Independent Learning through Interactive Multimedia Based on Problem Based Learning

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ABSTRACT

This research is based on the lack of use of creative and interactive learning media. This has an impact on student learning outcomes. This study aims to describe the process of developing interactive learning multimedia. This development research uses the ADDIE development model. The subjects of this development research are one subject matter expert, 1 learning design expert, 1 learning media expert, 3 students for individual testing, and 9 students for small group testing. The data collection methods used in this development research are the interview method, observation, and questionnaire method. The instrument used to collect data is a questionnaire. The technique used to analyze the data is descriptive qualitative and quantitative analysis. The results of this research on the development of interactive multimedia learning were declared valid with the results of expert reviews of the subject matter content of 98.46% with very good qualifications. The results of the learning design expert review are 92% with very good qualifications. The results of the learning media expert review are 92.72% with very good qualifications. The review results from the individual test are 95%, with very good qualifications. Multimedia interactive learning based on the problem-based learning (PBL) model is suitable for learning.

1. INTRODUCTION

Education is a process of interaction between students and teachers in the form of learning information that contains education as a source of learning and media as a means of learning (Afriyanti et al., 2021; Dumitrescu et al., 2014; Zhang et al., 2020). For this reason, education is a conscious and planned effort aimed at creating a learning environment and learning process for students to actively develop their
potential in the form of religious spirituality, noble character, personality, self-control, intelligence, and other (Abbas & Sagsan, 2020; Johansson et al., 2020). The development of computer technology has a tremendous impact on learning today. One of them in the teaching and learning process, the teacher, must not only make the learning environment fun and interesting, but the teacher must also understand and master the knowledge of learning management inside and outside the classroom (Glory & Ghafray, 2021; Lynch et al., 2021). Teachers must also be able to integrate technology into learning, including through the use of learning media. The choice of a particular teaching method influences the appropriate instructional media, although other aspects must be considered when selecting instructional media (Agustiawan, 2021; Ružičić, 2021). It is because technological developments cannot maximize the teaching and learning process in the classroom. Therefore adequate learning methods are needed to take advantage of existing facilities (Fatqurhohman, 2021; Simamora, 2020). The learning process plays a critical role in producing or creating quality education graduates to create a quality learning process (Codreanu et al., 2020; Graham et al., 2020; Kaso et al., 2021).

However, today's problem is that there are still many teachers who have difficulty using technology to develop teaching materials or learning media that can facilitate students in learning (Simamora, 2020; S. S. Weng & Chen, 2020). In addition, many cases are found regarding the implementation of classroom learning that is still centred on teachers who use the lecture method, which makes students bored in learning (Syauqi et al., 2020; Yuzulia, 2021). This problem was also found in one elementary school. Based on the results of observations and interviews conducted at SDN 1 Banjar Bali, it was found that the problem was that the fifth-grade teacher at SDN 1 Banjar Bali said that teachers had problems in learning, namely the lack of learning media used and the lack of facilities and infrastructure in schools that did not support the production of video media or audio. The teacher also has difficulty conveying the content, especially in relating the material and providing examples of temperature and heat descriptions, because the teacher only explains without pictures of changes in the shape of objects due to the lack of available media. Moreover, students also have difficulty digesting the material presented by the teacher. This condition will make it difficult for students to learn science subjects. Students will only know and study science material because of the limitations of the learning media used to increase students’ knowledge during learning. In this case, the lack of innovation, creative and interactive learning tools in the classroom, and the lack of interaction between teachers and students so that interest in learning can be generated by the students themselves (Jogeza et al., 2021; Samsudin et al., 2019). In accordance with the minimum completeness criteria (KKM) set by the school, namely 63 with a class average of 69.6 and all students in class V/B totaling 32 students. There were 9 students who completed while 23 students did not complete. The problem with low student learning outcomes is that in this learning the teacher only relies on textbooks and visual media, so that students only know the contents of the material in the textbook and there is no application of multimedia learning that involves students’ interest in learning.

The solution offered to overcome these problems is to develop interactive teaching materials. One of them that can be used is interactive multimedia learning using problem-based learning (PBL) learning models. Learning multimedia is media in the form of multimedia packages as a tool to display media content in text, images, audio and video or animation used in learning activities with the help of computer devices for operation (Prasetyo et al., 2020; Rubini et al., 2018). Currently, multimedia refers to the fusion and integration of media such as text, animation, graphics, sound and video in a computer system (Calista & Pujiriyanto, 2021; Fauyan, 2019).

In this case, it defines multimedia as the use of various forms of media in presentations (Lau et al., 2020; Ngurah et al., 2019). Multimedia that is very well known today combines graphics, text, sound, video, and animation. This association is a unit that displays information, messages or learning content together. Various combinations of graphics, text, sound, video and animation are multimedia (Prasetyo et al., 2020; Purwanita et al., 2019). The components in multimedia can be divided into five parts: text, images, sound, animation, and video (Prasetyo et al., 2020; Purwanita et al., 2019). In addition to the importance of interactive multimedia learning, learning also requires the selection and application of learning models. The learning model is a plan or pattern that we can use to design a lesson that will be used in the classroom. One of the learning models that can support interactive multimedia in the learning process is the problem-based learning (PBL) model.

The problem-based learning (PBL) learning model is a learning model in which students solve a problem through the stages of the scientific method so that they learn knowledge related to the problem and have the skills to solve problems (Kavanagh et al., 2020; Ngalimun, 2016). It can be concluded that the problem-based learning (PBL) learning model is an educational approach where the problem is the starting point of the learning process (Hussin et al., 2018; Kristinawati et al., 2018). Various learning processes are needed to acquire knowledge and skills, along with each individual's ability to apply them to life applications. The problems presented are contextual problems with the real world, stimulating students to
think actively and critically according to their experiences (Kumala et al., 2020; Suryawati & Osman, 2018). The main goal of problem-based learning (PBL) is not only to provide a large amount of knowledge to students but also to develop critical thinking skills, learn authentic adult roles and students’ ability to actively build their knowledge (Hotimah, 2020; Nurtanto et al., 2020). This Suparwati arises when students try to solve existing problems with their skills. With this habituation, students can understand the material more deeply.

The findings of previous research also stated differences in learning outcomes in Hindu religious lessons before using Hindu religious learning multimedia (Ayu et al., 2015). Other research findings also state differences in English learning outcomes before using English language learning multimedia (bin Abdul Samat & Abdul Aziz, 2020). Other research findings also state that the results of this PBL interactive multimedia meet the criteria of validity in learning and practicality in learning (Khamzawi & Wiyono, 2015). Other findings also state significant differences in science learning outcomes between students who learn to follow the conventional learning model in fifth-grade elementary school (Kristiana & Radia, 2021; Lestari, 2019). So based on these findings, it can be concluded that interactive learning multimedia is proven to impact student learning outcomes positively.

2. METHOD

This type of research is development research. This development research was carried out at SD Negeri 1 Banjar Bali in class V. The procedure for this development research used refers to the ADDIE development model, which consists of five stages, namely: the analysis stage; the design stage (design); development stage (development); implementation phase (implementation); and the evaluation stage (Cahyadi, 2019). The subjects of this development research are 1 subject matter expert, 1 learning design expert, 1 learning media expert, 3 students for individual trials, and 9 students for small group trials. Data collection methods used in this development research are observation method, interview method, and questionnaire method. This development research uses several instruments in collecting data for research, including observation sheets, interview sheets, and questionnaire sheets. This observation sheet is used to find out the facilities in learning owned by the school and students and to see the teaching and learning process that occurs in the classroom. The use of interviews in this study is to collect data by asking orally to obtain information from respondents. This guide is used to collect data regarding learning problems that occur in the field. Moreover, the use of a questionnaire or lift in this research collects data from reviews from content experts in the field of study or subjects, learning design experts and learning media experts, individual trials, and small groups. The instrument grid of subject matter experts, design experts, instructional media experts and individual trials can be presented in Tables 1, 2 and 3.

Table 1. Grid of Subject Content Expert Instruments

| No | Aspect      | Indicator                                                                 | No |
|----|-------------|---------------------------------------------------------------------------|----|
| 1  | Curriculum  | The suitability of the material with core competencies                     | 1  |
|    |             | The suitability of the material with basic competencies                    | 2  |
|    |             | The suitability of the material with the indicators                        | 3  |
| 2  | Method      | Completeness of the material presented                                     | 4  |
|    |             | Accuracy of presentation of material in multimedia                        | 5  |
|    |             | The suitability of the example with the material presented                 | 6  |
|    |             | The suitability of the image in the multimedia with the material           | 7  |
|    |             | The suitability of animation in multimedia with the material               | 8  |
|    |             | Presentation of material can motivate students                            | 9  |
| 3  | Language    | Suitability of language use in multimedia                                  | 10 |
| 4  | Evaluation  | Suitability of questions with learning objectives                          | 11 |
|    |             | The suitability of the question with the material                          | 12 |
|    |             | Ease of difficulty level of questions on multimedia                        | 13 |

Table 2. Learning Design Instrument Grid

| No | Aspect      | Indicator                                                                 | No |
|----|-------------|---------------------------------------------------------------------------|----|
| 1  | Theme       | The suitability of the material with the learning objectives               | 1  |
|    | Accuracy    | The suitability of the material with the chosen theme                     | 2  |
| 2  | Methodology (how to present the material) | Clarity of the description of the material presented with the theme  | 3  |
|    |             | Clarity of learning methods                                              | 4  |
|    |             | The presentation of the material presented varies                        | 5  |
The data analysis method used in this interactive learning multimedia development research is a qualitative descriptive analysis method and a quantitative descriptive analysis method. This descriptive analysis method is used in processing data in the form of input, criticism, and suggestions in the questionnaire used in revising interactive learning multimedia products from the results of subject matter expert trials, learning design expert tests, learning media expert tests, individual test subjects and test subjects. Try small groups. At the same time, the quantitative descriptive data analysis method is a way of the data processing done by systematically compiling in the form of numbers and percentages regarding an object under study to obtain general conclusions (Agung, 2014).

3. RESULTS AND DISCUSSION

Results

The first stage is the analysis stage. At this stage, three things are analyzed, namely the analysis of student characteristics and problems in learning. Fundamental competency analysis (KD), namely applying the concept of heat transfer in daily life and indicators that include, among others: explaining the meaning of heat transfer, understanding the types of heat transfer and identifying ways of heat transfer in everyday life; facility/environment analysis. This stage of analysis was carried out through observation and interviews. The results of the analysis of student characteristics and problems in teacher learning are the primary learning resources in the classroom, with the method often used being the lecture method and the media used is audio-visual. In this case, students often feel bored and lack the motivation to learn. Then the fundamental competency analysis (KD) and indicators show that the instructional analysis carried out is related to the competencies required to be achieved by students. The material in the interactive learning multimedia developed is based on essential competencies (KD) and indicators. The facility/environment analysis results were carried out, namely to find out the infrastructure owned by the school, such as LCDs and computers. Based on the three analyzes in the analysis phase, the researcher developed an interactive multimedia learning model based on problem-based learning (PBL) in science subjects for fifth-grade elementary school. The second stage is the design stage. This stage is carried out, namely selecting and determining the software/software used to create interactive learning multimedia. The software used is Adobe Flash Professional CS6, Adobe Illustrator 2021, Adobe Audition CC 2017, Corel Draw X8, and

Table 3. Learning Media Instruments Grid

| No | Aspect       | Indicator                                                                 | No. |
|----|--------------|---------------------------------------------------------------------------|-----|
| 1  | Appearance   | Attractive cover/cover design                                              | 1   |
|    |              | The suitability of the cover to the content / content in the multimedia     | 2   |
|    |              | Composition and color combinations that are right and match                 | 3   |
|    |              | Quality of images, graphics, symbols and icons                           | 4   |
|    |              | Readability of material in multimedia                                     | 5   |
|    |              | Button consistency in multimedia                                           | 6   |
|    |              | Media strength/durability                                                  | 7   |
| 2  | Programming  | Consistent multimedia appearance                                           | 8   |
|    |              | The linkage of the relationship between multimedia pages with other pages  | 9   |
|    |              | Proper use of animation                                                   | 10  |
| 3  | Curriculum   | Multimedia learning contains elements of learning.                         | 11  |

(Heo & Toomey, 2020)
Wondershire Filmora X, designing interactive learning multimedia flowcharts and storyboards; develop an interactive learning multimedia assessment instrument; compiling RPP (learning implementation plan). The third stage is the development stage. This stage is developing a product design made into a natural product based on flowcharts and storyboards, which will later be tested for feasibility in the field. The fourth stage is the implementation stage. The results of the development of interactive learning multimedia are presented in Figure 1.

Figure 1. Multimedia Interactive Learning Problem Based Learning (PBL) Learning Model

At the implementation stage, the activities carried out are product validity tests by experts, including subject content experts, learning design experts, and learning media experts; product trials include individual and small group trials. The purpose of testing the validity of the product and testing the product is the effectiveness of the product and the feasibility of the product being developed. The final stage is the evaluation stage. The evaluation stage is the stage for revising the product according to the input, suggestions, and comments received after the feasibility test is carried out to students. Based on the validity test results of interactive learning multimedia products conducted by subject content experts, the percentage was 98.46%, with very good qualifications. Learning design experts obtained a percentage of 92%, with very good qualifications. Learning media experts obtained a percentage of 92.72%, with very good qualifications. Individual trials get a percentage of 95%, with very good qualifications. Small group trials get a percentage of 95.17% with very good qualifications. With very good validity, the product developed is feasible to be applied to the learning process in science lessons. Through the results of the validity of interactive learning multimedia products, suggestions, input, and comments will then be used as a reference for consideration to revise the product for the perfection of the developed interactive learning multimedia product.

Discussion

Based on further studies, several essential experts influence the validity of the developed interactive learning multimedia. The acquisition of very good validity qualifications for subject matter experts is influenced by the presentation of material by the demands of core competencies, essential competencies, and learning objectives used. The suitability of the media will determine the qualifications obtained (Kartika et al., 2019; C. Weng et al., 2018). The assessment results are evidence by subject matter experts on the instrument items related to the suitability of the material with core competencies, essential competencies, and learning objectives to obtain very good criteria. So it can be concluded that the suitability of content with learning objectives is essential in making media. In assessing content aspects, it is necessary to pay attention to the design of learning objectives, competencies and indicators (Lai et al., 2019; Ran & Jinglu, 2020; Septia et al., 2018). Previous research findings stated that subject matter is an essential part of the learning process, even in the subject-centred teaching process, where the subject matter is the core of learning activities (Chen & Li, 2011; Haddock et al., 2020). Other research findings also state that learning effectiveness is defined as realising learning outcomes by predetermined learning objectives (Shea et al., 2013). Clear goals can be used as a reference in every learning process (Arif, 2018; Astra et al., 2020). Based on the assessment of subject matter experts, it can be said that the interactive learning multimedia that has been developed is suitable for use by students in learning activities.

Very good qualifications for learning design experts were also obtained because the suitability of the presentation of the material could increase students’ motivation, as well as the clarity of the media with the material presented. The suitability of learning materials will increase students’ enthusiasm for learning (Garbin et al., 2020; Liang et al., 2011; Oh, 2019). The previous research findings stated that the media used in learning attract students and can motivate student learning (Alexander et al., 2020; Suartama, 2016). So that it makes the interactive learning multimedia developed easy to understand by students and increases student learning motivation, and can increase student interest in learning so that in the learning process,
students can improve learning outcomes well (Lauc et al., 2020; Lee & Osman, 2012). Other research findings also state that instructional design relates to determining learning objectives, strategies, and techniques to achieve learning objectives and providing examples or illustrations in the material (Febrita & Harni, 2020; Sanjaya, 2015). Clarity of illustrations/examples of events in the form of problem orientation. In the development of interactive learning multimedia, it contains illustrations or examples of events in everyday life that are on a problem-oriented display, and each material is also presented with illustrations or examples of events in everyday life (Abu-Eisheh & Ghanim, 2021). With these illustrations/examples, students can activate interest in learning, and students can also involve students to solve a problem in everyday life (Indah Septiani et al., 2020). Other research findings also state that problem-based learning can help students develop thinking and problem-solving skills and become independent learners (Chounta et al., 2017). Based on the assessment results that the learning design expert has given, it can be concluded that the interactive learning multimedia that has been developed is suitable for use by students in learning activities, especially in science subjects for class V and can increase student learning motivation.

The interactive learning multimedia that has been developed pay attention to the elements of the determination and readability of the material in the multimedia, such as font size, typeface, writing space, the suitability of the layout of the text presented in interactive learning multimedia using sentences that are easy to read by students. Learning media has a crucial function, namely as carriers of information and preventing obstacles to the learning process, so that information or messages from communicators can reach the communicant effectively and efficiently (Lynch et al., 2021; Suartama, 2016). Quality of images, graphics, symbols and icons and consistency of multimedia appearance. In the interactive learning multimedia that has been developed, some pictures strengthen the delivery of the material. It is considered in the addition of pictures, among others, as follows; the quality of images, graphics, symbols and icons in the media; consistency of multimedia appearance (Bus et al., 2020; Marnita & Ernawati, 2017). The presence of images, graphics, symbols and icons that match the material and the consistent multimedia appearance presented can attract students’ attention to make learning fun (Khamparia & Pandey, 2017; Khan & Masood, 2015).

The media aspect is to determine the criteria for multimedia quality, which can generate motivation using images, graphics, symbols and icons and the consistency of the suitable multimedia appearance (Antal et al., 2017; Suartama, 2016). As with other research findings, it is also stated that long and abstract descriptions are easier to understand if visualized with pictures, and pictures can make it easier for people to remember messages (Kurniawan et al., 2020). The suitability of the cover to the content in the multimedia. In the development of interactive learning multimedia that has been developed, there is a cover in the multimedia. So that it can cause students’ attention and can make it easier for students to understand the material presented on this multimedia. Quality criteria for learning multimedia such as covers will attract students’ attention, leading to increased learning outcomes (Müller & Wulf, 2020; Suartama, 2016). Materials that are facts and concepts require media so that students can easily understand the material (Imamah & Susanti, 2021). The existence of interactive learning multimedia developed by researchers makes it easier for students to understand science learning. In addition, interactive multimedia learning is also interesting for students. That way, students become motivated to learn and improve learning outcomes (Dede Mukti Herdiyanto, Sultan, 2020; Utama et al., 2014).

Based on the results of this study, it has several implications, namely an interactive learning multimedia product based on problem-based learning (PBL) learning model with excellent qualifications so that students can understand learning materials, especially science. With interactive multimedia learning based on problem-based learning (PBL) learning models, teachers will find it easier to deliver learning materials and motivate teachers to create creative, innovative, and interactive learning media. In addition, the advantages of interactive learning multimedia products based on the problem-based learning (PBL) learning model developed are displaying concise media and interactive learning multimedia equipped with essential competencies, indicators, and learning objectives. In addition, interactive multimedia learning is also equipped with a problem orientation, which shows the problems found in the home and school environment. Moreover, this interactive learning multimedia is also equipped with independent observation/investigation. This interactive multimedia learning also reflects the problem-based learning (PBL) learning model. As well as this interactive learning multimedia, it is also equipped with learning videos to support the material being studied. However, there are shortcomings in developing interactive learning multimedia products based on problem-based learning (PBL) learning models. Namely, interactive learning multimedia products have not been implemented, so it is recommended that researchers continue this research and produce interactive learning multimedia products based on problem-based learning models. (PBL) on other learning materials and models.
4. CONCLUSION

The interactive learning multimedia is in excellent qualification and is declared feasible based on the results of the validity test of the experts. Thus, it is feasible to use in the learning process in the classroom. The use of interactive learning multimedia in the learning process is very effective in attracting students' interest in learning and making learning more interactive to improve student learning outcomes significantly.

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