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The Development of Animation-Based Learning on Students' Numeracy Literacy Skills

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ABSTRACT

This research is to provide animation-based learning media to enhance the autonomous curriculum programme in the area of numeracy. The study's findings will be reliable and useful in the real world. The ADDIE paradigm is being used in this study of development. This study had three phases: The fourth-grade students of a state elementary school in Banjar during the 2022–2023 school year made up the study's population. The data was collected from a group of 35 fourth graders. The data was analysed using quantitative and qualitative methods. The Smart Apps Creator software is being used in this development study; ultimately, researchers use it to create animated educational materials. Expert validation results show that the data generated from these trials are quite valid, with an average of 90% accuracy. In addition, 93 % of students rated animation-based learning material as effective, while 90 % of teachers rated it as useful. Students then finish traditionally, scoring an average of 94% in the very effective category on the numeracy literacy test. This figure establishes animation as a realistic, practical, and successful learning medium for fourth-grade elementary school fractions.

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1. INTRODUCTION

Indonesia and the rest of the world were hit hard by the COVID-19 Pandemic in early 2020. There was a dramatic increase in the number of students who fell behind in both reading and maths during the two years the COVID-19 epidemic was in effect. The Department of Advanced Research and Higher Education (2021). Evidence suggests that first-grade literacy and numeracy were at 129 points and 78

points, respectively, before the COVID-19 Pandemic (Pasaribu, 2020). Meanwhile, Grade 1 learning stagnated throughout the COVID-19 pandemic. A student's learning loss in literacy is equivalent to a six-month learning delay. According to BSKAP (2021), children lose as much knowledge in mathematics as they would in five months of school. Simple interviews and classroom observations conducted at the beginning of the odd semester at an elementary school in Banjar corroborate the facts. The study's findings indicate that textbooks and not even Student Worksheets (LKPD) are still used as the primary means of instruction in the classroom. Given these realities, it's clear that instruction is still falling short of what children need and what teachers want, leading to stagnant growth and poor learning outcomes for students. The recent COVID-19 pandemic in Indonesia has made the situation even worse. For education in general, and for education at SD N 010246 Banjar in particular, the establishment of an autonomous curriculum as an endeavour to reestablish learning is a breath of fresh air.

One of the solutions to the problems described above can be overcome by presenting digitalization in learning, namely by utilizing the sophistication of information technology. Animation-based learning media(Fedák & Bauer, 2005). The advantage of this animation-based learning media product is that this animated video learning media increases interest in learning, can provide a sense of fun during the teaching and learning process, and increases understanding of the learning process.Huang, Hwang, & Jong (2022) or Abdallah (2019) or Chaudhari (2017) or Anggraeni, Alpian, Prihamdani, & Winarsih (2021) or (Andriati, Susanti, & Hudaidah, 2016) or (Parlindungan, Mahardika, & Yulinar, 2020). Animation can be designed with various colours, shapes, and other creative things. This animation will make the learning atmosphere more lively or active because the visual appearance of the subject matter is more attractive. Learning media is useful for teachers and students to. Teachers can be clearer in conveying material using media; students will more easily understand the material presented with interesting media by Winarto, Syahid, & Saguni (2020) or Mayer (2002). Displaying animation-based learning media directly can help implement an independent curriculum designed to catch up with education during the COVID-19 pandemic by Grace, Isa, Ismaniar, & Mintarsih Arbarini (2021).

An independent curriculum programme authorised by the Minister of Education and Culture needs to be implemented, and this study's urgency stems from the need to address issues that have been researched by academics from many existent phenomena: pupils' difficulties with numeracy and quantitative literacy. Supplementing the previous curriculum are Kepmendikbudristek Number 56 of 2022, Guidelines for Implementing Curriculum in the Context of Recovery Learning (Free Curriculum), and Law No. 56 of 2022, Concerning Guidelines for Implementing Curriculum in the Context of Recovery Learning (Free Curriculum). Given the pressing nature of the situation, this study is crucial to assisting the Ministry of Education, Culture, Research, and Technology in adopting MBKM (Merdeka Learning Kampus Merdeka), an alternative curriculum essential to the improvement of the current one. This study is timely since it supports the goals of the university's strategic plan for 2021–2025: promoting creative education in the age of the digital society. 5.0.

This research was conducted to produce valid, practical, and effective animation-based learning media to support the independent curriculum program. This research is called development research because this research produces a product. The product produced in this study is an animation-based learning media. The resulting animation-based learning media has also been validated and tested, so this research produces learning media suitable for use by Pereira, Tan, Li, & Purnama (2020). The development model used in this study is the ADDIE model developed by Reiser and Mollenda by Molenda (2003). This development model was chosen because it has several advantages: (1) it is more appropriate to use as a basis for developing a learning system, (2) its description is more complete and systematic, (3) its development involves expert judgment so that before the trial it is revised based on expert advice.

Based on the description above, it is necessary to develop animation-based learning media to support the independent curriculum. Therefore, this study aims to produce animation-based learning media to support an independent curriculum based on valid, practical, and effective criteria.

2. METHOD

This research produces valid, practical, and effective animation-based learning media to support the independent curriculum program. This research is called research and development because this research produces a product. The product produced in this study is an animation-based learning media. The resulting animation-based learning media has also been validated and tested so that this research produces learning media that are suitable for use in the process.

The research employed the ADDIE model of development created by Reiser and Mollenda by Molenda (2003). The benefits of this development strategy led to its selection. The development involves expert judgement so that it is amended based on expert advice prior to testing, (2) the description is more comprehensive and methodical, and (3) it is more suitable to serve as the basis for constructing a learning system. Five primary phases comprise the ADDIE development model: analysis, design, development, implementation, and evaluation (Molenda, 2003).

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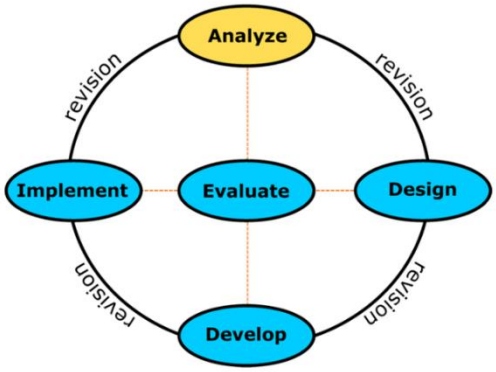

Figure 1. ADDIE Model Development Flow

The analysis phase consists of two steps: performance analysis and needs analysis. The performance analysis stage was carried out to gather information about the teacher's performance in the learning activities encountered on the material properties of flat shapes in grade IV students. From the results of the performance analysis evaluation, the researchers were able to determine the needs analysis of fourth-grade students. Based on the results of observations, it was found that the teacher had not used instructional media that could attract students' interest and concentration. The results of this analysis are used for consideration of developing learning media.

This research was conducted at SDN 010246 Banjar at the start of an odd semester. This research was conducted with a broad test. The sample in the broad test was carried out as many as 35 grade IV students. The instruments used in this study were questionnaires and tests. Questionnaires are used to determine the validity and practicality of animation-based learning media. This questionnaire consists of a construction validation questionnaire for animation-based learning media, a material validation questionnaire, a language validation questionnaire, and a practicality questionnaire for animation-based learning media. While the test is used to determine the effectiveness of animation-based learning media used by fourth-grade students.

The techniques used to analyze the data are quantitative and qualitative analysis techniques. This technique is used to process data regarding the validity of the media, the practicality of the media, and the effectiveness of the media used so that the end result can be determined. The stages of data analysis techniques carried out are as follows.

2.1 Validity Data Analysis

In this study, data analysis refers to the process of describing the results of product development. To start analyzing expert and teacher validation data on media, first change the results of the assessments that are still there from media experts, material experts, and teachers into scores, which are shown in the following table:

Table 1. Rating Score Guidelines

Score	Category
4	Very Valid
3	Valid
2	Valid Enough
1	Invalid

The activities carried out in the process of analyzing the validity of the device data are as follows (A. Pratiwi et al., 2022).

$$NV = \frac{x}{y} \times 100\%$$

Where:

NV = Average validation score

x = Sum of validator scores

y = Maximum validator score

Table 2. Validity Category

Criteria Intervals	Category
$81\% - 100\%$	Very Valid
$61\% - 80\%$	Valid
$41\% - 60\%$	Valid Enough
$21\% - 40\%$	Invalid
$0\% - 20\%$	Invalid

Source:(Hodiyanto et al., 2020)

2.2 ***Practicality Data Analysis***

1. Analysis of Student and Teacher Response Questionnaires

The Likert scale is used in a student assessment tool for learning media and student responses after using learning media, changing each answer choice from qualitative data to quantitative data to allow for the following calculations:

Table 3. Score Guidelines for Student Response Assessment

Score	Category
5	Strongly Agree (SS)
4	Agree (S)
3	Simply Agree (CS)
2	Disagree (TS)
1	Strongly Disagree (STS)

Source:(Arciniegas Paspuel, 2021)

The following is the teacher's evaluation tool for learning media and the teacher's response to Prezi using a Likert scale:

Table 4. Guidelines for Teacher Response Assessment Scores

Score	Category
4	Very Good (SB)
3	Good (B)
2	Less (K)
1	Very Less (SK)

Source:(Sulistya, 2017)

Student and teacher response questionnaire instruments, were used to collect data on response questionnaire assessment guidelines using a Likert scale. The percentage of all assessed is determined after the assessment using the formula below:

$$R = \frac{F}{N \times I \times R} \times 100\%$$

Where:

R = Response
F = Number of respondents' answers
N = Highest Score
I = Number of items
R = Number of respondents

For student and teacher responses to instructional media, the percentage ranges and questionnaire criteria are as follows:

Table 5. Practicality Category

Criteria Intervals	Category
$81\% < R \leq 100\%$	Very Practical
$61\% < R \leq 80\%$	Practical
$41\% < R \leq 60\%$	Pretty Practical
$21\% < R \leq 40\%$	Less Practical
$0\% < R \leq 20\%$	Impractical

Source:(Modul et al., 2019)

In accordance with the description above, learning media is considered practical if it gets a qualifying category score of 61% or more.

2.3 Effectiveness Data Analysis

The effectiveness of students' mathematics learning outcomes was determined through tests of students' mathematics learning media.

1. Learning Outcome Test

Data was collected on students' mathematics learning outcomes through tests of students' mathematics learning outcomes. The following are test scoring guidelines:

Table 6. Guidelines for Scoring Tests for Mathematics Learning Outcomes

Student Answer Criteria	Score
Does not provide a solution at all	0
Just copy the problem in the problem	1
Provide solutions that have elements of truth but are incomplete	2
Provides complete relevant solutions but contains errors in placement	3
Provides complete relevant solutions, mathematical notation is correct, but there is an error in the mathematical calculation	4
Provide a complete and correct solution	5

Source:Harefa (2009)

While the final student score is obtained by the following formula:

$$Final\ Score = \frac{Total\ Score}{Maximum\ Score} \times 100$$

3. FINDINGS AND DISCUSSION

Animation-based learning media was developed on fractional material to support the post-Covid-19 recovery acceleration program. The development carried out in this study has two objectives. The first goal in this development is to develop animation-based learning media on fractional material, which is seen from the numeracy literacy skills of fourth-grade students at SD N 010246 Banjar. The second objective of this development is to identify students' responses to the development of learning media on fractional material. This animation-based learning media is based on core competencies, essential competencies, and achievement indicators on fractional material in grade IV. In this study,

researchers used the ADDIE development model, which consisted of 5 stages Peterson (2003) or Widyastuti (2019), namely the stages of analysis, design, development, implementation, and evaluation. The analysis phase of the activities carried out is to determine and define the needs in the learning process and find all the information needed to be used to develop animation-based learning media. At this stage, the researcher conducted a preliminary analysis (Front-End Analysis), and learner analysis. Task analysis, concept analysis, and the last is the analysis of learning objectives (Specifying Instructional Objectives) Kristanto (2016).

The stages of activity design are the preparation of an animation-based learning media framework, systematic and material design, as well as instrument design by Wijaya, Mustaji, & Sugiharto (2021). The application used in the development of animation-based learning media is the Smart Apps Creator application. At the development stage, the activities carried out are steps to produce a product from the results of the development. After the animated video is finished, it is validated by media experts, material experts, and linguists. The goal is to determine whether animation-based learning media is suitable for the learning process. The Implementation Stage is the fourth stage of the ADDIE learning model; At this stage, everything that has been developed is installed or arranged in such a way according to its role or function so that it can be implemented.

The implementation stage of this training is carried out by the direct media trials Branch (2009). At this stage, the researcher will carry out a spaciousness test, after which students and teachers will be given student and teacher response questionnaires. This is done so that practical requirements can be met. At the Evaluation stage, tests are carried out before and after learning is carried out in class or trials that have been carried out. After the implementation phase, an initial evaluation is carried out at the end of the meeting to provide feedback on the application of animation-based learning media. The assessment was carried out in the form of giving students numeracy literacy ability instruments which were divided into pretest and posttest. The pretest is carried out at the beginning of the lesson, and the posttest is given at the end of the lesson. The validator has validated the tests given to students to determine the pretest and posttest results obtained during teaching and learning activities in class.

Based on the results of the learning media assessment carried out by the validator, namely three learning media experts, the results obtained were 1) The feasibility test of animation-based learning media has an average percentage of 93% which includes the very good category, 3) The feasibility test of the teacher's response questionnaire has an average of 90% which is included in the extraordinary category; 4) The feasibility test of student response questionnaires has an average percentage of 88% which is included in the very good category; 5) The feasibility test for the numeracy literacy test has an average of 84% which is included in the very valid category; 6) The feasibility test for observing student activity on average is 89.1% included in the very valid category. Based on all validation results, it can be concluded that animation-based learning media is very valid to use.

Table 7. Learning Media Validation Results

		Percentage	Criteria
1.	Material / Content	91%	VeryValid
2.	Learning Media Criteria	88%	VeryValid
3.	Media View	89%	VeryValid
4.	Language Aspect	91%	VeryValid
	Amount	93%	VeryValid

The following is a diagram of the results of learning media validation.

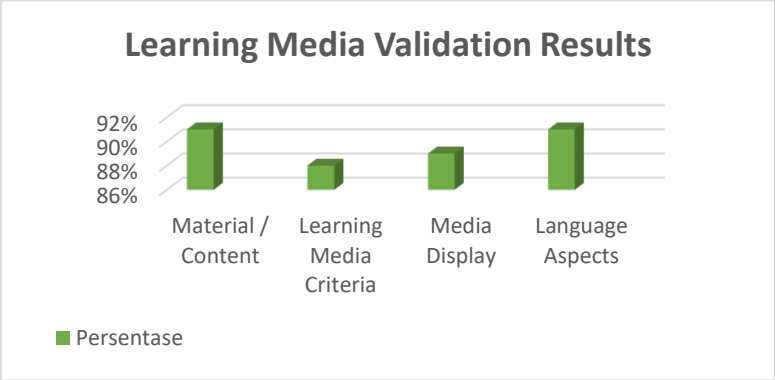

Figure 2. Diagram of Learning Media Validation Results

Table 8. Teacher Response Questionnaire Validation Results

Assessment Indicator	Percentage	Criteria
Format	89%	Very Valid
Fill	89%	Very Valid
Language	93%	Very Valid
Total	90%	Very Valid

Table 9. Student Response Questionnaire Validation Results

Assessment Indicator	Percentage	Criteria
Format	89%	VeryValid
Fill	85%	VeryValid
Language	93%	VeryValid
Total	88%	VeryValid

Table 10. Results of Pretest Validation of Numeral Literacy Ability

Assessment Indicator	Percentage	Criteria
Eligible Content	81%	VeryValid
Language and Question Writing	78%	VeryValid
Total	80%	Very Valid

Table 11. Posttest Validation Results for Numerical Literacy Ability

Assessment Indicator	Percentage	Criteria
Eligible Content	87%	VeryValid
Language and Question Writing	82%	Valid
Total	84%	VeryValid

The validators' assessments of the quality of various learning media are summarised in Table 1. Animation-based learning media, in particular, is found to be highly valid across a variety of criteria, including material/content, learning media criteria, display, and language use. Then, look at Table 2. According to the validation results based on the teachers' responses, animation-based learning media

was well-received in the classroom. In addition, as seen in table 3 below. Students gave the findings of the validation of their answers to animation-based learning material a resounding thumbs up. Based on the results of Table 4's pre-test validation and Table 5's post-test validation, it is safe to conclude that animation-based learning media can be effectively used in the classroom.

After validation by the validator, the next stage is animation-based learning media which will be tested on 35 grade IV students at SD N 010246 Banjar. Learning is designed for two meetings; Learning activities are divided into preliminary, core and closing activities. At the final stage of learning, students are given a test in the form of 5 essay questions to see the effectiveness of the mathematics learning media used. Then after testing the animated learning media, fill out a response questionnaire to students and teachers about the learning media used. The results of the student response analysis showed a percentage of 88% in the practical category, and the results of the teacher's response analysis obtained 100% with the active type. Judging from the results of the student response questionnaire and teacher response questionnaire,

Table12. Practical Value Data of Animation-Based Learning Media

Response	Score	Category
Student	88%	Very good
Teacher	100%	Very good

Based on the data in the table above, it appears that both students and teachers had positive reactions to animation-based learning media, lending credence to the idea that such media might be useful in the classroom.

Then to achieve effectiveness, it can be assessed from the student numeracy literacy test given previously to students at the end of learning and student activity observation sheets evaluated by observers by O'Malley et al. (2003) or (Evertson & Burry, 1988). Results analysis of the classical numeracy test shows a percentage of 85% with the complete category. Observational analysis of student activity results showed an average of 96% with a very effective type. Based on the analysis of student learning outcomes test data and observation of student activity, it can be concluded that animation-based learning media is included in the very effective category. The research results obtained from researchers were in line with several previous studies, one of which was research conducted by Agustien et al. (2018). This study aims to produce animated video learning media products, and the results are learning media products that are validated in the interesting category. Classically, the results of the validation of subject matter experts in the field of study are 80%, and the validation of media and instructional design experts is 78%. The level of interest in this study was 84% in the small group trial and 87% in the large group trial. This study concluded that the two-dimensional animated video learning media was expertly validated and interesting. Then, research conducted by Ponza et al. (2018) found significant differences in student learning outcomes before and after using learning videos, meaning that the animated videos developed are effective in improving student learning outcomes. Moreover, Himma (2020) states that animation-based learning media supports students' numeracy literacy skills. Based on the information above, the researchers conclude the results of the research conducted, namely that the development of animation-based learning media carried out turns out to be feasible to use in the learning process both in terms of valid, practical and effective. Then seen from several other researchers, it can be concluded that the development of an animation-based learning media in the form of animated videos is appropriate for use in the learning process and provides significant differences regarding student learning outcomes before or after using animation-based learning media.

4. CONCLUSION

Animation-based learning media that have been made by researchers get very good marks from various parties, namely material experts, media experts, teachers, and students. This learning media is

worthy of being developed and used especially for teachers to improve students' numeracy literacy. Based on the results of the trials conducted, the data obtained from the validation results of experts with an average of 90% are in the very good category. Furthermore, the student response to animation-based learning media is 93% in the efficient category, and the teacher's response to learning media is 90% in the efficient category. Then based on the results of the numeracy literacy test, students complete classically with an average of 94% in the very effective category. Then from the results of the development of learning media that has been done,

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