Development and validation of video-based learning media to increase competency achievement in civil engineering education

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Abstract. The purpose of this research is to develop and know the performance of video animation-based learning videos for measuring pegs from road curves, in the Geomatics Practice subject for civil engineering education students, and to find out the level of feasibility of instructional videos developed in the application of vocational practice learning processes. This type of research is research and development (R&D) that uses the 4D model. Data collection uses interviews aimed at lecturers who teach in vocational practices and questionnaires to assess eligibility in the context of media and materials, which aimed at media experts, material experts, and students who are analysed using quantitative data. The results of the feasibility of developing video animation on material expert perceptions obtained a value of 82.121% which is included in the very feasible category, the perception of media experts obtaining a media value of 93.444% included in the very feasible category, students’ perceptions get a value of 88.136 which is included in the very feasible category.

1. Introduction

The education world has become one of the institutions that have a major role in creating prospective Indonesian workers who are able to compete in the current era. The role of education here is to prepare the community to be ready to face it, which can be done by improving the quality of the community that is able to meet the needs of the business and industrial world and is able to compete with the quality and competence they have. In an effort to produce quality human resources and ready to work, it is necessary to improve the quality of education to prepare students who have certain skills to enter the workforce and compete globally with their competitors [1].

Vocational education is an educational institution that has the potential to prepare Human Resources that can be absorbed by the world of work [2, 3], because the applicable theoretical and practical material has been provided since first entering, with the expectation that graduates have the competence in accordance with the needs of the world of work [4, 5]. Vocational education has the main mission to produce a skilled workforce and in accordance with employment needs [6]. This can be interpreted that vocational education is a part of the education system that prepares a person to be more able to work in certain occupations than in other occupations [7, 8]. This understanding implies that each vocational education graduate has a depth of expertise in a field that is more prepared to enter the workforce [9].
Vocational education is expected to be able to create a dual effect, which is to encourage the educational achievements of citizens while also contributing directly to economic growth, especially through the informal sector [10].

The total station display is similar to the digital theodolite, the difference is that the total station has been combined with distance measuring components automatically [11]. Students must fulfil the mastery of competencies in learning the Geomatics Practicum, especially in the total station material for the measurement of buildings, roads, and others so that it is always relevant to the competencies needed by industry and in line with the development of construction technology. The material on Geomatics Practicum is very broad so it is important to provide for students. In addition, the change in technology that is manual to digital causes the importance of mastery of the material at the total station. The construction industry in this era has used digital technology while some schools still use conventional equipment [12]. The basic function of the total station is to be able to store work data on a large scale. Just like digital. The total station consists of three basic components that made into an integral unit. The three components are as follows: (1) electronic distance meter; (2) horizontal angle measurement; (3) microprocessor components [13]. Figures 1 and 2 represent the Electronic total station DTM-322.

![Figure 1. Electronic total station DTM-322](image1)

![Figure 2. Electronic total station DTM-322](image2)

The development of information and communication technology is very influential in various fields, especially in education. Learning media is one aspect of learning that closely related to educational technology. Both educators and students use technology as a learning medium without which learning is almost impossible. That happens because learning media are intermediary messages from information sources to recipients of information [14].

Lectures that predominantly use lecture methods and practice can cause students to lack learning experience. To overcome this we need learning media that can accommodate many ways of student learning and provide a more learning experience. The use of interactive learning media expected to reduce the obstacles that are often experienced by teachers and students in the teaching and learning process in the classroom and independent learning [15]. This is to see how the effectiveness of the media used in learning shapes students' preferences towards the material and gives good results [16].

2. Method

Research on the development of interactive learning media based on total station animation video for measuring stake out road curve in the Geomatics Practicum course in the Department of Civil Engineering Education is a type of Research and Development research. One of the research and
development models developed [17] is the 4D model (define, design, development and disseminated) (Figure 3).

![Figure 3. Schema of research procedure](image)

Subjects in this study grouped into three, namely: media expert and material expert in the Study Program of Civil Engineering and Planning Education as well as students from Civil Engineering and Planning Education, which amounted to 30 students. Data collection techniques in the development of video animation learning media use of this total station are interviews, questionnaires and document studies. Material expert instruments, media experts, and students in Tables 1, 2 and 3.

**Table 1. Material expert instrument**

| No | Aspect                      | Indicator                     | Item     | No. of questions |
|----|-----------------------------|-------------------------------|----------|-----------------|
| 1  | Learning objectives         | Conformity to objectives, learning | 5        | 1, 2, 3, 4, 5   |
| 2  | Presentation of material    | Material structure, Use of language | 8        | 6, 7, 8, 9, 10, 11, 12, 13 |
| 3  | Motivating quality          | The benefits of presenting material | 4        | 17, 18, 19, 20 |

**Table 2. Media expert instrument**

| No | Aspect         | Indicator                                         | Item     | No. of questions |
|----|----------------|---------------------------------------------------|----------|-----------------|
| 1  | Objectives     | Objectives, scope and learning strategies         | 5        | 1, 2, 3, 4, 5   |
| 2  | Visual         | Images, text, colors, fonts, layouts, animations  | 8        | 6, 7, 8, 9, 10, 11, 12, 13 |
| 3  | Audio          | Music, dubbing, language, time duration            | 5        | 14, 15, 16, 17, 18 |
| 4  | Usage          | The use of which, at any time, effectiveness       | 5        | 19, 20, 21, 22, 23 |
The technique or method used for data retrieval in the research development of video learning media is a questionnaire. The questionnaire 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. The alternative answers provided in the questionnaire consisted of four choices that were (1) disagree, (2) not agree, (3) quite agree, and (4) agree. Evaluation of every aspect of the product developed using a Likert scale, where the product can be said to be feasible if the average of each minimum assessment gets a feasible criteria using calculations according to [18] the percentage sought is obtained from the maximum score obtained divided by the maximum score multiplied by 100 %. The categorization of media eligibility is divided into 5 categories such as Table 4.

| Scale | Category   | Percentage  |
|-------|------------|-------------|
| 5     | Very feasible | >80% - 100% |
| 4     | Feasible    | >60% - 80%  |
| 3     | Decent      | >40% - 60%  |
| 2     | Not feasible| >20% - 40%  |
| 1     | Very unfeasible | 0% - 20%     |

3. Results and discussion

3.1. Results
The define phase analysis with curriculum review from the Geomatics Practicum course. This is done so that the product produced in the development of video animation media research uses a total station to measure the exit curve not to deviate from the learning objectives. The syllabus analysis process is used as a guide to determine the basic competencies used in instructional media products in the form of video animations using total stations to measure stakes out of the developed road curves.

The next step is an interview with the lecturer to get various data related to the learning media developed. Based on curriculum analysis and material analysis that has been done, basic competency is determined because research is determined as the basic competency of the stake out of the road curve. Based on the specifications of interactive media requirements for the use of total stations to measure the exit points of the developed road curves, the learning media model consists of 5 contents namely material, simulation videos, K3, work steps, and profiles.
Based on the results of the developed learning media model, a device is needed to develop interactive learning media consisting of Adobe Premiere Pro CC 2017, Adobe After Effects, Photoshop CS6, Blender, Corel Draw 2018, Lumion, Premiere Pro CC, Autocad 2014, iSpring Suite 8. The design phase is the design phase of video animation-based learning media that includes material design, display design, making flowcharts, and making the overall design. The design phase of the material used is horizontal curvilinear stakeout using the polar methods shown in Figures 4 to 7.

![Figure 4. Human character](image1)
![Figure 5. Display of creating job](image2)
![Figure 6. Display of angle menu at point C](image3)
![Figure 7. Animation of road curvature](image4)

The development phase is making interactive learning media that designed using Adobe Flash CS6 and iSpring Suite 8. All components arranged into one media unit in accordance with the storyboard and flowchart that designed. The material for stake out of the road curve uses total station, images, animated videos, simulations, backgrounds, buttons, and audio that are loaded in interactive media by importing from Ms. Power Point to iSpring Suite 8 software. Applications produced by this software have extensions that are part of the Adobe Flash software. Interactive learning media is stored in the format of flash (.swf) the goal can run without adobe flash software or can integrated with other software. The results of the development of interactive media shown in Figures 8 to 11.

![Figure 8. Title page](image5)
![Figure 9. Display of content coverage](image6)
Validation of material experts aims to determine the feasibility of the material contained in the media learning animation videos from aspects of learning objectives, aspects of material presentation, motivating quality aspects. The assessment of media development uses a questionnaire with a scale of 1-4 and amounts to 20 items shown in Table 5.

### Table 5. The results of validation by material experts

| No | Aspect                      | ∑Score | ∑Score Max | Percentage (%) | Eligibility Level |
|----|-----------------------------|--------|------------|----------------|------------------|
| 1  | Learning Objectives         | 17     | 20         | 85,000         | Very feasible    |
| 2  | Presentation of Material    | 38     | 44         | 86,364         | Very feasible    |
| 3  | Motivating Quality          | 12     | 16         | 75,000         | Feasible         |
|    | Average                     | 22,333 | 26,667     | 82,121         | Very feasible    |

The results of the assessment on the animation video learning media using the total station for measuring stake out road curve conducted by a material expert shown in the table above with a percentage of 82.121%. Assessment based on aspects of learning objectives, presentation of material and motivating quality shows that the animated video media using total station for measuring stake out road curve is "very feasible". The diagrams presented in Figures 12 and 13.

### Figure 12. Material expert eligibility

### Figure 13. Percentage of material expert

Validation/assessment of media experts aims to determine the feasibility of media covering aspects of objectives, visual aspects, audiences and aspects of use. The assessment of media development uses a questionnaire with a scale of 1-4 and amounts to 34 items shown in Table 6.
Table 6. The results of validation by media experts

| No | Aspect            | ∑Score | ∑Score Max | Percentage (%) | Eligibility Level |
|----|-------------------|--------|------------|----------------|-------------------|
| 1  | Purpose           | 20     | 20         | 100,0          | Very feasible     |
| 2  | Visual            | 26     | 32         | 81,25          | Very feasible     |
| 3  | Audio             | 20     | 20         | 100,0          | Very feasible     |
| 4  | Usage             | 19     | 20         | 95,00          | Very feasible     |
| 5  | Benefit           | 19     | 20         | 95,00          | Very feasible     |
| 6  | Design Interface  | 25     | 28         | 89,28          | Very feasible     |
|    | Average           | 21,5   | 23,3       | 93,42          | Very feasible     |

The results of the assessment on the video animation learning media using total station for measuring stake out road curve conducted by a media expert shown in the table above with the percentage yield of 93.442%. Assessment based on aspects of software engineering, learning design and visual communication shows that animated video media using total station for measuring stake out road curve is "very feasible". The diagrams presented in Figures 14 and 15.

Figure 14. Media expert eligibility

Figure 15. Percentage of media expert

The feasibility test for students aims to determine the feasibility of the media that includes material aspects, aspects of benefits, uses, and appropriateness of media, visuals, and audio. The feasibility test is the assessment stage on the actual target, which is 30 students, Department of Civil Engineering and Planning Education, Yogyakarta State University. The assessment done by showing the media to students and then filling in a questionnaire totalling 32 items shown in Table 7.

Table 7. The results of validation by students

| No | Aspect     | ∑Score | ∑Score Max | Percentage (%) | Eligibility Level |
|----|------------|--------|------------|----------------|-------------------|
| 1  | Material   | 869    | 960        | 90,52          | Very feasible     |
| 2  | Benefit    | 536    | 600        | 89,33          | Very feasible     |
| 3  | Usage      | 535    | 600        | 89,16          | Very feasible     |
| 4  | Media      | 207    | 240        | 86,25          | Very feasible     |
| 5  | Visual     | 748    | 840        | 89,04          | Very feasible     |
| 6  | Audio      | 507    | 600        | 84,50          | Very feasible     |
|    | Average    | 567    | 640        | 88,13          | Very feasible     |
Results of the feasibility test assessment in the table above, the development of instructional video media obtained a percentage of 88.136% based on the material aspects, benefits, uses, appropriateness of media, visuals and audio. Based on the results of the assessment of the feasibility test conducted on students, the video media developed "very feasible". The diagrams presented in Figures 16 and 17.

Dissemination stage is the stage where learning videos that validated by experts and students will be disseminated to a wider subject. Dissemination done by uploading learning videos into the YouTube channel. Interational learning media with the format (swf) on google drive.

3.2. Discussion
The purpose of this development is to determine the process and results of the development of instructional media based on video animation using a total station in the Geomatics Practicum course. The results of this study are the development of interactive media based on the validation of expert material obtained in the "very feasible" category with a percentage of 82.121%, while validation by the media expert obtained the "very feasible" category with a percentage of 93.444%. Eligibility tests by students in the "very feasible" category with a percentage of 88.136%. The results of research on the development of video animation-based learning videos on subjects of geomatics practicum for civil engineering majors are in line with research conducted by [12] with the results of the feasibility of developing video lessons in the perception of material experts, namely 3.62 in the very feasible category, media experts with a score of 3.44 in the very feasible category, while students with the acquisition of a value of 3.14 in the feasible category. Furthermore, [19] with the results in the feasibility of developing video in the perception of material experts and media experts, namely 3.64 in the very feasible category, while students received a value of 3.24 in a very feasible category. Based on the results of research that has been done previously by several other researchers regarding the development of learning videos for the subjects of Geomatics Practice, the development of videos in this study can be categorized as very feasible and can be implemented in the learning process in practical subjects in the civil engineering department. It is made clear by research [20] that the development of media developed can be applied in the learning process.

Then the results of the developed video are uploaded to the YouTube channel with the title of an animated video that studies the total stations used to measure the exit curve at stake. Interactive learning media format (SWF) with the Adobe Flash application downloaded on Google Drive and also in the form of DVD pieces given to lecturers in Civil Engineering Education for the learning process. The development of interactive learning media based on video animation using a total station to measure the stake out of the road curve is expected to be used later in other learning processes. Development must continue to the effective stage of learning media to find out the increase in student learning outcomes so that the benefits of interactive learning media can be more real. Making interactive media based on
video animation using a total station to measure road curve betting is expected not only for road material pegs, but can be developed not only by the polar method used in data collection but the method of arc differences, elongations, and other civilian devices. technical measures such as detailed maps, tillers, dam piles and bridges, polygon measurements. Interactive learning media can be further developed by combining video with the application used. The aim is that each step in each subject can be separated into sub-choices, where the user can independently choose each of these steps. With this innovation, learning is expected to be unlimited with the duration of material delivery.

4. Conclusion

The purpose of this study, in terms of practicality, so that it can be used by students as a new learning resource in the use of total stations for measuring street stake out. With this video, it can make it easier for students to think so that they can practice using a total station for measuring street stake out instantly and independently. Therefore, that it can increase the achievement of student competencies in the civil engineering department. In addition, presenting learning media that is interesting, creative, innovative, and easy to use for students as well as presenting learning media with a different concept than in general. From a managerial perspective, lecturers as instructors used as alternative tools and media to support classroom learning, in the Geomatics Practicum course. In addition, also expected to improve the maximum quality of teaching by using appropriate learning media so that students can more easily understand the learning material presented.

In addition, students should be able to increase their activeness and creativity in participating in learning activities so that they can improve learning outcomes in geomatics practices. It hoped that it could minimize boredom in conventional learning that causes reduced learning motivation to be interested and easily understand the material in the Geomatics Practicum. Learning media also uploaded on the YouTube channel, it hoped that all stakeholders, both lecturers, teachers, teachers and the public could access learning videos as an alternative reference to gain insight into learning.

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