



DEVELOPMENT OF MULTIMEDIA FOR LEARNING THE TOPIC OF BAR DIAGRAM FOR GRADE IV ELEMENTARY SCHOOL

Fitria Maya Iswara¹, Erlanda Nova Dinata^{2*}, Herlina Ike Oktaviani³, Agus Wedi⁴

State University of Malang, Jl. Semarang No. 5 Malang, East Java, Indonesia

*Author of correspondence, Email: erlanda.nova.2401216@students.um.ac.id

Abstract

The learning media on the topic of bar diagrams has limitations due to the lack of varied learning media, which is confined to print media in the form of modules only. This method of learning is considered to be less effective in supporting students' understanding and involvement in the learning process. In fact, the topic of bar diagrams requires visualization to effectively represent bar charts. Therefore, it is necessary to develop learning media on the topic of bar diagrams. This research and development uses the Canva website and aims to produce a multimedia learning product and to assess the feasibility of the developed multimedia to support learning in the 4th grade of SDN Sumbersari 2 in Malang City. This research uses the development model from Lee & Owens (2004) with the following research stages: 1) Analysis Stage; 2) Design Stage; 3) Development Stage; 4) Implementation Stage. This indicates that the developed multimedia learning is suitable for use as a learning medium and can be utilized in education.

Keywords: Learning Media, Multimedia Learning, Bar Chart, Elementary School.

1. Introduction

One important aspect that influences the development of educational quality is the development of science and technology (IPTEK). According Ministry of Education and Culture of the Republic of Indonesia, "The development of science and technology has a major impact on various aspects of life, including the learning process." Based on the statement conveyed, it is concluded that technological progress will affect various aspects, one of which is in the field of education which innovates and adapts to technological developments to create a more dynamic and interactive learning system. Moreover, the increasingly rapid development of technology, the learning process in the modern era is required to be more innovative and varied (Sapriyah, 2019).

Mathematics plays a crucial role in developing clear, critical, verbal, innovative, structured, and rational thinking skills (Wahyuddin, 2020). In reality, students still face difficulties in understanding mathematical concepts, especially bar diagrams, due to the abstract and unengaging presentation. Data obtained show that 76% of students experience errors in calculating averages, and 81% have difficulty analyzing statistical data (Kusumaningpuri, 2024). According to (Misnawati et al., 2024), the main obstacles faced by students are difficulty in converting reading questions into diagrams, as well as confusion in determining data values appropriately. This is in accordance with the learning objectives of bar diagrams, namely being able to understand, differentiate, present, and interpret bar diagrams. This proves that students have difficulty digesting concepts in mathematics, especially the topic of bar diagrams. Therefore, media is needed to visualize images so that students can understand the material.

(Sihkabuden, 2005) defines media as a tool that acts as a link in the process of conveying messages through the sender. information to the recipient. One of the innovative breakthroughs utilized is interactive learning multimedia. (Hofstetter, 2003) defines interactive multimedia as the use of computers that integrates text, images, audio, and animation, enabling users to navigate, interact, and communicate. Research by (Wulandari et al., 2020) states that the use of multimedia-based learning media has a positive impact on increasing students' attention, interest, and engagement with the material presented. This occurs because the combination of text, images, video, sound, and animation can support students in visualizing images effectively.

An innovative use of interactive learning multimedia is Canva. Canva has the capability to present various elements such as text, video, animation, music, images, and graphics that support student understanding in learning (Leryan et al., 2018). With its easy-to-use features and flexible access, Canva is a practical solution for educators in creating learning materials that are more enjoyable, creative, and understandable for students. Canva is available in several versions, including web, *iphone*, and Android, so it can be used anytime, including for studying at home. Besides being flexible and easy to use, Canva is also inexpensive, as it only requires a data plan or internet connection.*wifi*.

Based on observations at SDN Summersari 2, it was found that SDN Summersari 2 has adequate supporting facilities to support the learning process. Some of these facilities include LCDs, projectors in each classroom, and a computer laboratory that can be used to support learning. According to the homeroom teacher, most of the mathematics learning process that takes place in the classroom is still one-way and consists of practice problems. Oral delivery of material often cannot accommodate various learning styles of students, such as visual, auditory, and kinesthetic. As a result, not all students are able to understand the material well. The lack of interesting learning innovations causes students to face difficulties in understanding the concepts presented, making the learning process less effective.

The use of media in the classroom is still limited to printed media such as textbooks, concrete and tactile materials. Proves that the use of interactive multimedia can be an alternative to using printed media. Commonly used media, such as images made of paper, can easily be damaged if used continuously. The limitations of media include the inability to be used for a long period of time and the high cost of production, as each student must use it. This minimal and less varied use of learning media results in the material delivery process not being fully conveyed to students.

One possible solution to the aforementioned problem is the need for a variety of interactive learning multimedia development tools that are affordable, flexible, and easily accessible as tools for visualizing mathematical concepts in the learning process. Based on these considerations, researchers were motivated to conduct research focused on the development of digital-based learning media. This research will be entitled "*Development of Learning Multimedia for the Topic of Bar Diagrams for Grade IV Elementary School.*"

2. Method

The development model applied in this study is the (Lee & Owens, 2004) development model. This model is specifically for multimedia development and each development stage is explained in detail and completely from each stage. This is considered very appropriate in developing interactive learning multimedia products. The steps in the Lee & Owens

development model are: 1) Assessment/analysis which consists of two main parts: needs analysis and front-end analysis; 2) Design; 3) Development; 4) Implementation; and 5) Evaluation.

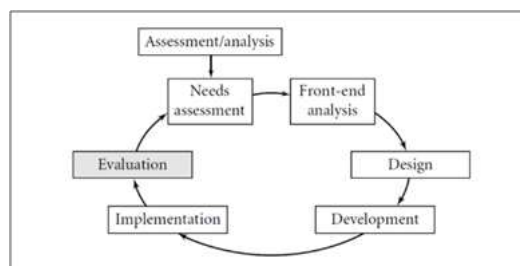


Figure 3. Steps of the Lee Owens Model

2.1. Research Procedures

2.1.1. Analysis

Based on observations, interviews and observations conducted, the results showed that learning activities still use printed media from paper which is easily damaged so it cannot be used in the long term so that the material presented is less interesting and does not meet the learning styles of students, so that students are not maximally involved in learning. Students are more interested in using varied learning, which involves the use of technology such as images, animations, videos, and educational games. Based on the stages *front-end* (final analysis) including:

1. Audience Analysis, the target number of students in this research and development is 20. Students have an interest in various learning media, especially those involving the use of technology such as images, animations, and educational games.
2. Technology Analysis, computer laboratory facilities according to the number of students and have LCD and projectors in each class.
3. Situation Analysis: Learning takes place in a classroom that is neat, clean, and comfortable. Learning is conducted entirely using textbooks and verbal explanations from the teacher.
4. Task Analysis, the skills that students are expected to have are mastering the ability to explain, differentiate, create and interpret bar charts.
5. Critical Incident Analysis, in critical incident analysis, the things that students must master are the definition of bar diagrams, the difference between horizontal and vertical bar diagrams, making bar diagrams and interpreting bar diagrams.
6. Problem Analysis (Issue Analysis), students need varied learning media to visualize the material and increase engagement so that learning objectives are achieved by accommodating various learning styles of students, both visual, auditory, and kinesthetic learning styles.

7. Objective Analysis, in interactive learning multimedia on bar diagram material, there are several learning objectives, including: 1) Students are able to understand the concept of bar diagrams, 2) Students are able to differentiate between vertical bar diagrams and horizontal bar diagrams, 3) Students are able to present data from tables in the form of diagrams appropriately, 4) Students are able to interpret bar diagrams.
8. Media Analysis, the type of media that will be developed is interactive learning multimedia that is able to display several media such as images, animations, and educational games that are able to accommodate various learning styles of students, both visual, auditory, and kinesthetic learning styles.
9. Existing Data Analysis: Based on the existing problems, the researcher will develop a Canva-based interactive learning multimedia, using bar charts taken from textbooks. This consideration has been taken into account in relation to previously obtained data, including school facilities, student challenges, and media limitations.
10. Cost Analysis, in this development does not require certain costs because it only uses Canva software which can be accessed for free.

2.1.2. Design

(Lee & Owens, 2004) explain that several steps are taken during the design phase, including creating a development schedule, media specifications, and material structure. At this stage, the media is structured according to the specifications and structure of the material and elements to be presented in the learning multimedia. The final stage is configuration control to ensure the developed media is consistent, manageable, and meets established quality standards.

2.1.3. Development and Implementation

The development and implementation stages were carried out to develop media in accordance with the designed framework using the Canva application or website and other supporting devices. Next, validation was carried out with material and media experts using a questionnaire. The validated media was then validated with subjects, namely 20 fourth-grade students of Summersari 2 Elementary School using a questionnaire.

In collecting questionnaire data using a scale *likert* with four answer choices: score 1 strongly disagree, score 2 disagree, score 3 agree, score 4 strongly agree. The questionnaire was given to the material expert validator, media expert validator, and students to determine the validity of the learning media. The data obtained were then analyzed using quantitative descriptive methods. To determine the percentage of feasibility, the following formula can be used:

$$P = \frac{\sum x}{\sum x_i} \times 100\%$$

Information :

P : Feasibility percentage

$\sum x$: Total number of validator answer scores (real value)

Σx_i : Total number of highest answer scores (expected value)

According to Arikunto, (2009) the criteria used in determining percentage results use the following data:

Table 1. Product Eligibility Criteria

Kriteria Kelayakan (Presentase)	Kriteria Validasi
81% - 100%	Sangat Layak
61% - 80%	Layak
41% - 60%	Cukup Layak
21% - 40%	Tidak Layak
0% - 20%	Sangat Tidak Layak

Source: (Arikunto, 2010)

3. Results and Discussion

3.1 Result

This research and development resulted in a multimedia learning tool to help students understand the learning concept of the main topic of bar charts. In developing this tool, the researcher used the Canva application to create interactive learning multimedia. This learning multimedia tool has navigation in the form of buttons to access the material menu that can be accessed by users. The main page contains a menu selection of instructions, learning objectives, materials, and games. On the material page, there is a presentation of material containing an explanation of the meaning of bar charts, the difference between horizontal and vertical bar charts, the steps to create bar charts, and interpreting bar charts. The delivery of material in this tool is in the form of images, text, and animation. The games menu Contains practice questions that students can work on to measure their understanding of the material contained in the learning media.



Figure 2. Multimedia Learning Display

The media development validity testing process was carried out in three stages. The first stage was obtained through the results of media experts' validation, the second stage was obtained through the results of material experts' validation, and the final stage was obtained through the results of student responses. Based on the questionnaire administered, the following results were obtained:

Table 2. Material Expert Assessment Scores

In the validity test data with material experts with several aspects, namely material suitability, content accuracy, usefulness, and operational ease. Based on table 2, the results of the material suitability aspect have an average of 4 aspects of material content suitability obtaining a score of 3.54, the usefulness aspect obtaining a score of 4, and the operational ease aspect obtaining a score of 4. The overall analysis can be presented at 93.5% so that it can be interpreted that the material contained in the interactive multimedia on the topic of the developed bar diagram is stated to have been very worthy. The responses from material experts are: the media needs to be adjusted by providing background sound, including learning outcomes in the guidebook, creating question outlines and answer keys in the guidebook, and adapting questions to the students' daily conditions.

Table 3. Evaluation Score of Media Members

In the validity test data with media experts, there are several aspects, namely general appearance (design), ease of operation, media usefulness, and media variety. Based on table 3, the results of the general appearance (design) aspect obtained a score of 3.83, the ease of operation aspect obtained a score of 3.66, the media usefulness aspect obtained a score of 4.00, and the media variety aspect obtained a score of 3.75. The overall analysis can be presented at 95% so that it can be interpreted that the interactive multimedia topic of the bar chart developed has been declared to have been very worthy used. The response from the content experts was: "Generally good. Optimize the video sound quality, layout, and provide a complete identity. Synchronize with the learning design."

Table 4. Student Response Scores

In the validity test data with students, there are several aspects, namely the accuracy of the material, media presentation, ease of operation, and usefulness. Based on table 4, the results of the accuracy of the material aspect obtained a score of 3.34, the media presentation aspect obtained a score of 3.32, the ease of operation aspect obtained a score of 3.30, and the usefulness aspect obtained a score of 3.30. The overall analysis can be presented at 93.5% so it can be interpreted that the interactive multimedia topic of the bar diagram that was developed has been declared to have been very worthy used.

3.2 Discussion

Interactive multimedia has been successfully developed to enhance student understanding in learning. Attractive design can increase student engagement and understanding in learning. Visualization, a process of forming mental images, can help students understand abstract concepts more clearly (Wulandari et al., 2020). The advantages of this media lie in its engaging visualization, flexibility, ease of access, ease of delivery, and saving time in learning preparation.

This media has been validated by material experts and media experts, as well as responses from students. Based on the tests conducted, data has been obtained indicating that the interactive multimedia developed is effective. very worthy. This result is in accordance with review. The material experts consisting of 4 aspects, namely the aspect of material suitability, the aspect of material content suitability, the aspect of usefulness, and the aspect of

operational ease as a whole have a positive value with 16 statements obtaining a value of 4 and 5 statements obtaining a value of 3 with an overall percentage of 93.5%. This shows that the multimedia development developed can fulfill various aspects from the specified aspects.

Validation results Media experts, which consisted of four aspects, namely the general appearance (design), ease of operation, usability, and media variety, also showed that overall the assessment was positive, with 16 statements scoring 4 and 4 statements scoring 3, with an overall percentage of 95%. In accordance with previous research, validation results from media, material, and language experts showed that Canva-based interactive media had a validity level of between 90% and 97%, which is categorized as very valid (Erta, 2025). This shows that the multimedia development that has been developed is able to fulfill various aspects of the media that have been determined.

The results of the trial on students showed that the overall value was positive with an overall average of 3.28 and a percentage of 83.5%. Overall, students commented positively on the multimedia developed. This was reinforced by the results of student learning showing maximum results with the percentage of students who passed the KKM as many as 13 children with a percentage of 65%, on the contrary, students who did not pass the KKM were 7 children with a percentage of 35%. Based on the data obtained, the majority of students showed maximum learning outcomes, so that students have succeeded in achieving the learning objectives that have been set after using interactive multimedia. This statement is in accordance with the research of (Fazriyah et al., 2023) who stated that the use of Canva learning media has an effect on student learning outcomes in elementary schools.

The implementation results indicate that the development of interactive multimedia effectively improves student understanding, increases student engagement in learning, and motivates students to engage with bar diagrams. (Permatasari et al., 2021) demonstrated that the use of Canva in learning significantly improves student learning outcomes. This is because Canva facilitates educators in presenting material systematically and engagingly, and facilitates students' visual and kinesthetic learning styles. The use of Canva significantly improves student learning outcomes, particularly in mastering concepts and early reading skills. Furthermore, Canva supports student creativity and enhances their digital skills (Firdaus, 2020).

The application of the (Lee & Owens, 2004) model in the development of interactive multimedia has proven effective in improving the quality of learning material on bar charts from learning outcomes and student engagement. Each stage in this model contributes to producing learning media that suits student needs. Improved student learning outcomes indicate that this media is not only visually appealing but also effective in supporting students in understanding abstract mathematical concepts and increasing student engagement in learning. The use of appropriate learning media can support increased understanding and absorption of students towards the material they are learning (Puspitarini & Hanif, 2019; Widodo & Wahyudin, 2018). Positive responses from students indicate that media can be a good alternative in mathematics learning in elementary schools.

Interactive multimedia can transform abstract material into concrete through visualization and can be operated independently to provide learning opportunities for students to actively participate in their learning activities (Manurung, 2020). Canva-based interactive media provides opportunities for students to be able to learn independently and collaboratively, because the material presented is not only interesting but also flexible and easily accessible

through digital devices. (Cairncross & Mannion, 2001; Wulandari et al., 2020) stated that the interactive system in interactive multimedia facilitates active learning activities that involve students in learning activities to achieve better understanding. Student involvement in learning activities provides opportunities to explore more material. Learning activities that involve students in accessing information about the material can improve understanding for the better (Rusman, 2014).

The results of this study are in line with Mayer's multimedia theory, which states that learning is more effective if information is presented through a combination of writing, images, and audio (Mayer, 2005). The media developed has an interesting presentation of material from a combination of writing, images, animation and interactivity so that it can help improve student understanding. According to research by (Armansyah et al., 2019) the use of interactive multimedia as an alternative learning media can increase student interest and understanding of the material. According to (Sadiman, 2008), multimedia is able to present a richer learning experience because it combines elements of writing, images, sound, and animation in a unified whole. This is in line with Mayer's opinion (2009) in the Multimedia Learning theory, which states that "students learn better from words and images than from words alone" (Mayer, 2005).

Complex and abstract learning materials can be concreted using interactive multimedia to help students understand the material (Armansyah et al., 2019). The use of diverse learning media such as writing, audio, animation, and images makes the information conveyed have high communication value so that it can support students in learning. (Gustina et al., 2024) stated that the use of multimedia is effective in helping students understand the material in the learning process. Based on research conducted by (Azmi & Rahmat, 2020), the menu that the use of visual-assisted media can improve student understanding seen from cognitive activities and visual reading activities. It can be concluded that interactive multimedia on the subject of bar charts is designed for the learning process that can be used individually. Students are encouraged to be able to explore the material to achieve learning objectives and learning outcomes in improving conceptual understanding through student visualization.

4. Conclusion

Based on the research results of the development of interactive learning multimedia on the topic of bar diagrams for grade IV Elementary Schools, it can be concluded that this development can be an innovation and solution in overcoming problems in learning, especially as a tool in visualizing mathematical concepts in the learning process that is cheap, flexible, and easy to access. Reviewed from the results of the validation of media and material experts, this learning media received a very suitable category for use in learning. Students also showed a positive response and interest in using this learning multimedia. This development uses the Lee & Owens (2004) model with steps namely analysis, design, development, implementation, and evaluation. From the results of the validity test by media experts, material experts, and students, the developed learning multimedia was declared suitable for use as a learning medium. It is hoped that in the future, this multimedia will be developed even better with innovations that adapt to current developments.

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