



Validation and Development of Video-Based Learning Media to Increase Competency Achievement in Civil Engineering Education

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Abstract. This development research aims to determine the process and feasibility of the results of the development of learning videos to improve the achievement of student competencies on concrete flexural strength testing materials in the Building Materials Practicum subjects in the department of Civil Engineering. This research is development research with the 4D model. Learning media are validated by material experts, media experts, and students as learning video users. Respondents were 30 students from the department of Civil Engineering. Quantitative descriptive data analysis techniques from the results of questionnaire data with 4 alternative answers. The assessment of the feasibility of developing video-based learning media for testing the strength of concrete flexures in the Building Materials Practicum according to material experts scored 87.5 included in the category "very decent", according to media experts obtained a score of 77.5 including the "decent" category, according to students scored 85.8 in the "very decent" category. Video-based learning media as a whole is very decent to use in the learning process to improve the achievement of student competencies.

Keywords. Video Learning Media, Civil Engineering, Concrete Flexibility Testing, Competency Achievement

1. Introduction

Science and technology are increasingly advanced and sophisticated along with the times. Even technological advances today are very fast developing (Ismail & Hassan, 2019) to shift education that was originally face to face to interact in the virtual environment (Dewi, Riyanto, & Suhanadji, 2020). Directly or indirectly this has a major influence on several aspects of human life, one of which is the aspect of education. Education plays an important role in creating quality human resources. Education as one of the main instruments in the development of human resources (Putra, Aminah, & Marzuki, 2020; Caingcoy & Libertad, 2020). To

improve the quality of education, various breakthroughs are needed, both in curriculum development (Rahdiyanta, Nurhadiyanto, & Munadi, 2019), learning innovations (Triyono, Trianingsih, & Nurhadi, 2018), and fulfillment of educational facilities and infrastructure (Rahdiyanta, Nurhadiyanto, & Sukardi, 2019). Innovation in the learning model is needed to get better learning outcomes (Nashir, 2018). Vocational education is expected to increase competitiveness (Nurtanto, et al., 2020). as well as being a policy concept in improving the country's economy (Neusuess, 2020; Nurtanto, 2020).

One of the courses in the department of Civil Engineering Education is the Building Materials Practicum. The main topic studied in this Building Materials Practicum course is the work of making and testing concrete. The work of making concrete is one of the important jobs in the development process. The quality of concrete will be directly proportional to the strength of the building in accordance with the plan. Poor quality concrete will cause construction failure which will harm many sectors. Work accidents and building collapse due to concrete quality that is not according to the standard often occur, this is because the manufacture of concrete in accordance with Indonesian National Standards is often ignored by workers for various reasons so that losses will multiply when construction failure occurs due to poor concrete quality.

Demands for competency in making concrete must be met so that vocational education remains relevant to the competencies of the industrial world (Warju et al., 2020; Fakhri & Munadi, 2019) and construction industry technology (Daryono et al., 2020). In addition, with the competency in making concrete, students know for certain the flow of concrete in accordance with Indonesian National Standards so that later when working as a supervisor or project implementer, the competency can be applied so as to minimize errors that will have an impact on buildings (Entika et al., 2017).

Based on experience in the learning process, it shows that student interest in a practicum in building materials, especially concrete work and testing, is still low. Some of the causes are that the media provided by lecturers are still conventional (Ismail et al., 2018) and there are no supporting books on practice material. In addition, many students still find it difficult to study teaching materials (Cenas, 2020). Another difficulty experienced by students is the limited learning videos about the work of making and testing concrete and also more specific learning videos about the material are still very limited.

Students' understanding of the Building Materials course viewed from teaching and learning activities that have been observed is still lacking. In the learning, students cannot digest material that is explained directly if the lecturer only explains the material using blackboard media. Learning that still uses blackboard media makes many students feel bored. Whereas this course emphasizes practice material not theory.

By considering the various problems mentioned earlier, then we need a solution to improve the efficiency of the learning process in the classroom. The solution is to strive for the use of more effective and efficient learning media (Pamungkas, Widiastuti, & Suharno, 2020) and learning innovations (Bakar & Ismail, 2020). Because learning media is important to improve the learning process (Oluwatobi, Oluwaseun, & Adekunle 2020; Hasan, Zainal, & Suhadjerah, 2020; Irshaid, 2020). With media that is in accordance with technological advancements, it is expected to overcome the boredom of students during the learning process of Building Materials for Civil Engineering Education.

2. Method

Research on the development of video-based learning media for testing the strength of concrete flexures in the Building Materials Practicum course is a type of Research and Development (R&D) research. This research is defined as a process or steps to develop a new product or

improve existing products. Borg & Gall (1983). The video-based learning media development model uses the 4D Thiagarajan (1974) model. The procedure in the study consisted of four stages namely define, design, development, and dissemination.

At the design phase of the trial, expert validation is carried out, limited trials and large-scale feasibility tests. Expert validation was carried out on material experts and media experts while the feasibility test was conducted on users (students). Expert validation was carried out for media experts and material experts. Media expert who is a lecturer in Civil Engineering Education who has expertise in the field of instructional media. Material expert trials are conducted on Civil Engineering Education lecturers who master the material in accordance with the contents of the learning media, namely concrete flexural strength testing material. A feasibility test is an assessment that will be conducted to students in the department of Civil Engineering Education.

The technique or method used for data retrieval in the research development of video learning media for testing the flexural strength of concrete is a questionnaire. The questionnaire was used to determine the results of the feasibility of the media developed by respondents of material experts, media experts, and students of the products developed. In research into the development of video learning media using quantitative descriptive data analysis techniques. Quantitative descriptive research is research in which data obtained from a sample of the study population will be analyzed by statistical methods that are then interpreted. The alternative answers provided in the questionnaire consisted of 4 choices (Mardapi, 2008), which were (1) not decent, (2) decent, (3) decent enough, and (4) very decent. Table 1 explains the conversion of scores on the results of the data obtained.

Table 1. Converting Scores

Average Score	Decision
$X \geq X_i + 1,5 S_{di}$	Very Decent
$X_i + 1,5 S_{di} \geq X > X_i$	Decent
$X_i \geq X > X_i - 1,5 S_{di}$	Decent Enough
$X \leq X_i - 1,5 S_{di}$	Not Decent

3. Results and Discussion

3.1. Results

The research procedure used is a developed research and development procedure, namely the 4D model (Define, Design, Development, and Dissemination). The first stage defines, namely the determination and definition of development requirements carried out by the development needs analysis activity, development requirements that are tailored to the user and models suitable for the development of concrete flexural media learning products. The defining stage is grouped into 5 activities.

Front-End Analysis which aims to raise and determine the fundamental problems faced in learning concrete flexural strength testing, so that the development of learning materials is needed. Furthermore, Student Analysis activities are the stages of studying student characteristics in accordance with the development of learning tools. This analysis phase will get a description of the characteristics of students, namely the level of ability, background experience, motivation to learn, and skills related to the selected learning topic, media, format, and language. The third activity is Task Analysis, which ensures a comprehensive review of tasks in the learning material. Concept Analysis Phase is a step to fulfill the principles in developing concepts for materials used as a means of achieving learning in accordance with the

target learning outcomes of the specified course. Analysis Phase The learning objectives are the stages of summarizing concept analysis and task analysis to determine the behavior of the research object.

The second stage designs, based on data obtained from the define stage, the media to be developed is media that will help students improve understanding of both theory and practice in the Building Materials Practicum course. The reason for choosing the learning media to be developed adapts to the character of students' interest in easy and interesting learning. The making of instructional media in the form of a concrete flexural strength testing video is designed with an attractive appearance, has easy to understand language, and clear and coherent learning flow. The design stage is the stage in which video learning media are described in detail in each process which includes the design of the material, display design, making flowcharts, and making the storyboard.

The third stage is the development. At the development stage, a media assessment process will be carried out by the material experts as well as the media experts and student responses to determine the feasibility of the flexible strength testing learning video developed. The assessment will be the basis for improvement so that better learning media will be developed. The assessment results are qualitative data which are then converted into quantitative data.

The material expert assessment was conducted by civil engineering lecturers, Yogyakarta State University. Evaluation of learning video material uses a questionnaire with a scale of 1-4 and totaling 20 items. Expert advice and material become the basis for improving product design so that later this learning media product is suitable for use in the learning process. The results of the expert validation of the material in the video-based learning media for testing the flexural strength of concrete get a score of 70 from a maximum score of 80 shown in Table 2.

Table 2. Data from the results of the Feasibility Assessment Expert Material

No	Aspects	Items	Score
1	Learning Objectives	4	16
2	Presentation of Material	11	38
3	Motivating Quality	5	16
Total		20	70
Convert scores to a scale of 100			87,5

Assessment is based on several aspects namely, learning objectives, presentation of material and motivating quality. Of the three aspects that have been validated by material experts, a value of 70 is obtained, if converted to a scale of 100, a score of 87.5 is obtained and is included in the "very decent" category. So that this media can be used as a learning medium in the Building Materials Practicum course in the department of Civil Engineering Education.

The assessment of media experts was carried out by a civil engineering lecturer, Yogyakarta State University. Evaluation of instructional video media using a questionnaire with a scale of 1-4 and totaling 50 items. Media expert suggestions and input are the basis for improving product design so that later this learning media product is suitable for use in the learning process. The results of the validation of the media experts in the video-based learning media get a score of 155 from a maximum score of 200 shown in Tabel 3.

Table 3. Data from the Feasibility Assessment Results of Media Experts

No	Aspects	Items	Score
1	Preliminary	7	22
2	Video Media	29	89
3	Audio Media	6	18
4	Operational	6	18
5	Closing	2	8
Total		50	155
Convert scores to a scale of 100			77,5

Assessment of several aspects namely, learning objectives, presentation of material, and motivating quality. Of the five aspects that have been validated by media experts, a value of 155 is obtained, if converted to a scale of 100, a score of 77.5 is obtained and is included in the "very decent" category. So that this media can be used as a learning medium in the Building Materials Practicum course in the department of Civil Engineering Education.

The feasibility test to users aims to determine the feasibility of learning media that includes aspects. The feasibility test was conducted on the actual target with 30 students in the department of Civil Engineering Education. The feasibility test procedure is carried out by displaying video-based learning media for concrete flexural strength testing and then filling out questionnaires with a scale of 1-4 totaling 30 items and given a column to provide advice and input. Suggestions and suggestions from users are also used as consideration in improving the concrete flexural strength test learning video. The results of the user feasibility test on the video-based learning media of concrete flexural strength testing get an average score of 103 from a maximum score of 120 shown in Tabel 4.

Table 4. Data on Student Feasibility Assessment Results

No	Aspects	Items	Score
1	Theory	5	504
2	The Benefits	5	508
3	Use	6	608
4	Media Suitability	2	207
5	Visual	7	724
6	Audio	5	523
Total		30	3074
Convert scores to a scale of 100			85,8

Assessment is based on several aspects namely, learning objectives, presentation of material and motivating quality. From the six aspects obtained an average value of 103, if converted to a scale of 100, a score of 85.8 is obtained and is included in the category of "very decent". So that this media can be used as a learning medium in the Building Materials Practicum course in the department of Civil Engineering Education.

The last stage is the dissemination or dissemination of instructional media videos that have been validated by media experts and material experts and users which will be disseminated to a wider subject. Media dissemination can use social media platforms such as Youtube. In addition, the final product packaging is done in the form of a CD / DVD that will be given to supervisors and lecturers in the Building Materials Practicum at the department of Civil Engineering Education to assist the learning process.

3.2. Discussion

The product developed in this research is a video-based interactive learning media. The contents of the video media are the processes carried out during the Building Materials practicum on flexural testing that starts from testing the material, making mix designs, making test specimens, storing test specimens, testing flexural strength up to data analysis. Proper video-based learning media will be disseminated to students and the wider community through social media platforms such as Youtube. Media is expected to be able to help the teaching and learning process well or help the process of independent learning anywhere and anytime.

This video-based learning media has been tested by playing on a standardized system, OS Windows 8. The design and compilation of videos using Adobe Premiere Pro CC software. Figure 1-4 is an explanation of the parts of the development of video-based learning media for concrete flexural strength testing.



Figure 1. Opening Video Section on Development Media

The opening is an introduction or introduction page. In the video-based learning media for concrete flexural strength testing, there are three opening sections, namely the identity of the educational institution, the learning media title, and teaser content. Displaying the identity of Educational institutions includes: majors, faculties, and universities.



Figure 2. Bridging Material Sections on Development Media

Figure 2 is the material bridging section. Bridging material is done before entering the core material where this section is the beginning part which contains several things to clarify the video. Bridging material includes the learning outcomes of the course and the sequence of testing pathways to be performed. Displays Subject Learning Achievements and Subject Learning Sub Achievements in which this section explains what will be achieved after learning and concrete flexural strength testing pathway that will be carried out.



Figure 3. Core Material Parts in Development Media

Figure 3 is part of the core material. The core material of this learning video is divided into eleven stages as stated in the testing flow. In this section, the origin of the material used as a concrete mixture is explained, before the material is used it needs to be tested according to standards on sand and gravel. Next, determine and calculate the concrete mechanical strength planning specifications based on the flexural strength that is converted to compressive strength. Calculation of the conversion of flexural strength to compressive strength because the mix design uses compressive strength. while the mix design calculations are explained one by one complete with graphs and tables. The next stage is the preparation of making test specimens, the process of immersion of sand and gravel, the process of making sand and gravel in the Saturated Surface Dry (SSD) state, testing sand samples to find out whether the condition is Saturated Surface Dry or not.

The next stage is test preparation. Preparation of the test by drying the concrete surface shortly after being taken from the soaking tub then weighing the concrete after approximately two days removed from the soaking tub. After finished measuring the dimensions of the concrete as well as the placement of the fulcrum. Universal Testing Machine will be used as a flexural testing tool. The last stage is testing the concrete flexural strength with a centralized load UTM according to the specified formula, to the conclusion of the concrete flexural strength testing.



Figure 4. Closing Section on Development Media

Figure 4 is the closing part. Closing of the learning media based on concrete flexural strength testing is a thank you to those who have been involved in making this media. The flow of testing that has been done is also concluded in this section. The end of this product development is a video-based learning media for testing the concrete flexural strength. Before making learning media, material deepening is about the strength of concrete. The making of the product is carried out in several stages, namely: (1) making storyboards and scripts that aim as an overview of the product to be made and then consulted with the supervisor to be given input as an improvement; (2) the process of video taking conducted at the Laboratory of Building Material, Faculty of Engineering, Universitas Negeri Yogyakarta; (3) video editing process with the help of a third party due to the limitations of researchers in the use of Adobe Premiere CC and Adobe Flash software; (4) input suggestions from the supervisor to add some scenes so that the material is coherent and more easily understood; (5) evaluation from material experts and media experts is obtained suggestions and input as a media improvement, media experts provide learning media suggestions made with the format (.swf) or Adobe Flash.

4. Conclusion

The assessment of the feasibility of developing video-based learning media for testing the strength of concrete flexures in the Building Materials Practicum according to material experts scored 87.5 included in the category "very decent", according to media experts obtained a score of 77.5 including the "decent" category, according to students scored 85.8 in the "very decent" category. Video-based learning media as a whole is very feasible to use in the learning process. The results of this media development research are in line and directly proportional to previous research by Herwinarso et al. (2020), Dewi, Riyanto, & Suhanadji (2020) and Parusheva et al. (2018) concerning the development of instructional media for use in the learning process in improving the mastery of student competencies. So, this research can be used in the learning process, especially in the concrete flexural strength testing material in the Building Materials subjects in the Civil Engineering department, because the results of validation have been tested in the feasibility of the media and materials.

Based on the research and development limitations of the research that has been described, making this animated video-based learning media there are still many shortcomings and weaknesses. Therefore, some suggestions for the use and manufacture of products needed are further research can be tested for the effectiveness of video-based learning media for concrete flexural strength testing to determine the effect of the use of media that is being developed on the learning of Building Materials Practicum in the classroom. This video-based learning media



can be further developed by combining video with the application. The goal is that each of the steps in each subject can be separated into sub-choices, in which the user can independently choose each of these steps. With this innovation, learning is expected to be unlimited with the duration of the delivery of material. This video-based learning media can be further developed for learning together. Based on existing theories, video media can be used by educators in large-scale classrooms with the condition that supporting facilities meet the learning realization.

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