The Development Optical Textbooks of Problem-Based Learning Trough Macromedia Flash

Hidayati, Sunarto, Ayu Fitri Amalia
{hidayati@ustjogja.ac.id[1], ayufitriamalia@ustjogja.ac.id[3]}

Physics Education Department, Universitas Sarjanawiyata Tamansiswa, Yogyakarta, Indonesia[1,2,3]

Abstract. This study aimed to develop and describe the optical textbooks of problem-based learning through Macromedia Flash. It is research and development consisting of 5 steps namely exploration study, early product development, expert validation and product revision, limited trial and product revision, main test and revision to final products. The instruments used were a validation questionnaire for material expert lecturers, media experts and a student response questionnaire. Data analysis techniques use qualitative and quantitative data. Data analysis techniques used qualitative and quantitative data. The results of this research are optic textbook of problem-based learning model through Macromedia Flash, with an average validation score of material experts 3.47 or 90.25% which is included in the excellent category, media experts 3.31 or 82.83% with very good category, and student responses 3.25 or 81.14% which are included in the very good category.

Keywords: optical textbooks, problem-based learning, macromedia flash.

1 Introduction

One important problem that is often faced by lecturers in learning activities is to choose or determine the proper textbook to help students achieve competence. teaching material in curriculum or syllabus is only written in outline in the form of subject matter. Teaching materials are all forms of materials used to assist lecturers in carrying out teaching and learning activities. The textbook component is the dominant factor in learning [1]. High-quality teaching materials can contribute substantially to the quality of students' learning experiences and student outcomes [2]. Teaching material or curriculum material is curriculum content that must be understood by the students in an effort to achieve the curriculum objectives. Textbooks are teaching materials that serve to assist lecturers and students in lectures [3]. The use of textbooks in lectures is a must. The aim of the lecturer in compiling textbooks is to improve the quality of lectures so that lectures become a place for fun and meaningful exchange of thoughts and creativity.

The learning paradigm in Higher Education has changed, no longer centred on lecturers but student-centred [4]. The role of the lecturer is as a facilitator and motivator, while students learn to find and construct knowledge. Students are required to show creative performance and integrate cognitive, affective and psychomotor abilities.

The function of educational institutions is to create the environment and climate learning that allows all the potential of actualized learning[5]. Learning resources such as libraries,

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laboratories, books, journals, and the internet are quite easily available and accessible. But unfortunately, the existing education tends to make students very dependent on the orders of lecturers, so that the students with poor creativity and innovation. If this is left unchecked, it will damage the ability of students to overcome various problems.

Physics is a science obtained from observations and experiments, which in general are limited to natural phenomena. In conducting observations and experiments using scientific methods followed by a scientific attitude, meaning physics includes four main elements, namely: attitude, process, product, and application. According to Leinonen, R, physics is a challenging lesson for students, even though the formula is simple, but applying it according to physical phenomena is a problem for students. This condition occurs in physics material, especially optics[6].

Every lecture, the students pay attention to the material or tasks presented by the lecturer. However, it has not been able to apply it properly, resulting in a low level of optics learning at the FKIP UST Physics Education Study Program. This is because the students are lazy to search and read literature available in libraries and social media. Every time they attend lectures, they just come, sit down and have a lot of silence, lack of activity and creativity.

To enable students, a learning model that challenges and attracts students is needed, one of which is the problem-based learning model. Why is the problem-based learning model?. A problem-based learning model is a learning approach by presenting real-world problems to be solved in learning activities[7]. Arends (2004) suggested that there are 5 phases (stages) that need to be done to implement PBL. These stages refer to the practical stages carried out in learning activities with PBL, as follows: 1). Student-oriented to problems 2). student-organized to study 3). Guiding individual and group investigations, because the core of PBL is an investigation. 4). Develop and present the work, because at the stage of the investigation followed by creating the work of 5). Analyze and evaluate the problem-solving process. Physics is a lesson that links physics concepts with the phenomena of everyday life[8]. In fact, physics learning tends to emphasize the development of cognitive abilities and not oriented towards the formation of skills and attitudes. Other facts show that physics learning activities (IPA) still use learning media that are less attractive to students[9].

Learning media has a very large role. The more sense devices used for learning, the greater the likelihood that students will know and understand the lesson. This is consistent with the opinion of Azhar Arsyad in Wijayanti who argued that learning by using multiple senses of view and hearing provides benefits for students[10]. One of which students will be more focus on understanding the material. Engaging all the senses in learning activities is very important, the way is by developing interactive learning multimedia. Roblyer in Lavin stated that through interactive multimedia, students can be creative[11]. One of interesting and easy-to-use interactive media is the Macromedia Flash program. Macromedia Flash is a program that is able to create animations ranging from simple to complex. Flash provides images, sounds, and videos to the animation that is created. Flash is very powerful but easy to use[12].

2 Method

This research was the development research with Borg and Gall model consisting of 5 steps, namely 1) Exploration Study, 2) Early Product Development, 3) Expert Validation and Product Revision, 4) Limited Trial and Product Revision and 5) Main Test and Revision to Final Products[13].

The research subjects included material experts, media experts and all the students of FKIP UST Physics Education Study Program who took Optics courses in the even semester of 2017/2018 academic year. The object of the research was the development of an optical textbook model of problem-based learning through Macromedia Flash.

Data collection techniques used interview and questionnaire techniques. The research instrument was a validation questionnaire sheet of optical textbooks. Product validation was used to assess developed textbooks both in terms of presentation, language, material, and design feasibility.

Data analysis techniques of validation results from validators and respondents are qualitatively and quantitatively as follows.

2.1. Change the qualitative score to quantitative as in table 1[14].

Table 1. Expert Validation Score Conversion

Category	Score
Poor	1
Average	2
Good	3
Very Good	4

2.2. Calculate the average score of each assessment component as follows[14]:

$$\bar{X} = \frac{\sum_{i=1}^{n} Xi}{N} \quad (1)$$

$\bar{X}$ = Avarage

$\sum_{i=1}^{n} Xi$ = score total

N = number of assessors

2.3. Calculate interval[14]

$$i = \frac{the\ highest\ score - the\ lowest\ score}{number\ of\ class\ intervals} \quad (2)$$

$$i = \frac{4-1}{4}$$

$$i = 0{,}75$$

2.4. Turning the average score into a qualitative form as in the table 2[14]

Table 2. Convert quantitative to qualitative scores

Average	Category
$3.25 \leq \bar{X} \leq 4$	Very Good
$2.50 \leq \bar{X} \leq 3.25$	Good
$1.75 \leq \bar{X} \leq 2.50$	Average
$1 \leq \bar{X} \leq 1.75$	Poor

2.5. Acceptance Criteria for Textbooks

The optical textbook model of problem-based learning through Macromedia Flash is said to be valid and feasible to be used as a textbook if the validation of Expert Judgment agrees and the average score of respondents is minimal good.

3 Result and Discussion

This type of development research uses Borg and Gall model (Soenarto, 2005) which consists of 5 steps, namely 1). Exploration Study. 2). Early Product Development. 3). Expert Validation and Product Revision. 4). Limited Trial and Product Revision. 5). Main Test and Revision to Final Products[13].

In the early stages, conducted exploratory studies and interviews about the potential and problems found in the FKIP UST Physics Education Study Program. It was found that there were no optical textbooks available to help students in optics lectures. Based on these potentials and problems, it was necessary to innovate to develop problem-based learning textbooks through Macromedia Flash which was expected to help students in the lecture process.

The second stage of the initial product development was the manufacture of initial products based on the results of the analysis of exploration results. The sequence of activities in this initial stage was the preparation phase, looking for reference books for Optics courses, a design of textbook displays, making textbooks. In determining the design of optical textbooks using A4 size paper. The problem-based learning model of optical textbooks through Macromedia Flash consisted of a cover page, an introduction, learning outcomes and indicators, table of contents and concept maps. Introduction consisted of the description of textbooks, instructions for use of textbooks and final objectives. Learning activities consisted of the material description, training, summary, formative tests, feedback and follow-up, evaluation questions, answer key, cover and Bibliography.

Expert Validation and Product Revision did after the textbook had been designed. Validation was carried out by material expert lecturers and physic education media experts. Validation aimed to obtain information, criticism and suggestions about textbooks developed so that they were suitable for use in the Physics Education Study Program. After validating, the textbook was corrected according to the input and suggestions from the validator, as in the table 3 and table 4.

Table 3. The Follow Up on Material Expert Comments

Comments	Categories
There is still a wrong formula writing.	Writing the formula has been fixed.
Information flow (concept map) is still unclear.	The concept map improved, so it is clear to understand.
Cover colours can be varied in colour and motif to make it more attractive.	The background of the cover repaired, and the colour was made to be more attractive.
Writing equations and symbols are italicized.	Writing the equations and symbols have been italicized.
Add high order thinking questions on evaluation questions.	The question of high order thinking added to the evaluation questions.

Table 4. The follow-up to Media Expert Comments

Comments	Categories
To be more interactive, add more questions.	Learning media has been given a question at the beginning of the opening of the material.
When the video is played, music can be set manually to stop or turn off.	Music on learning media has been given a button so that it was set manually
The animation image needs to be added again to make it more attractive to users	Animated images on learning media have been added.

The next step was limited testing to 5 students who took optics courses. This legibility test was to find out the response of students to problem-based learning textbooks through Macromedia Flash. The textbooks made in the main trial and revision stages of this final product. It was tested on students who took optics courses. The filled questionnaire will be a reference to conclude the feasibility of textbooks. The quality of optical textbooks based on the validation of material experts, media experts, and student responses.

The results of the validation of the material experts obtained that, the average validation in the aspect of presentation wealth 3.5 or 87.5%, language feasibility 3.34 or 83.5%, material feasibility of 3.6 or 90% and design feasibility of 3.5 or 87.5%, so the average score of material experts is 3.47 or 86.66%. In accordance with table 2, the average validation score of material experts is 3.47 included in the interval $3{,}25 \leq \overline{X} \leq 4$ categories that are very good or feasible to use. For more details, the percentage of each aspect can be seen as in Figure 1 below.

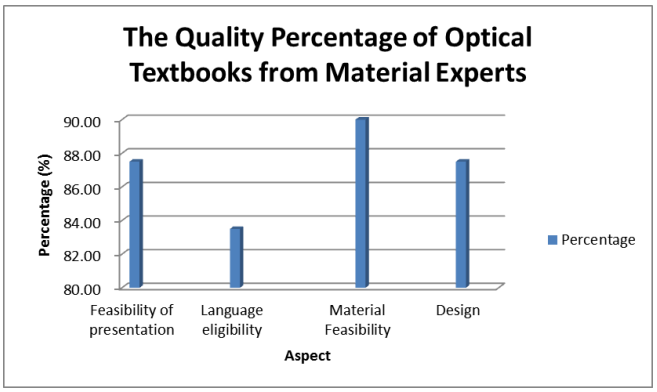

Fig. 1. Graph of the quality percentage of optical textbooks from material experts

Based on the results of the validation of media experts, the average of 3,47 was found at $3{,}25 \leq \bar{X} \leq 4$ intervals, so that the optical textbooks were very good for use in the FKIP UST Physics Education Study Program.

The results of the validation of media experts obtained the average validation on the presentation aspect is 3.05 or 76.25%, the language feasibility is 3.26 or 81.5%, the material feasibility of is 3.45 or 86.25% and the design feasibility 3, 75 or 93.75%. So the average score of the media expert is 3.31 or 82.83%. In accordance with table 2., the average validation score of material experts 3.47 included in the interval $3{,}25 \leq \bar{X} \leq 4$categories is very good or worthy to be used. For more details, the percentage of each aspect can be seen as shown in Figure 2.

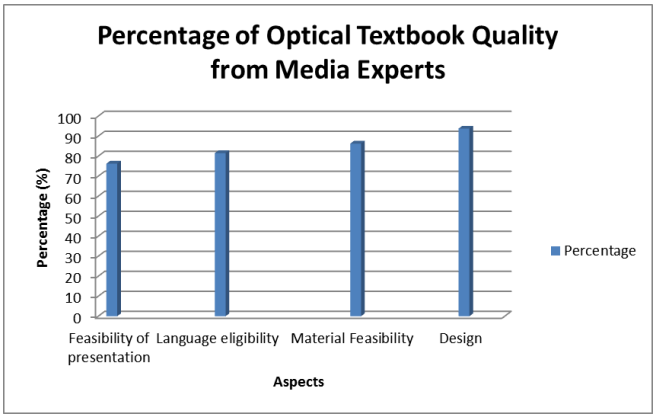

Fig. 2. Graph of percentage of optical textbook quality from media experts

Based on the results of the validation of media experts, the average of 3,31 was found at $3{,}25 \leq \bar{X} \leq 4$ intervals, so that the optical textbooks were very good for use in the FKIP UST Physics Education Study Program.

The validation results of the student response obtained that, the textbook model of problem-based learning through Macromedia Flash is appropriate to be used in the FKIP UST Physics Education Study Program. This can be seen from the average validation results on the aspect of presentation 3.25 or 81.25%, the language feasibility of 3.26 or 81.26%, the material feasibility of 3.27 or 81.8% and the feasibility of design 3.20 or 81.25%. So that, the average score of student respondents is 3.25 or 81.25%. In accordance with table 2., the average score obtained in the category interval is very good or worthy of use. For more details, the percentage of each aspect can be seen as in Figure 3. below.

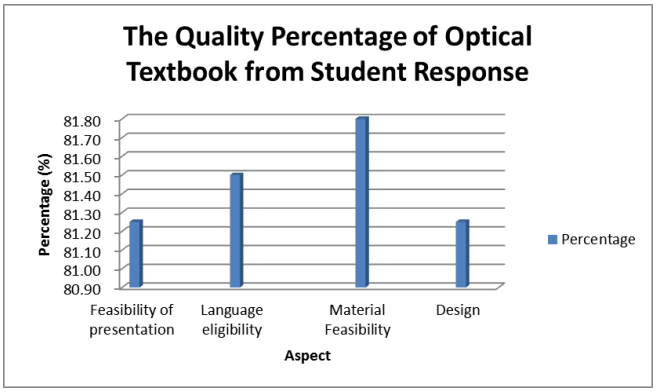

Fig. 3. Graph of percentage of optical textbook quality from media experts

Based on the results of the validation of media experts, the average of 3,25 was found at $3{,}25 \leq \bar{X} \leq 4$ intervals, so that the optical textbooks were very good for use in the FKIP UST Physics Education Study Program.

Based on the student response questionnaire, scores were obtained on the aspects of presentation 3.25 or 81.25%, language eligibility 3.26 or 81.26%, material eligibility 3.27 or

81.8% and the feasibility of design 3.20 or 81,25%. The average student response score of 3.25 or 81.25% is in the very good category interval, so the optical textbook model of problem-based learning through Macromedia Flash is very effective and feasible to be used as one of the textbooks in the Physics Education Department, FKIP, UST. This is in line with the results of Hidayati's research that there is a positive response to the implementation of learning with problem-solving methods of Science Education Department, FKIP, UST 2016/2017 Academic Year[15]. The 90.56% result was satisfied, and 89.42% feel happy and interested.

According to the results of the validation of the material experts and media experts, the optical textbook model of problem-based learning through Macromedia Flash was effective and feasible to be used in the FKIP UST Physics Education Study Program. It can be seen from the average score of the results of the validation of material experts 3.47 or 86.66% and media experts 3.31% or 82.83%. The mean of each validator is included in intervals of $3{,}25 \leq \bar{X} \leq 4$ categories that are very good, or feasible to use. It is in line with the results of a study by Muhammad Auliya, et al (2017) which concluded that the feasibility of the physics module of optical material with a scientific approach based on natural phenomena to improve the learning effectiveness of high school students was very good with an average value of 90.75%. Usage module is very effective seen from student response questionnaire of 89.53% and teacher response questionnaire of 90.00% categorized as very good.

As a result of development products, the textbook model of problem-based learning through Macromedia Flash has advantages and disadvantages. Beside that, it is more effective to use, because it is completed with Mcaromedia Flash as learning media supported and the student can use the textbook anytime and anywhere. This textbook can also be used for independent learning. The problems presented in the textbook can train students in applying their knowledge in daily life. The presentation of the material displayed with some Macromedia Flash animations and the practice questions provision became the main attraction in this textbook. The disadvantage is that it requires a longer study time to solve the problem, especially for those who have never used Macromedia Flash software.

4 Conclusions

Based on the analysis and discussion, it can be concluded that this development research produced an optical textbook model of problem-based learning through Macromedia flash for Physics Education Department, FKIP, UST through Borg and Gall model which consists of five steps, namely exploration, initial product development, expert validation and revision. products, limited trials and product revisions, main tests and revisions to the final product.

This development research produced a problem based learning optical textbook through Macromedia Flash that meets the criteria of very good and feasible to be used in the FKIP Physics Education Study Program. The average score of the validation of material experts at 3.47 or 86.66%, media expert at 3, 31% or 82.83% and student response at 3.25 or 81.25%.

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