

## Development of Learning Videos to Improve Students' Ability to Understand Mathematical Concepts on Polynomial Material

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**Abstract.** Behind the success of successful online teaching and learning, there must be careful preparation in creating or building the system. Some complaints that are around us are that some students have difficulty in online-based mathematics learning. Some of them have difficulty signaling due to cloudy or rainy weather, not having money to buy internet quota, boredom during the teaching, and learning process, and difficulty understanding the material in online learning. Although there are examples that have been explained by the teacher, they still do not understand what their teacher teaches them. The teacher had already made learning materials using instructional video media, but it was still not enough for students to understand the polynomial material taught by the teacher, and according to the teacher the main problem was that the students' ability to memorize formulas was still lacking. The objectives of this research to see validity, effectiveness and practicality of the video development using PowerPoint and Filmora application. This research is development research that applies the Dick & Carey development model. This research focuses on developing learning videos using PowerPoint as a learning media, and Filmora as a learning video editing medium.

**Keywords:** Learning Media, Video, Dick, Carey, & Carey

**Abstrak.** Di balik kesuksesan belajar mengajar online yang sukses, harus ada persiapan yang matang dalam membuat atau membangun sistemnya. Beberapa keluhan yang ada di sekitar kita adalah sebagian siswa mengalami kesulitan dalam pembelajaran matematika berbasis online. Beberapa dari mereka mengalami kesulitan sinyal karena cuaca mendung atau hujan, tidak memiliki uang untuk membeli kuota internet, kebosanan selama proses belajar mengajar, dan kesulitan memahami materi dalam pembelajaran daring. Walaupun ada contoh yang sudah dijelaskan oleh guru, mereka masih belum mengerti apa yang diajarkan oleh gurunya. Guru sudah membuat bahan ajar dengan menggunakan media video pembelajaran, namun masih belum cukup bagi siswa untuk memahami materi polinomial yang diajarkan oleh guru, dan menurut guru kendala utamanya adalah kemampuan siswa dalam menghafal rumus masih kurang. Penelitian ini bertujuan untuk melihat validitas, efektivitas dan kepraktisan pembuatan video dengan menggunakan aplikasi PowerPoint dan Filmora. Penelitian ini merupakan penelitian pengembangan yang menerapkan model pengembangan Dick & Carey. Penelitian ini berfokus pada pengembangan video pembelajaran dengan menggunakan PowerPoint sebagai media pembelajaran, dan Filmora sebagai media editing video pembelajaran.

**Kata Kunci:** Media Pembelajaran, Video, Dick, Carey, & Carey

## **INTRODUCTION**

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious-spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation, and state (UU SPN). Article 1 paragraph 1). This means that education has a very important role in human life. Because with education, humans will have a clearer and more focused view and direction of life. Therefore, a good education is an education that prepares students for a profession or position, but how education can prepare students to solve problems they will face in everyday life and be able to apply them in any conditions.

Understanding is a level of ability where students are expected to be able to understand the meaning of concepts, situations, and facts they know (Al-Siyam & Sundayana, 2014). Understanding concepts is the basis of understanding principles and understanding theories, so to understand principles and theories, students should first understand the concepts that make up these principles and theories, therefore students need to understand concepts in mathematics (Diana et al. al., 2020).

In learning mathematics, five basic abilities are the standard of mathematical ability according to NCTM (2000), namely: (a) problem-solving; (b) reasoning and proof; (c) communication; (d) connection, and (e) representation. This shows that in learning mathematics, it is necessary to learn mathematics with a deep enough explanation so that students understand the mathematical material.

Behind the success of successful online teaching and learning, there must be careful preparation in creating or building the system. Some complaints that are around us are that some students have difficulty in online-based mathematics learning. Some of them have difficulty signaling due to cloudy or rainy weather, not having money to buy internet quota, boredom during the teaching, and learning process, and difficulty understanding the material in online learning.

Results some of the students I interviewed and preliminary test results to high school students in class XI-IPA 1, there are 12 of 18 students in class XI - IPA 1 of them students cannot understand the material and mathematical concepts because the material their teacher does is only PPT and lecture-based, there is rarely a question-and-answer session. Although there are examples that have been explained by the teacher, they still

do not understand what their teacher teaches them. And from the teachers I interviewed, the teacher was still not optimal in making learning media. The teacher had already made learning materials using instructional video media, but it was still not enough for students to understand the polynomial material taught by the teacher, according to the teacher the main problem was that the student's ability to memorize formulas was still lacking. Although the material has just been explained, there are still students who do not memorize the formulas that have just been taught. When the teacher wants to give examples of questions outside the book, the teacher is still lacking in modifying the questions that have been taught by the teacher.

## **LITERATURE REVIEW**

Understanding is a level of ability where students are expected to be able to understand the meaning of concepts, situations, and facts they know (Al-Siyam & Sundayana, 2014). Understanding concepts is the basis of understanding principles and understanding theories, so to understand principles and theories, students should first understand the concepts that make up these principles and theories, therefore students need to understand concepts in mathematics (Diana et al. al., 2020).

According to Bloom, understanding mathematical concepts can be seen in students' abilities in (Munir, 2008: 55):

- a. Interpreting, namely verbalization or vice versa.
- b. Exemplifying, namely finding specific examples.
- c. Classifying, namely distinguishing something based on its category.
- d. Summarizing, namely, to make a summary in general.
- e. Inferring, which provides an overview of logical conclusions.
- f. Comparing, namely detecting the relationship between two ideas or objects.
- g. Explaining, namely constructing a causal model

Based on these indicators, the researcher uses three indicators proposed by Bloom. First, find the specific examples; second, distinguishing something based on category; third, detecting the relation between two ideas or objects.

According to James (in Suherman, 2005:16), mathematics is the science of logic about form, arrangement, magnitude, and concepts that relate to one another in large numbers and are divided into three fields: algebra, analysis, and geometry. Meanwhile,

according to Elca Tinggih (in Suherman, 2005:16) Etymologically the word Mathematics means knowledge obtained by reasoning. This does not mean that other sciences are not obtained through reasoning, but mathematics emphasizes activities in the world of ratios (reasoning), while other sciences emphasize the results of observations or experiments in addition to reasoning.

According to Hidayatullah et al. (2007), learning media as a source of learning helps teachers enrich students' insight. Learning media can assist teachers in presenting lessons so that the information presented is clearer and more varied.

In general, learning media can clarify the presentation of messages so that they are not too verbalized, can overcome the limitations of space, time, and senses, and can overcome the passive attitude of students because it can cause enthusiasm for learning, allowing more direct interaction between students and the environment and reality, allowing students to learn independently according to their abilities and interests (Arif et al., 2010).

Learning by using media in the teaching and learning process has two important roles, namely: (1) Media as a teaching aid or referred to as media-dependent because of its position here as a tool (effectiveness), and (2) Media as a learning resource that is used alone. by students independently or called media dependent. Dependent media is designed systematically so that it can channel information in a directed manner to achieve the learning objectives that have been determined by Hamalik in Rusman (2012: 140).

Video media is the most appropriate and accurate learning media for conveying messages and will greatly help students' understanding. With the video media, students will understand more about the material presented by the teacher through the screening of a film. The elements contained in video media such as sound, text, animation, and graphics. With the video media, participants can achieve abilities in the cognitive (mental brain activities), affective (attitude), psychomotor (skills) and improve interpersonal skills. It can be concluded from the research that students can achieve what is expected by the teacher in the classroom. (Yudianto, 2017).

## **RESEACRH METHOD**

This research is a Research and Development. Research and development methods are research methods used to produce certain products and test the effectiveness of these products. This research focuses on the development of learning videos with PowerPoint as a learning media, and Filmora as a learning video editing media.

### **1. Data Analysis Techniques Validity**

To see the validity of learning videos using PowerPoint as a learning medium and Filmora as a learning video editing media, descriptive statistical analysis was used based on the average score of the validation sheet instrument that had been validated by experts. The results of the data from the questionnaire in the form of quantitative (numbers) will be analyzed with the following formula:

$$P = \frac{\sum x}{\sum xi} = 100\%$$

Description:

- $P$  = Searched score
- $\sum x$  = Total number of respondents' answers
- $\sum xi$  = The ideal total number of i

### **2. Practical Data Analysis Techniques**

This instrument is used to obtain practicality criteria generated through a teacher response questionnaire to learning videos using PowerPoint as a learning medium and Filmora as a learning video editing medium. Then, the data generated from the teacher's questionnaire will be analyzed using the following formula:

$$Vp = \frac{TSEp}{S - max} \times 100\%$$

Description:

- $Vp$  : Practical validity
- $TSEp$  : Total practicality empirical score
- $S - max$  : Expected maximum score

### **3. Completeness Analysis of Student Concept Understanding**

The effectiveness of learning videos using PowerPoint as a learning medium and Filmora as a learning video editing medium to improve student learning outcomes can be seen based on individual and classical student learning mastery. Furthermore, the test

results that have been obtained are analyzed for individual student learning completeness which is calculated by the following formula:

$$KB = \frac{T}{T_t} \times 100\%$$

Description:

KB : Learning Completeness

T : The total score obtained by students

T<sub>t</sub> : Total Score

Criteria:

$0 \leq KB \leq 70$  : Students have not finished studying

$0 \leq KB \leq 100$  : Students finish studying

#### **4. Counting Mastery of Classical Learning**

To find out the Classical Completeness Presentation (PKK), you can use the following formula:

$$PKK = \frac{\text{Number of students who have finished studying}}{\text{Total number of students}} \times 100\%$$

Description:

PKK: Classical Completeness Presentation

#### **5. Analysis of Achievement of Learning Objectives**

According to Hasratuddin (2018: 242) that "The achievement of learning objectives is achieved if at least 75% of the formulated learning objectives can be achieved by 65% of students". To calculate the achievement of learning objectives used the formula:

$$T = \frac{S_i}{S_{max}} \times 100\%$$

Description:

T : Percentage of achievement of learning objectives

S<sub>i</sub> : Total score for item number i

S<sub>max</sub> : The maximum score for the question number i

Criteria:

$0\% \leq T \leq 75\%$  : TPK not reached

$75\% \leq T \leq 100\%$  : TPK reached

## 6. Students Response Data Analysis

Analysis of the results of student responses to the product is calculated using the following formula:

$$PRS = \frac{\sum A}{\sum B} \times 100$$

Description:

*PRS* : The percentage of students who gave a positive response to each category asked

$\sum A$  : Proportion of students who choose

$\sum B$  : Number of students (respondents)

## 7. Data Analysis of Improving Student Learning Outcomes

The amount of increase in the test before and after learning can be calculated using the N-gain formula. The formula for calculating N-gain is as follows:

$$g = \frac{\text{skor posttest} - \text{skor pretest}}{\text{Skor maksimal} - \text{skor pretest}}$$

## RESULT AND DISCUSSION

### A. Result

The final result of this research and development is Mathematics Learning Media in the form of Learning Videos for Polynomial class XI – IPA 1. This research and development were carried out at Don Bosco Budi Murni 2 Private High School Medan to determine the feasibility and effectiveness of Learning Media in the form of learning videos from PowerPoint as a medium material and Filmora as video editing media.

### 1. Improving Students' Conceptual Understanding

Increasing students' understanding of concepts by using video learning media can be seen from the results of the pre-test and post-test analysis. An overview of increasing students' understanding of concepts can be seen in the table 1.

**Table 1. Improved students' conceptual understanding**

| Information                      | Pre-Test | Post-Test | Improvement |
|----------------------------------|----------|-----------|-------------|
| Lowest Value                     | 40       | 80        | 40          |
| Highest Value                    | 60       | 100       | 40          |
| Average Conceptual Understanding | 49,18    | 90,26     | 40,61       |

Based on the table 1, the increase in students' conceptual understanding from pre-test to post-test showed that the average pre-test result was 49.18 and increased to 90.26 in the post-test. If the results are categorized into levels of conceptual understanding on the pre-test and post-test, it can be seen in the table below.

**Table 2. Category of Student Conceptual Improvement**

| Value Interval | Category  | Pre-Test       |            | Post-Test      |            |
|----------------|-----------|----------------|------------|----------------|------------|
|                |           | Total Students | Percentage | Total Students | Percentage |
| 90-100         | Very High | 0              | 0%         | 10             | 55,55%     |
| 80-89          | High      | 0              | 0%         | 8              | 44,44%     |
| 65-79          | Enough    | 0              | 0%         | 0              | 0%         |
| 55-65          | Low       | 5              | 27,77%     | 0              | 0%         |
| 0-54           | Very Low  | 13             | 72,22%     | 0              | 0%         |
| Total          |           | 18             | 100%       | 18             | 100%       |

An overview of increasing students' conceptual understanding on each indicator can be seen in the table below.

**Table 3. Increasing students' understanding of concepts with each indicator**

| Num. | Concept Understanding Indicator                                                                        | Average  |           |             |
|------|--------------------------------------------------------------------------------------------------------|----------|-----------|-------------|
|      |                                                                                                        | Pre-Test | Post-Test | Improvement |
| 1    | Determine the result of the difference between high-ranking coefficients and low-ranking coefficients. | 40       | -         | 40          |
| 2    | Determining the result of the addition in Polynomial Operations.                                       | 32,24    | 88,5      | 56,26       |
| 3    | Determining the result of subtraction in Polynomial Operations.                                        | 28,64    | 90,46     | 61,82       |
| 4    | Determining Multiplication in Polynomial Operations.                                                   | 25,4     | 87,84     | 62,44       |
| 5    | Determining Division in Polynomial Operations.                                                         | 24,56    | 88,55     | 63,39       |

Increased understanding of students' concepts can also be seen from the results of the gain analysis. The following table shows the improvement of students' conceptual understanding skills in the form of N-Gain analysis.



**Table 4. Improving Student Concept Understanding Using N-Gain**

| Students | Pre-Test | Post-Test | Differents | N-Gain | Category |
|----------|----------|-----------|------------|--------|----------|
| S-01     | 40       | 80        | 40         | 0,66   | Increase |
| S-02     | 40       | 90        | 50         | 0,83   | Increase |
| S-03     | 45       | 84,5      | 39,5       | 0,71   | Increase |
| S-04     | 50       | 87,5      | 37,5       | 0,75   | Increase |
| S-05     | 50       | 90        | 40         | 0,8    | Increase |
| S-06     | 45       | 88,25     | 43,25      | 0,78   | Increase |
| S-07     | 50,25    | 85,5      | 35,25      | 0,7    | Increase |
| S-08     | 60       | 100       | 40         | 1      | Increase |
| S-09     | 60       | 100       | 40         | 1      | Increase |
| S-10     | 55       | 90        | 35         | 0,77   | Increase |
| S-11     | 45       | 93        | 48         | 0,87   | Increase |
| S-12     | 60       | 95,25     | 35,25      | 0,88   | Increase |
| S-13     | 45       | 90,25     | 45,25      | 0,75   | Increase |
| S-14     | 45       | 80        | 35         | 0,63   | Increase |
| S-15     | 55       | 88,5      | 33,5       | 0,74   | Increase |
| S-16     | 50       | 94        | 44         | 0,88   | Increase |
| S-17     | 50       | 95        | 45         | 0,9    | Increase |
| S-18     | 40       | 93        | 53         | 0,88   | Increase |

Based on the various improvements above, such as from the total score of students' conceptual understanding, from each indicator, and N-Gain, it can be concluded that students' conceptual understanding from pre-test to post-test increased through video. Learning based on interactive learning media.

## **B. Discussion**

The effectiveness of this learning media is seen from the increase in students' understanding of concepts and students' responses to the applied learning media. From the results of the analysis, after students have a concept understanding test in the form of a description of the learning media developed, in various analyzes, such as the total score of students' conceptual understanding, each indicator of students' conceptual understanding, and N-Gain, this shows that there is an increase in understanding students' high concept from pre-test to post-test through video learning media.

From the results of the student response questionnaire analysis showed that students gave a positive response to the media, namely 88.5%, thus the media was in the "very effective" category.

From these data, it can be seen that there is a high increase in students' conceptual understanding and a positive response of students reaching 80.72%. Therefore, the developed augmented reality-based interactive learning media can be said to be effective.

Because it meets three quality criteria for learning tools, namely valid, practical, and effective, the augmented reality-based interactive learning media developed is said to be of high quality.

Like other learning media, this video learning media is one of the interactive learning media that can be used in the mathematics learning process and provides many benefits for the world of education. This interactive learning media allows students to interact with the media as a learning resource. Students not only see videos of the delivery of learning materials, but can also be repeated continuously to build concepts, and students are free to repeat the information presented if there are concepts that have not been understood.

## **CONCLUSION**

Increasing students' conceptual understanding, from various analyzes, such as the total value of students' conceptual understanding of each indicator of students' conceptual understanding, and N-Gain shows that there are increasing students' understanding of high concepts from pre-test to post-test through Learning Video media. Positive student responses are greater than 80%, from the results of the student response questionnaire analysis show that students respond positively to the media, namely 86%. Therefore, interactive learning media based on Learning Videos is included in the "very effective" category. Based on the results obtained, the increase in students' understanding of concepts from pre-test to post-test showed that the average pre-test result was 49.18 and increased to 90.26 in the post-test.

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