this problem. The selected electromagnet experiment materials are induction coils, transformers, electromagnets, and AC/DC generators. With this video, it is hoped that students can gain an understanding of the practical material presented. Furthermore, students can practice skills in obtaining data, analyzing, making reports, and presentations.
Based on the literature review that has been carried out, the electromagnetic experiment learning video has not been obtained by the expected competencies. Therefore, an electromagnet experiment learning video was developed to determine the ability of the video to provide an overview of the observational data and its feasibility to be used in learning activities. In the manufacturing process, an android phone is used with the help of the kinemaster video editor application. Broadly speaking, there are three main stages needed in making videos, including pre-production, production, and post-production [5][6][7].

2. Method

This type of research is the development (Research and Development) with the 4D method (four D model) which was developed by S. Thiagarajan, et al [8]. Several stages of the 4D method are defined, designing, developing, and disseminating [9][10]. However, in this study, it was only applied to the development stage. In the early stages, several aspects need to be analyzed to provide the basis for video development, namely the initial analysis to raise and determine the basic problems faced. After that, an analysis of the students was carried out to find out their character to develop media according to their academic abilities. Through these two things, a task analysis is carried out to detail the outline of the teaching material and concept analysis to identify the essential concepts to be taught. Then formulated the learning objectives of the material to be made.

The design stage is the second stage of the 4D method. In this stage, the initial manufacture of the product (prototype) of the media that will be used is carried out and in this case, is represented by a video made in cycle 1 of the electromagnetic experiment. The videos made are based on the formulation of learning objectives from the results of the analysis, topic selection, media, and source selection, learning strategy selection. Development is the last stage of the methodology used. At this stage, Thiagarajan (1976) divided it into two, namely expert appraisal and development testing. An expert appraisal is a technique to assess or validate the feasibility of the media to be developed. In this case, the researcher acts as a validator of video media content because he has become an expert in the field created. As for development testing, it is a product design test activity consisting of individual trials, small groups, and large groups. This was represented by students of S1 Physics Education Offering AC, B, C, and D class of the 2019 Universitas Negeri Malang. The purpose of this stage is to produce learning tools that have been revised based on the input obtained from the validator. At this stage, there are several stages carried out including product validation by the team, design revisions, limited trials, product revisions, and usage trials.

This research is divided into two cycles. The first cycle is used as the first video which is made as a provision for video development in the second cycle. The first cycle raised the topic of induction coils and transformers. Meanwhile, in the second cycle, the topic of AC/DC generators and electromagnetic forces was raised. Because the assessment was carried out for the ability of the video to display observational data and its feasibility, a questionnaire was provided to answer its feasibility and an experiment report was used as an indication of the ability of the video to display observational data.

In the classroom implementation, three stages are carried out in each cycle, namely pre-activity, planning, implementation, and reflection. In the pre-activity stage, an analysis is carried out as a form of defining the method used. Through this stage, it is known that students do experiments independently with the help of a virtual lab or project-based. Followed by the planning stage covering RPS, SAP, CPMK, making videos, and research questionnaires. This second stage represents the design stage of the media. Then all the things that have been prepared are carried out in class and produce some reflections contained in the cycle questionnaire and or in the discussions that take place in class. These results are then compared with the criteria for the assessment score (%) of the implementation of learning presented by Arikunto (2002). The results of this reflection are the basis of the video development for the second cycle.
### Table 1. Criteria for assessment scores (%) of learning implementation.

| Score (%) | Criteria   |
|-----------|------------|
| 92-100    | Very good  |
| 75-91     | Good       |
| 50-74     | Pretty good|
| 25-49     | Not good   |
| 00-24     | Bad        |

3. Result and Discussion

In the process of developing this electromagnetic experiment video, students' opinions were reviewed through questionnaires and experiment reports. A review is carried out on the content and appropriateness of the media used.

| Offering | Transformer | Induction Coil | AC/DC Generator | Force Electromagnetic |
|----------|-------------|----------------|------------------|-----------------------|
| AC       | 91,4        | 92,2           | 97,6             | 97,8                  |
| B        | 93,2        | 91,8           | 97,4             | 94,6                  |
| C        | 96,2        | 90,6           | 95,8             | 96,6                  |
| D        | 95          | 91             | 93,2             | 95                    |
| Average  | 93,95       | 91,4           | 96               | 96                    |

Through the data on the value of the electromagnetic experiment report, the average value of the first cycle for the topic of transformers and induction coils is 93.95 and 91.4, respectively. This rating is lower than the second cycle with the topic of AC/DC generator and electromagnetic force which has an average value of both 96.

| Questions                                                                 | Cycle 1  | Cycle 2  |
|---------------------------------------------------------------------------|----------|----------|
| The video can display the symptoms according to the material from the topic | 66,7%    | 73,3%    |
| Students are free to observe the existing independent variables           | 67,6%    | 69%      |
| Students are free to observe the existing dependent variables             | 73,3%    | 74%      |
| Students are free to explore related material                              | 71,1%    | 74,4%    |
| Average                                                                   | 69,675%  | 72,675%  |

Even the video content assessment questionnaire shows the same symptoms as the experiment report. In assessing the suitability of the symptoms shown in the video with the material, the first cycle of the video, 66.7% of students agreed with the statement and 33.3% disagreed. When compared to the
second cycle, there were 73.3% of students agreed with the statement and 26.7% of the other students disagreed. This shows that this media has increased in presenting symptoms for the topics discussed to students.

Not only in presenting symptoms, but the experiment videos made also show developments in the student's discretion in observing existing variables. The first cycle showed that 67.6% of students agreed to the discretion of the independent variable observation and 69% agreed to the discretion of the dependent variable observation. An increasing pattern also appears for the independent and dependent variables in the second cycle with percentages of 73.3% and 69% respectively. The last aspect that was assessed about the content was the students' flexibility in exploring each topic in each cycle. The first cycle has a percentage of 71.1% and the second cycle has a percentage of 74% of students agreeing with the question. Finally, students agree that the media used can provide flexibility for students to explore material related to the percentage of 71.1% for the first cycle and 74.4% for the second cycle. So that through this review the second cycle of media is said to have increased from the videos made in the first cycle. Through a comparison with the assessment criteria for the implementation of learning presented by Arikunto (2002) the second cycle media has a percentage of 72.675% in terms of content or has a pretty good predicate.

| Table 4. Student opinion on media quality. |
|-----------------------------------------|
| Questions                                      | Cycle 1 | Cycle 2 |
| Video image quality                        | 73.3%   | 83.8%   |
| Video color quality                        | 78.3%   | 86%     |
| Video lighting quality                     | 66.7%   | 81.4%   |
| Sound quality in video                    | 73.3%   | 81.4%   |
| There is no noise in the video             | 70%     | 81.4%   |
| References in the video are clear and supports | 63.3%   | 69.9%   |
| Readability of text on video              | 73.4%   | 81.4%   |
| The video contains important things related | 63.4%   | 72.1%   |
| Clarity of delivery of material in the video | 73.4%   | 81.3%   |
| Clarity of scale in video                | 51.7%   | 73.25%  |
| Average                                  | 68.68%  | 79.195% |

The review of the quality of the video media used also showed an increase when compared to the percentage of the first cycle of questionnaires and the second cycle of questionnaires. The first cycle has an assessment of 73.3% of students agree that the media used has good image quality. This increase is indicated by 83.8% of students agreeing that the second cycle media have good image quality. Likewise for color quality, the second cycle has a percentage of 86% of students agree. This is different from the first cycle media which only obtained 78.3% of students agree. The lighting quality of the second cycle media has better quality, with a percentage of 81.4%, when compared to the first cycle media which only has a percentage of 73.3%.

Not only visuals, but the audio is also an assessment that should be taken into account. In terms of clear sound quality and minimal audio interference, the second cycle video has a percentage of 81.4% each. In contrast to the first cycle of video which only has a percentage of 73.3% for clear sound quality and 70% for minimal audio interference. The same thing also happened to the assessment of supporting information contained in the video. The first cycle video has a percentage of 63.3% and the first cycle video has a percentage of 69.9% for the point rating. In addition, the second cycle video has a percentage of 81.4% for the clarity and legibility of the available text, and the first cycle video has a 73.4% percentage for this rating. Even the first cycle video had 63.4% student approval in the availability of important information in data collection. This increase was significant in the second...
cycle with a percentage of 72.1%. Students assess the clarity of the speaker in delivering the material in the second cycle has a percentage of 81.3% and the first cycle has a percentage of 73.4%. Finally, 73.25% of students agree that the video has a clear scale in the second cycle. This assessment increased when compared to the first cycle with a percentage of 51.7%. Through all assessments in terms of video quality, the second cycle of media has a percentage of 79.195% with a good predicate. So, if the average rating of the second cycle, content and video quality, is 75.935% with a good predicate.

However, several things become the evaluation of the making of this electromagnetic experiment video. The first thing to evaluate is that the video is less stable because the video was taken manually with a cellphone camera without the help of a tripod. Then, it would be better if the detailed scale was taken when shooting, not zooming during the editing process. In addition, students provide suggestions to include what data will be taken and how to collect it so that students are not confused in the data collection process. The emergence of observational data needs to be extended in duration so that students can obtain data and observe phenomena better. According to students' opinions, videos with the topic of transformers and videos of electromagnetic forces for the first and second cycles are videos that need to be improved. This is a reflection for researchers to always make improvements for the next videos.

4. Conclusion

The learning activities that took place in cycles I and II showed that there were two aspects to assess the success of this experimental video, namely the value of the experimental report and media analysis. The results presented in Figure 1 show that the experimental value of students in cycle 2 increased when compared to cycle 1. The students' ability in compiling reports shows that this video can make students take experimental data according to the topic easily. This is because the video contains experimental data which is a provision for students in observing the symptoms that occur according to the topic of discussion.

The results of the questionnaire given to students, in Figure 2, show that the video has the appropriate quality when used as a learning medium. This is because videos can provide a more comprehensive picture, and by utilizing the replay and pause features students are able to obtain more
accurate results and material related to the topic of discussion. In this experiment, the video can represent the position of students to observe the tools used in the data collection process. This is reflected in an assessment questionnaire for students. Through the quality of the content and media obtained through the questionnaire, the second cycle of videos has better quality from both sides as shown in Figure 2. This shows that this video is suitable to be used as a learning medium for electromagnetic experiments. However, there are several evaluations contained in the development of this video. Writing the script, taking pictures, and compiling the material to be delivered needs to be well planned so that students are able to accept it well. There is also a need for tools that support making this video well so that the video has good quality (image and sound).

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