THE DEVELOPMENT OF “MANUFACTURING DRAWING” VIDEO TUTORIALS IN STATE VOCATIONAL HIGH SCHOOL SMKN 2 PENGASIH

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Abstract. This research aims to develop and examine the feasibility level of the video tutorials for the Manufacturing Drawing subject in state vocational high school SMKN 2 Pengasih using the Inventor 2013 software. This research employs the research and development (R&D) model. The product assessment or validation was done by experts in the subject and the media, followed by an initial and final testing by the research participants. The obtained data are analyzed using the descriptive analysis technique. The product of the research is a set of MP4 video tutorials with 1280 x 720 format, not-too-long duration, texts, voice narration, and music accompaniment, which are put together in a PowerPoint program. The mean scores of the product in the subject materials assessment, media assessment, initial testing, and final testing are 3.30, 3.55, 3.37, and 3.18, respectively. The total mean score of the product (3.35) is classified as Very Good, which means that the video tutorials are feasible for use.

1. Introduction
Education is one of the foundations that a country must have in order to develop and not constantly rely on other countries. It is a conscious and planned attempt at realizing a learning condition and learning process in such a way that students feel encouraged to actively develop their own potentials and have a spiritual strength, self-control, personality, intellect, virtues, as well as the skills that the society, the country, and themselves need (Act No. 20 Year 2003). Education also plays a role as the benchmark on the development of a nation.

Article 15 of Act No. 20 Year 2003 on national education points out the role of vocational high school in preparing competent, work-ready and productive human resources. Machining Engineering is one of the study programs in vocational high school that provide a significant number of workforce for the industry, as it provides relevant knowledge and skills for the students. The graduates of Machining Engineering are expected to work and operate the machines and apply their skills immediately in the industry. The study involves basic knowledge on machining engineering in order to give students more comprehensive concepts on the subject, especially on the technical production drawing.

Manufacturing drawing requires the use of computer software, such as Creo Parametric, Pro|ENGINEER, SolidWorks, Inventor, etc. The variety of the software means that they have different
features, weaknesses, and strengths depending on the type of industry that uses them. Industries may use a particular type of drawing software that is different from one another, depending on the company’s internal policy.

In vocational high schools, manufacturing drawing classes generally use the Autodest software, as it has many features and is often used in the industry, as well. The subject of the study, state vocational senior high school SMKN 2 Pengasih, utilizes the Autodesk Inventor 2013 software in the Manufacturing Drawing learning. The software is considered to be sufficient as the basic equipment in assisting the students in the Manufacturing Drawing learning process.

One of the most frequent problems the students face is the difficulty in absorbing or receiving the information from the instructor. They tend to forget easily or simply do not understand the given explanation. Typically, the instructor uses the PowerPoint program to deliver the learning materials and only does it once in each class or meeting. As a result, the students only have one chance to understand the learning materials, which could be challenging for them to do, especially when they have to recall all the subject materials. For this reason, the learning process requires an accessible media for students so that they can learn independently, solve their problems or deal with their learning difficulties on their own.

Yudhi Munadi (2013:7) defines learning media as all means used to convey and deliver an information or message from a source accordingly in order to create a conducive learning experience where learners can conduct the learning process efficiently and effectively. On the video format, Azhar Arsyad (2011:49) states that it works by showing moving pictures or objects with its accompanied sound.

Video tutorial is one of the most appropriate media for the Manufacturing Drawing subject as it presents the real practice of the learning. It is also flexible for use, as well as accessible for anyone. One of its advantages is that it can be played over and over again when needed.

Amorro Nur Radian (2015) developed an Inventor-based learning module with supplementary video tutorials for Grade 12 students of Machining Engineering study program in state vocational high school SMKN 2 Yogyakarta. His study concludes that the media is highly feasible for use based on the product assessment, which involves subject materials expert validation, media expert validation, limited testing, and comprehensibility testing.

Meanwhile, Karim Hidayat Sholihin (2011) developed a PowerPoint-based learning media on the Lathe Techniques subject at the state vocational high school SMKN 2 Pengasih. The findings suggest that the media is effective in improving the students’ learning achievements.

Similarly, Imam Mustoliq, et al. (2007) developed a multimedia-based interactive learning media on the Basics of Electricity course. The product is proven to have a good performance, as suggested by the mean score (3.18 or 79.71% percentage) resulted from various assessments by media experts, subject materials experts, and the students.

A study by Metty Muhariati, et al. (2017) on developing a video for sweet bread production shows that the video is evidently effective for use in the learning process. The effectiveness was indicated by the score increase of students in the treatment group who received 46.5 in the pretest and scored 79 in the posttest.

This study aims to develop and examine the feasibility of video tutorials as the learning media for the Manufacturing Drawing subject at SMKN 2 Pengasih.
2. Method

2.1 Research Type
This study employed the research and development method.

2.2 Research Setting and Duration
The research was conducted in SMKN 2 Pengasih from October 2, 2017 to November 30, 2017.

2.3 Research Subject
The research subject consists of Yogyakarta State University lecturers as the subject materials and media experts, the SMKN 2 Pengasih teachers as the subject materials experts, as well as the SMKN 2 Pengasih students of Class XI TP1 and XI TP 2 as the participants in the field testing.

2.4 Procedure
The research procedure was conducted according to a development model by Dick & Carey (1996: 2-3), which consists of 1) Assessing Needs to Identify Goal; 2) Conducting Instructional Analysis in order to determine what skills or knowledge should be included in the learning; 3) Analyzing Learners and Contexts; 4) Writing Performance Objectives; 5) Developing Assessment Instruments; 6) Developing Instructional Strategy; 7) Developing and Selecting Instruction Materials, which in this case are the video tutorials; 8) Designing and Conducting Formative Evaluation of Instruction, in which the product is assessed by the experts, and by the research participants in the initial and final testing; 9) Revising Instruction; and 10) Designing and Conducting Summative Evaluation, in order to examine the feasibility level of the product.

2.5 Data, Instruments, and Data Collection Technique
The data were obtained through a survey on the feasibility of the product consisting of question items with a four-point scale (Very Good, Good, Poor, and Very Poor). The survey participants were asked to tick (√) one of the available answers.

The survey for the subject materials experts consisted of 20 items on the three aspects of assessment, namely the learning materials quality, the use of language, and the quality of the assessment items. On the other hand, the survey for the media experts contained 22 items on the quality of the media, use of language, and the layout of the media. For the initial and final testing, the survey consisted of 20 items on the intelligibility and comprehensibility aspects.

The first stage in the data collection was the assessment from subject materials and media experts. Revision was conducted prior to data collection based on the experts’ suggestion and recommendation. Next, the product was presented to the experts where they would fill out the assessment forms. Afterwards, field testing was conducted in two parts, namely the initial and final testing. The participants of the initial testing were 16 students of Class XI TP 1, while the final testing involved 14 students of the Class XI TP 2 of SMKN 2 Pengasih.

2.6 Data Analysis Technique
Once the data were obtained, they were analyzed using the descriptive analysis method in order to depict the findings from the previous research and examine the feasibility of the product. The classification levels of the feasibility were based on the formula by Widoyoko (2012:110). The interval range for each classification level was calculated using equation 1.

Interval range=(the highest score–the lowest score)/(the total number of interval points)........(1)

There were four interval points, namely Very Good, Good, Poor, and Very Poor, with highest score of 4 (Very Good), and the lowest of 1 (Very Poor). The interval range was found to be 0.75. The classification levels of the product can be seen in the Table 1 below.
Table 1. Product Classification Level

| No. | Mean Score       | Product Classification Level |
|-----|------------------|-----------------------------|
| 1   | >3.25 to 4.00    | Very Good                   |
| 2   | >2.50 to 3.25    | Good                        |
| 3   | >1.75 to 2.50    | Poor                        |
| 4   | 1.00 to 1.75     | Very Poor                   |

Next, the mean score was determined using equation 2.

\[
\text{Mean score} = \frac{\text{Total participants}}{(\text{Participants} \times \text{Instrument items})} \ldots \ldots (2)
\]

The results of the mean score calculation were then compared with the classification levels in Table 1 in order to learn the product classification level. The product was deemed feasible if its classification level was either Good or Very Good.

3. Results And Discussion

The results of the survey from the research participants consisting of the subject materials experts, the media experts, and the students, are presented in this section. The first reported survey is by the subject materials experts, namely a Yogyakarta State University lecturer and the subject teachers at SMK N 2 Pengasih. The findings can be seen in Table 2, 3 and 4.

Table 2. Subject Materials Expert Assessment on the Subject Materials Quality

| No  | Description                                                                 | Score |
|-----|-----------------------------------------------------------------------------|-------|
| 1   | The materials are in accordance with the learning objectives                 | 3.5   |
| 2   | The depth of the materials are in accordance with the students’ needs       | 3     |
| 3   | The difficulty level of the materials is in accordance with the students’  | 3     |
|     | competencies                                                               |       |
| 4   | The materials are clearly explained                                         | 4     |
| 5   | The materials are explained in an appropriate order                         | 4     |
| 6   | The materials improve students’ understanding on the subject                | 3.5   |
| 7   | The materials do not inconvenience the students                             | 4     |
| 8   | The materials quality is suitable for learning                              | 3.5   |
| 9   | The materials improve the students’ learning interests                      | 3     |
| 10  | The objects in the video are clear to see                                   | 4     |
| 11  | The objects in the video do not confuse the students                         | 3     |

Mean score 3.50

Table 3. Subject Materials Expert Assessment on the Use of Language

| No  | Description                                         | Score |
|-----|-----------------------------------------------------|-------|
| 1   | The use of language is easy to understand            | 3     |
| 2   | The use of language is comprehensible                | 3     |
| 3   | The sentences in the texts do not confuse the students| 3     |
| 4   | The voice narration is clear and comprehensible      | 3     |
**Mean score**

3.00

**Table 4. Subject Materials Expert Assessment on the Exercise**

| No. | Description                                                                 | Score |
|-----|------------------------------------------------------------------------------|-------|
| 1.  | The exercise is in accordance with the learning objectives                    | 3     |
| 2.  | The materials in the exercise are in accordance with those in the video tutorials | 3.5   |
| 3.  | The exercise requires students to learn for the exercise                      | 3     |
| 4.  | The exercise is reliable in measuring the students’ competencies             | 3     |
| 5.  | All of the assessment aspects in the exercise are in accordance with the learning objectives | 3     |

**Mean score**

3.10

The data of the subject materials assessment are converted into a bar chart which is consulted with the classification levels in Table 1, as presented in Figure 1 below.

![Bar chart showing mean scores](image)

**Figure 1. The Result of the Subject Materials Expert Validation**

The mean score and classification levels from can be seen in Table 5, as follows.

**Table 5. The Analysis of Subject Materials Expert Assessment**

| No. | Criteria                     | Score | Classification Level |
|-----|------------------------------|-------|----------------------|
| 1.  | Quality of Materials         | 3.50  | Very Good            |
| 2.  | Use of Language              | 3.00  | Good                 |
| 3.  | Quality of the Exercise      | 3.10  | Good                 |
|     | **Mean total score**         | 3.30  | **Very Good**        |

The data suggest that the mean total score (3.30) is Very Good. The next survey is for the media expert validation by the Yogyakarta State University lecturers. The results can be seen in Table 6, 7, and 8.

**Table 6. Media Expert Assessment on the Media Quality**

| No. | Description                | Score |
|-----|----------------------------|-------|
| 1.  | The video is enjoyable to look at | 4     |
| 2.  | The video is clear to see   | 4     |
3. The movement of the cursor is clear to see  
4. The sound in the video is clear to hear  
5. The voice narration is in accordance with the content of the video  
6. The duration of the video is in accordance with the materials  
7. The duration of the video is in suitable for students  
8. The narration texts are clear and easy  
9. The narration texts are in accordance with the steps in the video  
10. The steps in the video are easy to understand  
11. The steps in the video are in accordance with the learning materials  
12. The video format can be played in various application programs  

| No | Description | Score |
|----|-------------|-------|
| 1  | The use of language is easy to understand | 3     |
| 2  | The sentences in the texts do not confuse students | 3     |
| 3  | The voice narration is clear and comprehensible | 3     |
| 4  | The language structure does not inconvenience students | 4     |

**Mean score** 3.58

**Table 7. Media Expert Assessment on the Use of Language**

| No | Description | Score |
|----|-------------|-------|
| 1  | The font size of the narration texts is appropriate | 4     |
| 2  | The font color of the narration text is clear to see | 4     |
| 3  | The font size of the narration text is easy to read | 4     |
| 4  | The narration text layout does not disrupt the video | 3     |
| 5  | The video improves students’ concentration in understanding the materials | 4     |
| 6  | The movement of the cursor is appropriate | 3     |

**Mean score** 3.25

**Table 8. Media Expert Assessment on the Appearance of the Media**

The data are then converted into a bar chart (Figure 2) so that it is easy to understand.

![Bar Chart](image)

**Figure 2. Media Expert Validation**

The mean total score of the media expert validation is then consulted with Table 1. The result can be seen in Table 9, as follows.
Table 9. The Analysis of Media Expert Assessment

| No. | Criteria             | Score | Classification Level |
|-----|----------------------|-------|----------------------|
| 1.  | Quality of Media     | 3.58  | Very Good            |
| 2.  | Use of Language      | 3.25  | Good                 |
| 3.  | Appearance           | 3.67  | Very Good            |

**Mean total score** 3.55 Very Good

The data reveal that the mean total score of 3.55 is classified as Very Good, which means that the product is feasible for further assessment. Next, the data on the initial assessment involving 16 students of Class XI TP 1 are presented in Table 10 and 11.

Table 10. Initial Testing of Intelligibility

| No. | Description                                             | Score |
|-----|---------------------------------------------------------|-------|
| 1.  | The materials in the video are clearly explained       | 3.6   |
| 2.  | The steps in the video are clearly explained           | 3.4   |
| 3.  | The materials are in accordance with the learning objectives | 3.6   |
| 4.  | The materials are explained in an appropriate order    | 3.5   |
| 5.  | The depth of the materials are in accordance with the students’ needs | 3.6   |
| 6.  | The language use is easy to understand                 | 3.3   |
| 7.  | The sound is clear                                    | 3.0   |

Table 10. Initial Testing of Intelligibility (Cont’d)

| No. | Description                                             | Score |
|-----|---------------------------------------------------------|-------|
| 8.  | The narration texts do not disrupt the video            | 3.3   |
| 9.  | The font size is appropriate                            | 3.6   |
| 10. | The font type is appropriate                            | 3.3   |
| 11. | The objects in the video are clear to see               | 3.4   |
| 12. | The movement of the cursor is clear to see              | 3.4   |

**Mean score** 3.41

Table 11. Initial Testing of Comprehensibility

| No. | Description                                             | Score |
|-----|---------------------------------------------------------|-------|
| 1.  | The information provided improves the students’ learning interest | 3.4   |
| 2.  | The video is enjoyable for studying                    | 3.3   |
| 3.  | The video helps students to understand the materials easily | 3.5   |
| 4.  | The video appearance is easy to understand             | 3.5   |
| 5.  | The video duration is in accordance with the students’ needs | 3.2   |
| 6.  | The video duration for each material is adequate       | 3.3   |
| 7.  | The video format can be played through various application programs | 3.0   |
| 8.  | The video is easy to manage                            | 3.3   |

**Mean score** 3.30

The data from Table 10 and 11 are then converted into a bar chart in order to present all the mean scores of each aspect, as seen in Figure 3 below.
The data from the initial testing is analyzed based on the classification in Table 1. The result can be seen in Table 12, as follows.

**Table 12. The Analysis of the Initial Testing**

| No | Criteria           | Score | Classification Level |
|----|--------------------|-------|----------------------|
| 1  | Intelligibility    | 3.41  | Very Good            |
| 2  | Comprehensibility  | 3.30  | Very Good            |
|    | **Mean total score** | **3.37** | **Very Good**        |

The mean total score of 3.37 is classified as Very Good. This means that the product is feasible for use in the learning process. However, there are several items with low scores in the survey, namely item 7 and 19, which is caused by the unclear sound of the video. This is due to the use of inappropriate equipment in the sound recording. The recording uses a mobile phone device which cannot filter sound appropriately. Another possible factor is the location of the recording, which is in the researcher’s and a colleague’s personal residences. The room in these personal residences are not able to keep other unnecessary sounds away like a recording studio can.

The next testing involves 14 students of Class XI TP 2. The final testing is similar to the initial testing, except that the product has been improved based on the expert assessments. Revision is also done before the initial testing. The result of the final testing can be seen in Table 13 and 14, below.

**Table 13. Final Testing of Intelligibility**

| No | Description                                                      | Score |
|----|------------------------------------------------------------------|-------|
| 1  | The materials in the video are clearly explained                 | 3.4   |
| 2  | The steps in the video are clearly explained                     | 3.3   |
| 3  | The materials are in accordance with the learning objectives     | 3.6   |
| 4  | The materials are explained in an appropriate order             | 3.1   |
| 5  | The depth of the materials are in accordance with the students’ needs | 3.3   |
| 6  | The language use is easy to understand                          | 3.1   |
| 7  | The sound in the video is clear                                 | 3.1   |
| 8  | The narration texts do not disrupt the video                    | 3.1   |
| 9  | The font size is appropriate                                   | 3.2   |
| 10 | The font type is appropriate                                   | 3.1   |
| 11 | The objects in the video are clear to see                       | 3.2   |
| 12 | The movement of the cursor is clear to see                      | 2.9   |
Table 14. Final Testing of Comprehensibility

| No. | Description                                                                 | Score |
|-----|-----------------------------------------------------------------------------|-------|
| 1.  | The information provided improves the students’ learning interest           | 3.2   |
| 2.  | The video is enjoyable for studying                                         | 3.2   |
| 3.  | The video helps students to understand the materials easily                  | 3.1   |
| 4.  | The video appearance is easy to understand                                  | 3.1   |
| 5.  | The video duration is in accordance with the students’ needs                | 3.3   |
| 6.  | The video duration for each material is adequate                            | 3.0   |
| 7.  | The video format can be played through various application programs         | 3.1   |
| 8.  | The video is easy to manage                                                 | 3.2   |

Mean score 3.15

The data in the table are then transformed in the bar chart so that they are more comprehensible and easy to read. The bar chart of the final testing is presented in Figure 4, as follows.

![Bar chart showing scores](image)

Figure 4. The Result of Final Testing

All the obtained data are then grouped into the classification table in order to measure the product’s feasibility level in the two aspects, as well as that of the final product itself. The classification table for the final testing can be seen in Table 15 below.

Table 15. The Analysis of Final Testing

| No. | Criteria          | Score | Classification Level |
|-----|-------------------|-------|----------------------|
| 1.  | Intelligibility   | 3.20  | Good                 |
| 2.  | Comprehensibility | 3.15  | Good                 |

Mean total score 3.18

The result of the final testing in Table 14 suggests that compared to the previous testing, there is a decrease in the score, especially in item 12 on the movement of mouse cursor which receive 3.4 in the initial testing and only receive 2.9 in the final one. On the other hand, item 7 has a 0.1 increase. Thus, despite the decrease, the increase of the score also needs to be taken into account. The product is deemed feasible for use as it is classified as Good, which is the minimum feasibility level, with the mean score of 3.18.
4. Conclusions

4.1 Conclusions
This study is conducted in order to develop video tutorials as learning media for the Manufacturing Drawing subject, and to examine the feasibility of the media. As a product of the research, the format of the video tutorials is MP4, with 1280 x 720 frame size, a not-too-long duration, texts, voice narration, and music accompaniment. The video tutorials are then put together in a PowerPoint program. Students may access the video through a PowerPoint file which consists of various learning materials of the Manufacturing Drawing subject.

Both the mean scores of the media assessment by the subject materials experts (3.30) and media experts (3.55) can be classified as Very Good. On the other hand, the mean score in the initial testing (3.37) is classified as Very Good, while the final testing results in a Good classification level with 3.18. The overall classification levels of all the assessments and testing of the product can be seen in Table 16, as follows.

Table 16. The Result of Product Assessment and Testing

| No. | Assessment and Testing          | Score | Classification Level |
|-----|---------------------------------|-------|----------------------|
| 1.  | Subject Materials Expert Assessment | 3.30  | Very Good            |
| 2.  | Media Expert Assessment         | 3.55  | Very Good            |
| 3.  | Initial Testing                 | 3.37  | Very Good            |
| 4.  | Final Testing                   | 3.18  | Good                 |
|     | Total mean score                | 3.35  | Very Good            |

All of the mean scores from each assessment and testing result in the final total mean score of 3.35, which is classified as Very Good. Thus, the video tutorial learning media developed in this study is feasible for use.

4.2 Suggestions
The product of video tutorial in the study is a basic/preliminary development. The video file has quite a large size, and is limited in the feasibility level. It is expected that in the future, there will be a more developed model such as the 3D Complex and Assembly with a smaller size. In addition, it is recommended that future studies conduct a more insightful research on the impacts of the video.

For the development of similar type of video, this study suggests that the recording be done in a recording studio with more suitable equipment in order to produce a clear sound with no noise.

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