Innovation Media Learning: Online Project-Based Learning (O-PBL) on Drawing Competence in Automotive Engineering
Using Video on YouTube

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Abstract. This study aims to develop and analysis the feasibility of a video-assisted project-based learning model on YouTube in automotive engineering drawing subjects. Research development using ADDIE design which is simplified into 4 steps. The developed model was validated by material experts, media and learning practitioners as well as user perception tests. Data were collected through a questionnaire with a product feasibility questionnaire and a perception questionnaire using 5 Likert scales. The results of developing a project-based learning model assisted by YouTube videos contain planning procedures, syntax implementation, and assessment mechanisms that are packaged in a learning model guide book. The results of the validation test obtained a very high level of feasibility, both from material experts, media experts and learning practitioners. Likewise, the student response test showed a very good response to the developed model. The video-assisted project-based learning model on YouTube in automotive engineering drawing subjects is very feasible to be applied in learning.

1. Introduction
The essence of vocational education is to provide work competencies to students through their learning [1], [2]. Entering the 21st century, vocational learning must be transformed to suit the needs of competence in today’s world of work [3], [4]. Improving creativity skills, critical thinking and problem solving are some of the focuses of current vocational learning. Various efforts have been made to improve these skills, such as the development of models, media and learning resources that are continuously being carried out. Project-based learning is one of the appropriate learning models to be used in current vocational learning. Project-based learning models have a positive influence in shaping
and improving students’ 21st century skills [5]–[7]. Through results-oriented learning products will foster critical thinking skills, creative and problem solving. However, in its implementation, subject competencies need to be adjusted to the concept of the model.

Automotive engineering drawing is one of the vocational education subjects that can apply a project-based learning model. The output of student learning outcomes in the form of image products is the basic reason for implementing this learning [8]. Nevertheless, the complexity of learning automotive engineering drawings is a serious obstacle in achieving learning competencies. The procedure for drawing 2D and 3D objects with various projection models is a competency that must be mastered by students [9], [10]. In addition, the cleanliness of the image, the level of precision, the clarity of various symbols and drawing lines are important aspects in the assessment. The complexity of automotive engineering drawing learning competencies becomes a separate difficulty for students in learning it. Various efforts made to overcome these problems have not been optimal. In addition, the low learning motivation of students also affects students’ learning difficulties, so that the quality of the results of student drawing projects is still low [11], [12].

Students’ learning difficulties in learning automotive engineering drawings are increasing due to the COVID-19 pandemic conditions [13]. Face-to-face learning is transformed into online learning using the internet [14]. Researchers conducted observations and interviews with teachers and students in 6 vocational high schools. Productive teachers expressed difficulties in teaching and facilitating students during learning, especially when practicing drawing [15]. Teachers find it difficult to determine media and learning resources that can support project-based learning easily and practically [16]. Meanwhile, students complained about the lack of knowledge and literacy to carry out effective online learning to achieve learning competencies. Thus, effective learning media innovations are needed that can overcome project-based learning problems during the covid19 pandemic.

Project-based learning in automotive engineering drawing subjects can be done online using media assistance in the form of video tutorials on YouTube. YouTube is one of the social media platforms that provides video resource services, including practical learning videos [17]. The ease and practicality of access are the advantages of the YouTube platform as a media to support project-based learning [18]. Videos on YouTube can be accessed anywhere and anytime by students. The need for smartphone ownership is the basic reason for making it easier for students to learn effectively and efficiently [19]. The teacher will act as a facilitator and direct learning resources on YouTube that are relevant and in the context of learning automotive engineering drawings. Meanwhile, students through YouTube will learn independently to make automotive engineering drawing projects according to the instructions and achievement of learning competencies.

Based on the description above, this research will focus on developing a project-based learning model in automotive body learning which is carried out online with the help of video media on YouTube. The research will be conducted in 6 vocational high schools in Sleman-Indonesia. The research questions are: (1) How is the process of developing project-based learning models in automotive body learning assisted by video media on YouTube? and (2) How is the feasibility of a project-based learning model in automotive body learning assisted by video media on YouTube?

2. Methodology

This research is a research and development that adopts the ADDIE model developed by Walter Dick [20]. This development model consists of five simplified stages without the fifth stage, namely evaluation. In the first stage (analyzing), the researcher analyzes the development needs from the perspective of students and teachers. Then the second stage (design), the design of a project-based learning model assisted by video learning media on YouTube is carried out. The video media used include video tutorials and animated videos related to technical drawing procedure tutorials and image construction animations from various types of views. Simulation of animated videos and tutorial videos using the YouTube platform, then modified according to learning needs. At this stage the expert validates the content and media to determine the feasibility before being tested on users. After that, in the third step (development), the product starts to be developed to completion. After the product is ready,
then proceed with the implementation of project-based learning assisted by video media on YouTube to get student feedback about the product being developed.

The trial design consisted of a product feasibility test involving material and media experts, and a perception test and students. The trial respondents involved 8 university lecturers, 120 students of class X and 16 teachers who were divided into 4 vocational schools in Sleman regency. The distribution of test subjects is shown in table 1 below.

Data collection was carried out using a questionnaire technique to determine development needs, and validation techniques to determine feasibility based on expert and user assessments. The data collection instrument used a 5 Likert scale questionnaire and an expert validation sheet consisting of a material expert validation sheet, media expert, learning practitioner expert and user. The grid of validation instruments for material experts, media experts and users is shown in table 2 below.

| Table 1. Distribution of test Respondents |
|----------------------------------------|
| No | Characteristics | Sum (n) | Percentage (%) |
|----|-----------------|---------|----------------|
| 1 | Expert Validation Respondents University lecturer |         |                 |
|   | 1.1. Expert of material | 4       | 2.94            |
|   | 1.2. Expert of media | 4       | 2.94            |
| 2 | Expert of practitioner Public school teachers and Private school teachers |         |                 |
|   | 2.1. SMK N 1 Ngaglik | 4       | 2.21            |
|   | 2.2. SMK N 1 Seyegan | 4       | 2.21            |
|   | 2.3. SMK Maarif 1 Sleman | 4 | 2.21 |
|   | 2.4. SMK Muhammadiyah Prambanan | 4 | 2.21 |
| 3 | User Public school students and Private school students |         |                 |
|   | 3.1. SMK N 1 Ngaglik | 30      | 22.06           |
|   | 3.2. SMKN 2 Depok | 38      | 27.94           |
|   | 3.3. SMK Maarif 1 Sleman | 25 | 18.38 |
|   | 3.4. SMK Muhammadiyah Prambanan | 27 | 19.85 |
|    | Total | 144     | 100             |

| Table 2. Instrument validation based on characteristics and aspects |
|-------------------------------------------------------------------|
| Characteristics | Aspects                  | Item (n) | Distribution |
|-----------------|--------------------------|----------|--------------|
| Need assessment | Use of learning media    | 4        | 1 – 4        |
|                 | Use of learning model    | 4        | 5 – 8        |
|                 | Student learning outcomes| 4        | 9 – 12       |
|                 | Development support      | 4        | 13 – 16      |
| Expert of Material| Suitability of the material| 9 | 1 – 9 |
|                  | Syntax suitability       | 5        | 10 – 16      |
|                  | Language and format      | 5        | 17 – 21      |
| Expert of Media and Practitioner | Video output | 4 | 1 – 4 |
|                  | Consistency              | 3        | 5 – 7        |
|                  | Context suitability      | 8        | 8 – 15       |
|                  | Ease of use              | 3        | 16 – 18      |
| User/Student     | Video output             | 4        | 1 – 4        |
|                  | Consistency              | 3        | 5 – 7        |
|                  | Ease of use              | 3        | 8 – 10       |
|                  | Language suitability     | 2        | 11 – 12      |
Data analysis techniques are carried out in determining categories at the stage of needs analysis, and validation of experts and users. The categories in the needs analysis include five categories, namely VN "very need"; N "needs"; FN "fairly need"; NN "not need"; and VNN "very not need". Meanwhile, the categories at the validation stage are divided into five categories, namely VF "very feasible"; F "feasible"; FF "fairly feasible"; NF "not feasible", and VNF "very not feasible". The number of respondents determines decision making, the rating scale chosen, and the question items for each fixed variable. The data were analyzed descriptively using a quantitative approach based on the formula shown in table 3 below.

### Table 3. Interval Score of Feasibility

| Interval Score | Category | Validation/Respon |
|----------------|----------|-------------------|
| \( M > M_i + 1.5 S_d_i \) | Very Need | Very Feasible/ Very Good |
| \( M_i + 0.5 S_d_i \leq M \leq M_i + 1.5 S_d_i \) | Need | Feasible/Good |
| \( M_i - 0.5 S_d_i < M \leq M_i + 0 S_d_i \) | Fairly Need | Fairly Feasible/Fairly Good |
| \( M_i - 1.5 S_d_i < M \leq M_i + (-0.5) S_d_i \) | Not Need | Not Feasible/ Not Good |
| \( M \leq M_i - 1.5 S_d_i \) | Very Not Need | Very Not Feasible/Very Not Good |

Source: Mardapi (2012) [21]

### Result and Discussion

#### 3.1. Analysis

The first stage, the researcher conducted a development needs analysis through a questionnaire containing 16 statements with 5 answer options, namely strongly agree, agree, disagree, disagree, and strongly disagree. The contents of the questionnaire consist of model problems and those that have been applied, learning outcomes problems, and support for the development of project-based learning models assisted by YouTube video media. The results of the needs analysis, obtained data from 20 respondents which is shown in table 4 below.

### Table 4. Results of the needs analysis

| Respondent | Mean | Percentage | Median | Mode | Std. Dev | Min | Max |
|------------|------|------------|--------|------|----------|-----|-----|
| Teachers   | 64.92| 82.66%     | 64.50  | 64   | 4,581    | 61  | 76  |
| Students   | 64.50| 81.15%     | 64.00  | 64   | 4,252    | 60  | 76  |

The average value of 64.50 for students is in the "very need" category, so it can be concluded that students need and support the development of project-based learning models assisted by video media on YouTube. Meanwhile, the average score of 64.92 for teachers is in the "very need" category, so it can be concluded that teachers need and support the development of project-based learning models assisted by video media on YouTube.

#### 3.2. Design

The focus on design is to design by integrating videos on YouTube into project-based learning syntax. Researchers explored video sources which included animated videos and automotive engineering drawing tutorial videos. The video that will be used for student learning is adjusted to the material and competencies to be achieved. Video is also adjusted to the quality with minimum criteria of 1280x720 resolution (720p) and 25 fps with a max file of 255MB. After obtaining a draft list of videos that are eligible to be integrated in project-based learning on automotive engineering drawing subjects,

After the draft list of videos is collected, then the preparation of learning guidebooks, learning tools and worksheets is carried out. The manual contains the implementation of the developed model. The integration of the videos in the book in the form of links and images (clickbait) that will be displayed in the learning syntax. The manual is also equipped with procedures and assessment instruments to measure the achievement of learning competencies.

#### 3.3. Development
This development stage is carried out to produce a needs-based learning model to support online-based learning projects. The development process is carried out by focusing on learning syntax that is integrated with video tutorials on YouTube. The syntax in learning automotive engineering drawings developed is adapted to the context. The learning syntax is packaged into a manual to make it easier to implement. The following display cover and table of contents of the developed model manual is shown in Figures 1-4 below.

After the product has been developed, the next step is to conduct a feasibility validation test by asking for an expert assessment. Experts involved include material experts, media experts, and learning practitioners. Material experts and media experts appointed to provide product feasibility assessments are Yogyakarta State University lecturers with academic positions of lector and head lector. Meanwhile, learning practitioners who conduct product feasibility assessments are productive SMK teachers who
have been certified. The following table 5 is a summary of the results of the validation carried out by material experts, media, and learning practitioners.

| Expert   | Aspect                      | Score | Category        |
|----------|-----------------------------|-------|-----------------|
| Material | Suitability of the material | 4.22  | Feasible        |
|          | Syntax suitability          | 4.40  | Very Feasible   |
|          | Language and format         | 4.40  | Very Feasible   |
| Media    | Consistency                 | 4.00  | Feasible        |
|          | Context suitability         | 4.00  | Feasible        |
|          | Ease of use                 | 4.67  | Very Feasible   |
| Practitioner | Video output | 4.67  | Very Feasible   |
|          | Consistency                 | 4.33  | Very Feasible   |
|          | Context suitability         | 4.33  | Very Feasible   |
|          | Ease of use                 | 4.67  | Very Feasible   |

Based on the results of material validation, it can be explained that the value of the suitability of the material to the learning context is in the "appropriate" category. The value of the suitability of the learning steps, language and format is in the "very feasible" category. Then the results of media validation, obtained the feasibility value for video output and ease of use into the "very feasible" category. The feasibility value on the consistency and suitability of the context is included in the "adequate" category. Meanwhile, the assessment carried out by learning practitioners, the results obtained on video output, consistency, context suitability and ease of use are in the very feasible category. Thus, it can be concluded that the feasibility of the developed product is in the "very feasible" category to be used and implemented.

3.4. Implementation

After being declared feasible to be used and implemented, the next step is to implement the product developed in learning. Implementation is done to find out the responses or responses from students related to the product being developed. Implementation is carried out in 2 stages, namely the first stage is carried out on a limited sample and the second stage is carried out on a wider sample. The implementation of the first phase involved 52 students from 2 SMKs. The results of the responses from students in the first stage are shown in table 6 below.

| No  | Aspect          | Score | Category |
|-----|-----------------|-------|----------|
| 1   | Video output    | 4.00  | Good     |
| 2   | Consistency     | 3.67  | Good     |
| 3   | Ease of use     | 4.67  | Very Good|
| 4   | Language suitability| 4.00| Good     |

The results of the user response analysis in the first stage of implementing the developed product were obtained in 4 aspects. Video output, consistency, and language suitability fall into the “good” category. While the aspect of ease of use received an "excellent" rating. Thus, it can be concluded that in the implementation of the first stage, a good response was obtained for the product being developed. After the first stage is completed, then the second stage is implemented with a wider sample. The implementation of the second phase involved 120 students in 4 SMKs. The results of the response test in the implementation of the second stage are presented in table 7 below.
Table 7. Large Scale Assessment Results

| No | Aspect                | Score | Category    |
|----|-----------------------|-------|-------------|
| 1  | Video output          | 4.50  | Very Good   |
| 2  | Consistency           | 4.33  | Very Good   |
| 3  | Ease of use           | 4.67  | Very Good   |
| 4  | Language suitability  | 4.50  | Very Good   |

The results of the user response analysis in the second stage of the implementation of the developed product were obtained in 4 aspects. All aspects including video output, consistency, ease of use and language suitability fall into the “very good” category. Thus it can be concluded that in the first stage of implementation the response was very good. The results of the comparison of user response tests in the first and second stages are shown in the following chart.

The video-assisted project-based learning model on YouTube is feasible to use after getting validation from experts. In addition, the results of the development are also received and get a good response from users. The feasibility of the model to be applied in automotive engineering drawing subjects in SMK is influenced by several factors. Increased motivation and interest in learning as a result of using a learning model that integrates video-based learning media on YouTube is an important factor [22], [23]. In addition, through the integration of videos from YouTube, students can choose their own learning resources according to their respective interests [24].

In addition, the problems faced during online learning during the current COVID-19 pandemic provide a positive value for the development carried out. This learning model can be done online, so it can provide the flexibility and flexibility of independent learning anywhere and anytime [25]. The teacher acts as a learning facilitator to provide instruction and literacy on how to implement online project-based learning. Meanwhile, students are given the freedom to work on projects with the help of video tutorials and animated videos on YouTube [26].

The easy accessibility of technology such as smartphones and the YouTube platform is a distinct advantage of developing this model. Students have the opportunity to develop their abilities independently and explore resources according to their interests [27]. Thus, through independent learning using digital sources, especially YouTube, it can form learning creativity and students' critical thinking power [28]. In addition, through learning to make projects, self-efficacy can be formed by itself [29].

![User Response Test Chart](chart.png)
4. Conclusion
The development of video-assisted project-based learning models from Youtube can be applied to automotive engineering drawing subjects. Model development is carried out by positioning YouTube as a source of student learning in working on automotive engineering drawing projects. Various characteristics of animated videos and video tutorials are adapted to the context and achievement of automotive engineering drawing learning. The entire procedure for implementing the learning syntax is packaged in a manual. The developed model received high feasibility assessment results from material experts, media and learning practitioners. In addition, a good positive response to the developed model was obtained from users. Thus, the project-based learning model assisted by YouTube videos is feasible to be applied in vocational high schools, especially in automotive engineering drawing subjects.

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