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Audio-Visual-Based Optical Applications as a Media to Improve Students' Understanding of Concepts: A Feasibility Test

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ABSTRACT

One of the learning media by utilizing device technology is realized in the form of an audio-visual physics-based physics mobile learning application called Optically. In the mobile learning application, there are various kinds of content, such as illustrated images, educational videos, sample questions, and practice questions. The research conducted has the aim of (1) producing products in the form of audio-visual physics mobile learning applications on the subject of Diffraction as a learning medium; (2) knowing the feasibility of audio-visual physics-based physics mobile learning applications as a supporting medium for students in understanding the concept of physical optics material. The research and development method uses the ADDIE model which consists of 5 stages, namely Analysis, Design, Development, Implementation, and Evaluation. However, this study is limited only to the development stage (Design). The product feasibility tester in this study was carried out by 17 people who had studied Physical Optics Physics and were studying in the field of Physics. The results of the analysis of the feasibility test of the product carried out, obtained on average on all indicators belonging to the category of very feasible.

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1. INTRODUCTION

Physics is a science that discusses the factors and phenomena found in nature. So that learning is not only done verbally but also factually. Thus, the implementation of Physics learning must be able to attract students' interest in learning Physics by designing the learning as well as possible. With the influence of technology in the world of education, teaching materials are designed that are varied and suit the needs of students' learning styles [1]. Physics learning is more abstract in nature so visualization is needed such as images, videos, animations or graphics that can be used to help students understand the material [2]. The use of audio-visual media is a learning medium that really supports the interaction process in the classroom [3].

Understanding concepts is a process of activities carried out to correctly understand a design or abstract idea which can be classified as an object and can be achieved through the learning process [4]. Understanding according to Bloom is knowing students' abilities to understand, absorb, and accept the lessons the teacher gives to students, or knowing about students' understanding of what they read, experience, see, or hear in the form of research or direct observation [5].

In science learning, one of which is Physics, student analysis of the knowledge aspect shows that students are less able to understand physics concepts and relate natural phenomena to physics concepts because students do not directly observe events in nature [6]. Indicators of concept understanding are, (1)

restating a concept; (2) Classifying objects according to certain properties (according to the concept); (3) Provide examples and non-examples of the concept; (4) Presenting concepts in various forms of mathematical representation; (5) developing necessary or sufficient conditions for a concept; (6) Using, utilizing, and selecting certain procedures or operations; (7) Apply problem solving concepts or algorithms.

Audio-visual learning media can be used as a way to make it easier for students to understand physics concepts [7]. Currently students prefer audio-visual media [8]. This is because the presentation of audio-visual media displays videos in the form of images accompanied by sound, so that the senses of sight and hearing are stimulated [9]. The use of audio-visual media can make physics learning more interesting, interactive, and the quality of student learning can be better [10]. Students become more understanding, and students' learning attitudes and attention can be improved and focused [11].

The more students have and use mobile devices, the greater the opportunity to use technological devices in their learning process [3], [12]–[15]. Learning media using mobile phone technology is called mobile learning [16]. One alternative for developing learning media is using mobile learning [17]. The existence of mobile learning is intended to complement the learning process and provide students with the opportunity to study material that is not well understood and mastered anytime and anywhere [14]. Many students still use laptops or even use manual books to support the learning process at school [18]. Using laptops as a learning medium is troublesome because it makes it difficult for students to carry them [19]. Seeing this possibility, the development of learning media using cell phones aims to create mobile learning for all cell phone devices using the Android platform, because the Android operating system is the system most widely used for smartphones [10], [20], [21]. With mobile learning, students can access learning material anywhere without being limited by space and place and have flexibility, because it is not related to time [2], [16], [22]–[24].

Based on the problems above, researchers will design learning media in the form of audio-visual based mobile learning applications. Learning using audio-visual based mobile learning applications is better because students can have the skills to understand and reason questions through exposure to material in the form of videos, example questions, and discussions presented in various practical and efficient representations [7], [25]–[29]. Mobile learning is used as a complement to the student learning process which can be used on Android-based smartphones. The feasibility, efficiency and practicality of learning media applications using Android-based smartphones has been proven [4], [11], [30].

In this study, the control variables used were Diffraction and Interference material and the research subjects were high school students. There are several basic competencies that are difficult to understand in physics lessons for high school students in class 12 semester 1, especially in abstract material such as diffraction and light interference. The results of interviews with physics teachers showed that the average daily test score for diffraction and light interference material was 52.50, while for questions related to cognitive structure, analysis, evaluation and creation or HOTS category questions it was still low.

2. METHODS

The research was conducted using research and development methods with the ADDIE model. The aim of the research carried out was to determine the feasibility of an audio-visual based mobile learning application on the subject of diffraction as a learning medium. The research procedure in the ADDIE model consists of 5 stages which include the Analysis, Design, Development, Implementation and Evaluation stages [4]. However, researchers limited it to the development stage due to limited time and opportunities available to conduct research.

At the Analysis Stage, what is done is to analyze learning methods, appropriate teaching materials and development requirements. The analysis stage carried out is analyzing the condition of the teaching materials as the main reference in learning. Curriculum analysis is carried out by paying attention to the characteristics of the curriculum being used. This aims to ensure that development is carried out in accordance with the applicable curriculum. Next, analyze basic competencies to formulate indicators of learning achievement.

At the design stage, a prototype is prepared and the appearance of the application is carried out. The things that are done in designing a prototype are determining the final goal of application design or competencies that must be achieved after learning to use the application, determining the outlines of the application, and developing the material that has been designed in outlines. Meanwhile, in the application display, the display design is carried out on the main page in the application and the material content page. On the material content page there is an explanatory video according to the material content.

In the Development Stage, the activity carried out is to assess the application that has been developed. The assessment was carried out to test the feasibility of an audio-visual based mobile learning application as a learning medium. The assessors or examiners in this research are people who have been involved in the

field of Physics and are currently studying in the field of Physics. The input and suggestions obtained from the assessors are taken into account and then improvements are made. The results of the testing or assessment are then analyzed to obtain conclusions about the feasibility of the application that has been developed.

The instrument used in the application feasibility test is a questionnaire with an assessment using a Likert scale. Assessment is carried out by filling in via the Google form page. The data obtained from filling out the questionnaire is ordinal data. The numbers contained in ordinal data are symbols so statistical calculations cannot be carried out. Ordinal data in the questionnaire is qualitative data or not actual numbers. Thus, the data must first be converted into interval data. Changing the data from filling out this questionnaire uses successive interval method analysis.

There are three aspects measured in the questionnaire. The first aspect is the audio-visual aspect. The audio-visual aspect is related to the suitability of the video content in the application with the diffraction material as well as the ease of understanding the video presented. The second aspect is the content aspect of the application. The content aspect is related to the suitability of the material formulation in the mobile learning application with the learning indicators in the syllabus as well as the clarity of the material presented. The third aspect is the language aspect. The language aspect relates to the suitability of the language based on the General Guidelines for Indonesian Spelling (PUEBI) as well as the use of language that is simple and easy to understand. The questionnaire instrument used as a feasibility test is presented in Table 1.

Table 1. Feasibility Test Questionnaire Instrument

Aspect	Indicator
Audio visual	1. Compatibility of the video content presented in the Optical Application with the Diffraction material
	2. Explanation of Diffraction material in the video presented in the Optically Application is easy to understand
	3. Video discussions of example questions and practice questions presented in the Optically Application are easy to understand
Contents	4. Suitability of the formulation of Diffraction material in Optical Applications with the learning indicators in the syllabus
	5. Suitability of the content of the material regarding Diffraction in Optical Applications to increase understanding of the concept
	6. Feasibility of sample questions regarding Diffraction material presented in the Optical Application
	7. Suitability of practice questions with the Diffraction material presented in the Optical Application
Language Aspect	8. Clarity of the sentence structure used in the Optical Application
Audio visual	9. Conformity of the language used in the Optical Application with the rules of PUEBI (General Guidelines for Indonesian Spelling)
	10. Suitability of the language used in the Optical Application with the level of development of students

Assessment of the feasibility test by examiners is carried out using a Likert scale. The response questionnaire regarding the suitability of learning media was carried out by providing 4 score choices according to the content of the question. The scoring rules for assessing product suitability are shown in Table 2.

Table 2. Scoring Rules

Category	**Skor**
SB (Very Good)	4
B (Good)	3
K (Less)	2
SK (Very Poor)	1

The results of calculating the average value based on the formula for converting quantitative data to qualitative data obtained are then interpreted in the assessment criteria proposed by Sukardjo (2008) in Table 3 below.

Table 3. Ideal assessment criteria scale 4 (Sukardjo, 2008)

Kategori	Score
$X > Xi + 1{,}80\ Sbi$	Very Worth It
$Xi + 0{,}60\ Sbi < X \leq Xi + 1{,}80\ Sbi$	Decent Enough
$Xi - 0{,}60\ Sbi < X \leq Xi + 0{,}60\ Sbi$	Not Worth It
$Xi - 1{,}80\ Sbi < X \leq Xi - 0{,}60\ Sbi$	Very Inadequate

Keterangan :

$X : Skor\ akhir\ rata - rata$

$X_i : Nilai\ rata - rata\ ideal$

Dapat ditentukan menggunakan rumus :

$$X_i = \frac{Skor\ tertinggi\ ideal + Skor\ terendah\ ideal}{2}$$

$Sbi :\ Simpangan\ baku\ ideal, dapat\ dicari\ dengan\ menggunakan\ rumus;$

$$Sbi = \frac{Skor\ tertinggi\ ideal - Skor\ terendah\ ideal}{6}$$

After carrying out calculations based on the assessment criteria on scale 4, the assessment criteria for this research are as shown in Table 4.

Table 4. Research Assessment Criteria

Kategori	Score
$X > 3{,}4$	Very Worth It
$2{,}8 < X \leq 3{,}4$	Decent Enough
$2{,}2 < X \leq 2{,}8$	Not Worth It
$1{,}6 < X \leq 2{,}2$	Very Inadequate

3. RESULTS AND DISCUSSION

The main objective of the research carried out is to develop and determine the feasibility of an audio-visual based mobile learning application with the subject of Diffraction in Physical Optics. The product produced in this research is an Optical application on the subject of diffraction. This application has several components consisting of: (1) Indicators and learning objectives; (2) Instructions for using the application; (3) Description of material based on sub-topics; (3) Explanatory videos based on sub-topics; (4) Simulation to increase understanding of concepts. The function of simulation media is to improve critical thinking and understanding of concepts [6]; (6) Example questions based on sub-topics; (7) Evaluation questions.

These menus function to make it easier for application users to select content to study. The application developed uses a lot of videos in delivering learning material. This is because this application focuses on an audio visual basis. The following images are several views of the Optically application products with the topic of Diffraction that have been developed.

Figure 1. Initial appearance of the application

Figure 2. Menu, Learning Objectives and Purpose of

Figure 3. Material Explanation Page and Example Questions

Use

Figure 4. Evaluation and discussion questions

The Optical application feasibility test was carried out by seventeen people who had studied Physics and were currently studying Physics. The analysis results of the Optical application feasibility test are shown in figure 5, figure 6 and figure 7. Based on the results of the Optical application feasibility test analysis in the figure, it can be concluded that all aspects of the Optical application are feasible and can be used as a learning medium. This is indicated by the average value which shows a value above 3.4. Based on table 4, this average value is included in the very feasible category.

The feasibility test results for each aspect are presented in graphical form. Figure 5 shows the scale of each statement item contained in the audio-visual aspect indicators.

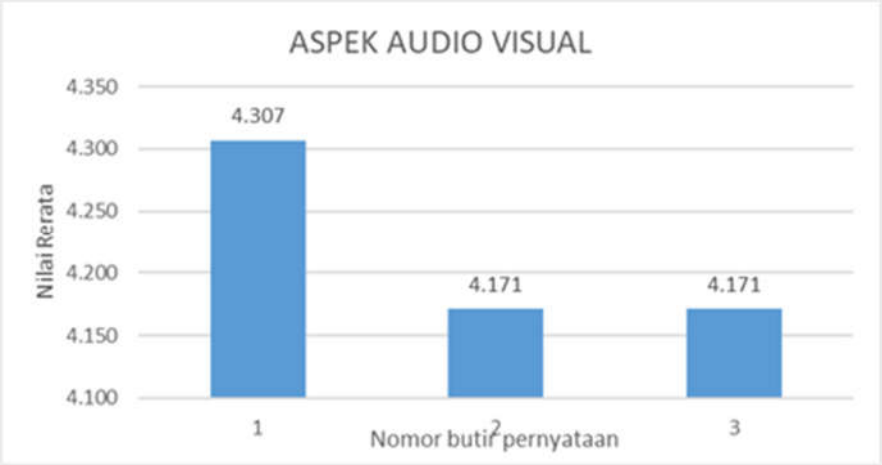

Figure 5. Graphic of Feasibility Test Results for Audio Visual Aspects

In general, the results on the audio-visual aspect show that the Optically developed application product is very feasible. These results are shown by the scale value of each statement item which is above 3.4. Respondents' answers to the feasibility test questionnaire on the audio-visual aspect showed that the audio-visual or video media presented in the Optically application was easy to understand and in accordance with the subject of Diffraction. Video displays in learning media can help students understand abstract material [4]. Learning media with video displays can change students' concepts from abstract to concrete [2].

Next, Figure 6 shows the percentage value of each statement item in the content aspect.

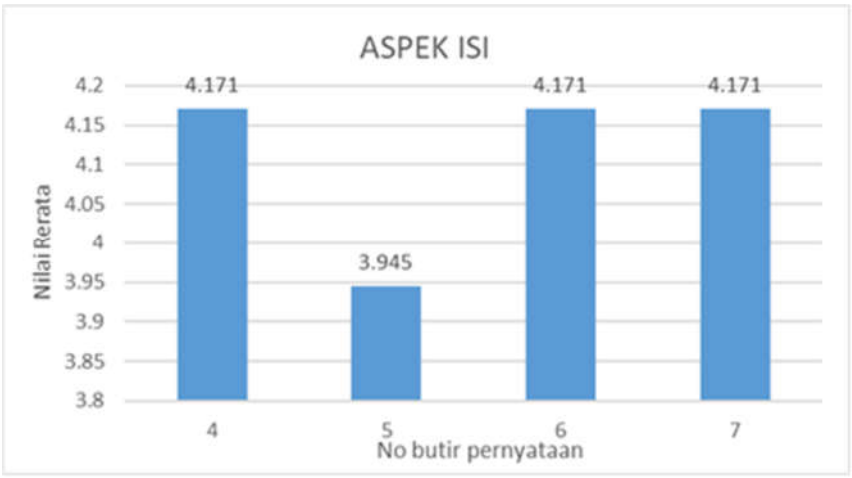

Figure 6. Graphic of Feasibility Test Results for Content Aspects

Figure 6 shows the suitability of the content in the audio-visual based Optically application. Based on the results in Figure 6, all statement items contained in the content aspect are included in the very appropriate category. This shows that the material content, example questions and practice questions in the Optically application are suitable for use. Lesson materials equipped with tutorials, simulations, practice questions, and assistance to make things easier for students can improve students' understanding of concepts and critical thinking [6].

Next, Figure 7 shows a graph of the average value of each statement item in the language aspect.

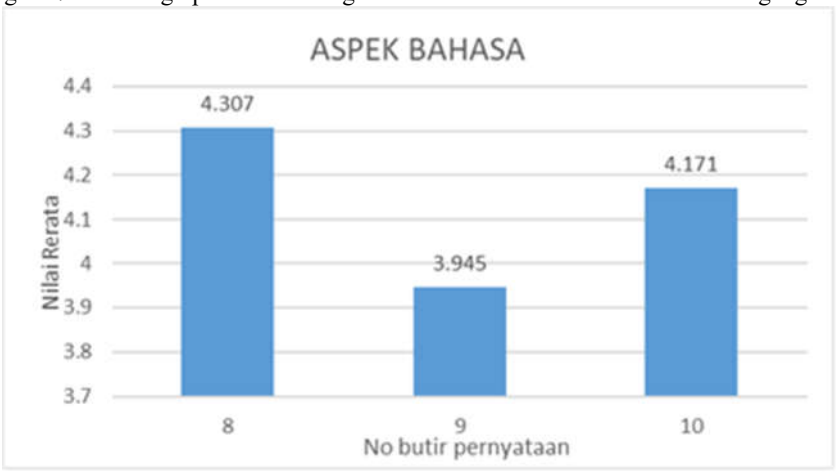

Figure 7. Graphic of Feasibility Test Results for Language Aspects

In the language aspect there are 3 statement points. These results show that the language used in Optically is very feasible. This is shown in the average value of all statement items in the language aspect which has a value above 3.4. Respondents' answers to the feasibility test questionnaire on the language aspect show that the language used in the Optically application can be categorized as appropriate and in accordance with the General Guidelines for Indonesian Spelling (PUEBI) and in accordance with the level of development of students. In developing learning media, it must consider the level of development, potential, world development and suitability to the needs of students.

The product obtained from the research is an Optical application on the subject of Diffraction. The percentage criteria for this research questionnaire are said to be suitable as a learning medium both at school and outside school. Based on the results of the feasibility test on the product development results that have been carried out, it shows good results. However, there are several suggestions and comments provided by the validator which can be taken into consideration to improve aspects of the Optical application on the subject of Diffraction so that it becomes better. The audio-visual aspect discusses the suitability of the video

content with diffraction material as well as the ease of understanding the video content. On the audio-visual aspect, there were no suggestions from respondents. Thus, the audio-visual aspect of the Optically developed application can be categorized as very feasible without any revisions. Furthermore, the content aspect includes the suitability of the problem formulation, the content and completeness of the material, as well as examples of questions and practice questions provided. There are suggestions given by respondents on this aspect, namely providing more detailed descriptions of the material presented in the Optically application. Respondents also provided suggestions for adding more example questions and practicing questions with other models such as description questions, cause and effect relationship questions, analysis questions, and so on. The language aspect which emphasizes the use of language and the use of sentences in the Optical application must also be paid attention to. This is done so that the language contained in the Optically application is in accordance with PUEBI rules and does not contain matters relating to SARA that could harm other parties. The advice given by respondents on the language aspect is that there is a need to improve the spelling of several words in English so that they are printed in italics. The several suggestions and input provided by the validator provide other alternatives for developing this Optically application. Some of the content presented in the Optically application, such as educational videos, online simulations, and picture illustrations can help students understand abstract material topics.

This Optical application has the advantage of being able to take advantage of developments in the current world of technology. The Optically developed application displays interesting content that has been presented in a coherent manner which can support the students' learning process. Currently, almost everyone in the world, including students, already has a smartphone that can access various applications. So that the Optical application can be easily accessed by students to study anywhere and anytime, making it more practical and efficient. The existence of mobile learning media can make learning activities unique because students can access materials, directions and applications related to learning anytime and anywhere. Psychology influences students' understanding of the concepts of learning material because to increase understanding of these concepts, students are expected to have the motivation and determination to learn. Motivation plays an important role in learning activities, because motivation to learn will increase enthusiasm for learning. As a supporter of learning, the use of mobile learning applications can increase learning motivation so that students' enthusiasm for participating in learning activities can grow and students are more encouraged to achieve higher learning outcomes.

4. CONCLUSION

Based on the research results, the physics learning media in the form of the Optical application, which is an audio-visual based Physics mobile learning application on the subject of Diffraction to improve understanding of concepts, is said to be suitable for use in learning. The results of the product feasibility test from the audio-visual aspect, content aspect and language aspect obtained an average score for all indicators which were included in the very feasible category.

DECLARATION

Author Contribution

The research was conducted using research and development methods with the ADDIE model.

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Conflict of Interest

Declare conflicts of interest or state “The authors declare no conflict of interest.”

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