Development of learning media using VBA excel in physical learning in senior high school

A D Safitri¹, A D Lesmono¹, Maryani¹ and A A Wardoyo²

¹ Department of Physics Education, Faculty of Teacher Training and Education, University of Jember, Indonesia
² Elementary School Teacher Education Study Programs, Faculty of Teacher Training and Education, University of Jember, Indonesia

arikguk13@gmail.com

Abstract. This study aims to examine the practicality and effectiveness of instructional media. This research uses research and development research. The development procedure in this study uses 4D which has four stages namely define, design, develop, and disseminate. This study examines the disseminate stage of validating testing. The results of the development stage to state that they are valid, practical and effective. The subject of the dissemination stage of this study were students of class XI MIA-1, XI MIA-2, and XI MIA-4 at SMA Umbulsari. Data collection is done through pre-test and post-test and student questionnaire responses. The results of validating testing at the disseminate stage to measure the practicality of learning media carried out by XI MIA-1, XI MIA-2, and XI MIA-4 respectively scored 81.32%, 80.20%, and 81.46%, obtaining criteria practical and get effective enough criteria for the effectiveness of learning media using VBA Excel with a score of 40.05% at XI MIA 1, 36.21% at XI MIA 2 and 39.23% at XI MIA 4 based on the N-Gain test criteria.

1. Introduction

Physics learning is learning that studies natural phenomena and all events that occur in everyday life [1]. Based on the results of researchers' observations on physics learning in one school in December, there were still many students who had difficulty learning physics, and the average student did not like physics. This problem often arises in learning physics. Factors that influence students' learning difficulties are physics when students learn physics that is easily tired, less excited, easily dizzy, quickly drowsy, lack of student interest in learning physics, students' abilities that are lacking especially in mastering concepts, formulas and calculations that are still low, the ability to catch and the activeness of students that are different, as well as the lack of readiness of students in learning physics such as not carrying a notebook, not carrying a pen and not entering the classroom on the grounds of being late. Besides, the way to convey the teacher which is sometimes unclear also influences students' physics learning difficulties [2]. In addition to student learning difficulties, schools rarely use practicum when teaching and learning due to limited time and practical tools at school.

Problems in learning physics can be overcome with media in learning. Learning media are all things that can convey and channel information from sources in a planned manner to create a conducive learning environment so that the recipient can carry out the learning process efficiently and effectively [3]. Learning media can provide benefits in the learning process. These benefits are as follows: (1)
facilitates teachers in managing learning (2) helps teachers guide their students to be able to find concepts both independently and in groups (3) can be used to develop process skills, and develop scientific attitudes (4) Facilitate the teacher monitors the success of students achieving learning goals [4]. One of the efficient and effective learning media is learning media assisted by information and communication technology (ICT). Pandia stated that information and communication techniques could help students understand learning material. The results of his study stated that before learning by using computer-aided media as many as 22 (61%), students stated that physics was a difficult subject. But after doing learning using this media, the number of students who say physics is difficult is reduced by 16 people (44%) [5]. This change shows that learning media can change students' perceptions. Nikita's research results also state that student responses in using Dynamic Fluid E-Modules are categorized very positive at 91.81% which means students respond very positively to the development of Dynamic Fluid E-Modules learning products [6]. This shows that computer-assisted learning media gets a positive response and helps students understand the learning material.

One of the computer programs that can be used in learning media is Microsoft Excel. Microsoft Excel is a number processing sheet that is owned by experts and researchers to support their experiments in the laboratory. Excel can obtain data and analyze it using visual basic for application (VBA) and make excel as a controller then run it [7]. Visual basic for application (VBA) on Excel or can also be called Macro Excel is a series that automates several aspects of Excel so that it can work more efficiently and effectively [4]. Excel VBA program can also be used to show an animation [5]. Animations are made based on graphs of rows of numbers generated by macros. Macro is the development of a basic visual programming language that is applied in Excel applications [8]. The graph is then run by activating it through the macro code as programmed. The role of graphic charts in Excel VBA is very useful to provide a physical picture of data management such as animations made by mirrors and mirrors. So the learning media that researchers have developed is a learning medium using VBA excel which includes animation.

Physics learning by utilizing Visual Basic for Applications in Microsoft Excel has been widely carried out, including by Nurhayati on the use of animation media based on Visual Basic (VBA) excel spreadsheets to improve students' mastery of concept concepts on simple harmonic oscillator potential material. The results of the study concluded that the mastery of the concept of simple harmonic oscillator potential for students who obtained learning using Visual Basic spreadsheet excel based media was higher than students who obtained learning without using Visual Basic spreadsheet excel based media [9]. Besides that, Amalia et al. Also used VBA-based learning media on the excel microscope as a physics learning media and found that this learning media is valid and appropriate to be used as a physics learning media on wave material for senior high school students in class XI [10]. But as far as researchers are aware, they have not yet found learning media research using VBA excel on geometry optics material. Therefore, from the problems presented, researchers developed learning media using VBA excel on geometry optics material. The results of the research on the development test stated valid, practical and effective on the learning media that had been developed. Researchers aim to examine the practicality and effectiveness of instructional media on a broader target.

2. Methods
This type of research used in this research is Research and Development Research. Which aims to produce new products through the development process [11]. The development research method used is 4D which consists of 4 stages, including Define, Design, Develop, and Disseminate. This study examines the disseminate stage of validating testing. The results of the development stage state that they are valid, practical and effective. The test site was conducted at SMA Umbulsari. The study was conducted in the even semester of the 2018/2019 school year in three classes, namely XI-MIA 1, XI-MIA 2, and XI-MIA 4.

Data collection techniques used were tests and student response questionnaires. Student response questionnaire is used to determine the practicality of the product being developed. The technique of
obtaining the results of student responses from learning using Excel VBA learning media, the results can be categorized in Table 1 [12].

| Correlation Coefficients | Interpretations       |
|--------------------------|-----------------------|
| P > 95%                  | Very Practical        |
| 80% < P ≤ 95%            | Practical             |
| 65% < P ≤ 80%            | Practical Enough      |
| 50% < P ≤ 65%            | Less Practical        |
| P ≤ 50%                  | Not Practical         |

The test is used to measure student learning outcomes that are useful for knowing the effectiveness of a product being developed. The study used two tests, namely pre-test and post-test. The pre-test and post-test questions consist of 5 questions about the geometry optics material. This test was analyzed to find out the increase in student learning outcomes measured using the formula N-gain score. The N-gain score formula can be seen in equation below [13].

\[
< g > = \frac{\text{post test} - \text{pre test}}{\text{100} - \text{pre test}} \times 100\%
\]

The improvement criteria using N-Gain can be categorized in Table 2 [14].

| Classification of N-Gain values | Criteria   |
|---------------------------------|------------|
| \(Ng \geq 70\%\)                | High       |
| \(30\% \leq Ng < 70\%\)        | Medium     |
| \(Ng < 30\%\)                  | Low        |

3. Results and Discussion
The product developed in this study is a learning media that utilizes Microsoft Excel applications, which includes a visual basic for application (VBA) program. The learning media developed are learning media on the subject of geometry optics. The results of the development stage stated that the learning media were declared valid, practical and effective. A wider trial phase was carried out for 5 meetings. The first meeting pre-test first. The second to a fourth meeting conducted teaching and learning activities. The fifth meeting conducted a post-test activity and filled in the questionnaire on student responses. The data obtained at this stage are student response questionnaire used to measure the practicality of instructional media and tests used to measure the effectiveness of instructional media. The following will be explained about the data obtained.

3.1. The practicality of Learning Media Using Excel VBA
The practicality of instructional media using VBA Excel is obtained by analyzing the assessment data of experts in the learning media validation sheet and user assessment in the student response questionnaire. Student response data was taken by giving questionnaires to class XI MIA 1, XI MIA 2 and XI MIA 4 students after learning. The results of the validation of instructional media experts using VBA excel obtained a score of 4 included in either category. The results of the questionnaire analysis of student responses can be seen in the Table 3.

| Class   | Average Percentage of Total Student Response | Category |
|---------|---------------------------------------------|----------|
| XI MIA 1 | 81.32%                                       | Practical |
Based on the results of data analysis of student responses to learning media using VBA Excel, it was obtained presentation of student responses 81.32% in class XI MIA 1, 80.20% in XI MIA 2, and 81.46% in XI MIA 4 with practical categories so that learning media using Excel VBA can be said to be practical. This is following Hobri's statement which states that learning media developed can be said to be practical if it meets two criteria, namely theoretical-practical and practical practice. Theoretical practical is the assessment of experts in the learning media validation sheet. Practical in practice is user assessment in student response questionnaires [15].

3.2. The Effectiveness of Learning Media Using Excel VBA

The effectiveness of learning media using VBA Excel is obtained by analyzing student learning outcomes improvement. The instrument used to determine the effectiveness of learning media using VBA Excel is a test. This test is in the form of pre-test and post-test. The pre-test is done before learning begins and post-test is done after learning is finished. The average value obtained by students in the pre-test and post-test activities for class XI MIA 1 can be seen in Table 4.

Table 4. The effectiveness of learning outcomes using Excel VBA learning media.

| Components       | Pre-test | Post-test | N-gain | Criteria |
|------------------|----------|-----------|--------|----------|
| Total Students   | 36       | 36        |        |          |
| Lowest Value     | 11.5     | 30        | 40.05% | Medium   |
| Highest Value    | 49       | 77        |        |          |
| Average          | 27.29    | 56.41     |        |          |

Based on Table 4, it can be seen that the average score of pre-test and post-test of students is 27.29 and 56.41 with a difference of both of 29.12. These results indicate that the post-test scores are greater than the pre-test scores and indicate an increase in learning outcomes. Large increase in the effectiveness of student learning outcomes can be known by using N-gain. Table 4 shows that the N-gain value is 40.05%. These values indicate that an increase in student learning outcomes after using Excel VBA learning media. Based on Table 2, the magnitude of N-gain is included in the medium category. This means that improving student learning outcomes using Excel VBA is good enough. Based on these results, it was found that learning media using Excel VBA is effective in improving student learning outcomes. The average value obtained by students in the pre-test and post-test activities for class XI MIA 2 can be seen in Table 5.

Table 5. The effectiveness of learning outcomes using Excel VBA learning media.

| Components       | Class XI MIA 2 | N-gain | Criteria |
|------------------|----------------|--------|----------|
|                  | Pre-Test       | Post-Test |        |
| Total Students   | 33             | 33     | 36.21%   | Medium   |
| Lowest Student   | 19             | 32     |          |          |
| Highest Student  | 68.5           | 88     |          |          |
| Average          | 40.86          | 62.28  |          |          |

Based on Table 5, the students' mean pre-test and post-test scores were 40.68 and 62.28 with a difference of both 21.42. These results indicate that the post-test value is greater than the pre-test value and has increased. Increasing the effectiveness of student learning outcomes is obtained by using N-Gain. In Table 5, the N-gain value is 36.21%. Based on these values shows an increase in student learning outcomes after using Excel VBA learning media. Based on Table 2, the magnitude of the N-
gain value is included in the medium category. This means that improving student learning outcomes using Excel VBA is good. Based on these results, it was found that learning media using Excel VBA is effective in improving student learning outcomes. The average value obtained by students in the pre-test and post-test activities for class XI MIA 4 can be seen in table 6.

| Komponen          | Kelas XI MIA 4 | N-gain  | Criteria |
|-------------------|----------------|---------|----------|
|                   | Pre-Test       | Post-Test|          |
| Total Students    | 35             | 35      |          |
| Lowest Value      | 21             | 40      | 39.23 %  | Medium |
| Highest Value     | 60             | 80      |          |
| Average           | 40.29          | 63.71   |          |

Based on Table 6, the average score of pre-test and post-test of students is 40.29 and 63.71 with the difference of both is 23.42. These results indicate that the post-test value is greater than the pre-test value and shows an increase. Large increase in the effectiveness of student learning outcomes and can be known by using N-Gain.

In Table 6, the N-gain value is 39.23%. These values indicate that an increase in student learning outcomes after using Excel VBA learning media. Based on table 3, the magnitude of the N-gain value is included in the medium category. This means that improving student learning outcomes using Excel VBA is good enough. The results found that learning media using Excel VBA is effective in improving student learning outcomes. This is consistent with Muliatiingsih's statement that in order to find out the effectiveness of instructional media in improving learning outcomes, the activity was continued with question exercises to measure the achievement of learning objectives [11].

4. Conclusions

Based on the data that has been obtained from the results and discussion, it is concluded that learning media using VBA Excel is declared practical with the acquisition of a student questionnaire score of 81.32% in class XI MIA 1, 80.20% in class XI MIA 2 and 81.46% at XI MIA 4. Learning media using VBA Excel are stated to be quite effective in improving student learning outcomes with the acquisition of a score of 40.05% in class XI MIA 1, 36.21% in class XI MIA 2 and 39.23% in XI MIA 4.

Acknowledgments

Suggestions that learning media in the form of animation should be further developed in accordance with student needs and curriculum development. The research implementation should check all components used, such as computers and so that the implementation can be carried out smoothly.

References

[1] Mundilarto 2002 *Capita Selekta Physics Education* (Yogyakarta: JICA FMIPA UNY)
[2] Abbas M Y H 2018 *Factors of Learning Difficulties in Physics in High School Science students* (Jember, East Java: Jurnal Pendidikan Fisika) Vol 6 ed 1 pp 45–49.
[3] Munadi Y 2012 *Learning Media* (Jakarta: Gaung Persada (GP) Press Jakarta)
[4] Maryani 2018 *The effect of LKS with reasoning based guided inquiry strategy on the decision making skills of high school students on renewable energy materials* (Jember, East Java: Jurnal Pembelajaran Fisika) Vol 7 ed 1 pp 93-99
[5] Pandia S P dan R Hadiantini 2017 *Promoting the Role of Informatics Engineering in Solving Physical and Mathematical Problems in SMAN 1 Pangalengan* (Jurnal Wahana Pendidikan Fisika) Vol 2 ed 1 pp 69-72
[6] Nikita P M Albertus D L dan Alex H 2018 *Development of Dynamic Fluid Material E-modules to Enhance Critical Thinking Ability of Grade XI High School students* (Jurnal Pembelajaran Fisika) Vol 7 ed 2 pp 175-180.
[7] Bloch S C 2007 Excel for Engineers and Scientists (Jakarta: Erlangga)
[8] Wicaksono Y 2014 Processing an External Database Using Excel (Jakarta: PT Elex Media Komputindo)
[9] Nurhayati 2015 Using Visual Basic (VBA) Animated Media as an Excel Spreadsheet to Strengthen Student Concepts on Simple Harmonic Oscillator Potential Material (Jurnal Edukasi Matematika dan Sains) Vol 3 ed 1 pp 54-61.
[10] Amalia E M Rahmad dan Syahril 2017 VBA-based Wave Visualization Design using Microsoft Excel as a Media for High School Physics Learning (Jurnal Geliga Sains) Vol 5 ed 2 pp 95-103.
[11] Mulyatiningsih E 2014 Applied Research Methods in Education (Bandung: Alfabeta)
[12] Yusuf A M 2015 Educational Assessment and Evaluation (Jakarta: Raja Grafindo Persada)
[13] Hake R R 2002 Relationship of individual Student Normalized Learning Gains in Mechanics With Gender, High-school Physics, and pretest score on Mathematics and spatial Visualization (The Physics Education Research Conference) pp 1-14.
[14] Hasana S N dan E R Maharany 2017 Multimedia development uses Visual Basic for application (VBA) to improve teacher professionalism (Jurnal Pendidikan Matematika) Vol 3 ed 2 pp 30-40
[15] Hobri 2010 Development Research Methodology: Applications in Mathematical Education Research (Jember: Pena Salsabila)