

Development of Animated Videos Based on the Merdeka Curriculum to Improve Students' Mathematical Problem Solving Ability

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Abstrak

Penelitian ini bertujuan untuk mengembangkan video animasi berbasis kurikulum merdeka untuk meningkatkan kemampuan pemecahan masalah matematis siswa sekolah dasar dengan menguji kualitasnya berdasarkan kriteria valid, praktis, dan efektif. Jenis penelitian ini adalah R&D dengan model pengembangan ADDIE (*Analyze, Design, Development, Implementation, and Evaluation*). Subjek penelitian ini adalah 1 guru dan 23 siswa kelas V di salah satu SD Negeri di Kota Sukabumi. Instrumen yang digunakan dalam penelitian yaitu lembar validasi ahli media dan ahli materi untuk menguji validitas video animasi, angket respon guru dan siswa untuk menguji kepraktisan video animasi, dan tes kemampuan pemecahan masalah matematis siswa untuk menguji efektivitas video animasi. Teknik analisis data yang digunakan yaitu analisis Uji Hipotesis dan N-Gain. Hasil penelitian menunjukkan bahwa (1) Video animasi yang dikembangkan termasuk dalam kategori sangat valid atau sangat layak untuk diuji coba. (2) Guru dan siswa memberikan respon yang sangat baik terhadap video animasi yang dikembangkan dan termasuk dalam kategori sangat praktis. (3) Berdasarkan hasil uji hipotesis dan N-Gain menunjukkan bahwa terjadi peningkatan kemampuan pemecahan masalah matematis siswa dalam kategori sedang sehingga video animasi yang dikembangkan dinyatakan efektif.

Kata kunci: Kurikulum Merdeka, Matematika, Pemecahan Masalah, Video Animasi

Abstract

This research aims to develop an animation video based on the merdeka curriculum to improve mathematical problem solving skills of elementary school students by testing its quality based on valid, practical, and effective criteria. This type of research is R&D with the ADDIE development model (*Analyze, Design, Development, Implementation, and Evaluation*). The subjects of this study were 1 teacher and 23 fifth grade students at one of the public elementary schools in Sukabumi City. The instruments used in the study were media expert and material expert validation sheets to test the validity of the animated video, teacher and student response questionnaires to test the practicality of the animated video, and student mathematical problem solving ability tests to test the effectiveness of the animated video. The data analysis techniques used were Hypothesis Test and N-Gain analysis. The results showed that (1) The animation video developed was included in the category of very valid or very feasible to be tested. (2) Teachers and students gave very good responses to the animated video developed and included in the very practical category. (3) Based on the results of hypothesis testing and N-Gain, it shows that there is an increase in students' mathematical problem solving skills in the medium category so that the animated video developed is declared effective.

Keywords: Merdeka Curriculum, Mathematics, Problem Solving, Video Animation

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INTRODUCTION

Mathematics is one of the subjects that has an important role in education, where students are directed to the ability to count which is expected to be able to solve problems in everyday life in the future. In Istiqla's research ([2017](#)) there is a statement of Permendiknas No. 22 of 2006 concerning Content Standards which states that one of the objectives of learning mathematics at the primary and secondary education levels is for students to be able to solve problems which include the ability to understand problems, design mathematical models, solve models, and interpret the solutions obtained. The National Council of Teachers of Mathematics (NCTM) formulates five mathematics learning objectives, namely: (1) mathematical problem solving (2) mathematical communication; (3) mathematical reasoning; (4) mathematical connections; (5) mathematical representation; (Indriana & Maryati, [2021](#)). From this explanation, one of the abilities that students need to have is problem-solving ability.

Mathematical problem solving ability is the ability of students to solve or solve problems in the form of problems that are not routine (Muslim, [2017](#)). According to Russefendi, there are several reasons for the importance of problem-solving skills and why students need to be trained and accustomed to solving problems in the form of problem solving, namely (1) can foster creative nature, curiosity and motivation, (2) in addition to having knowledge and skills (counting and others), students have the ability to read and make correct statements, (3) can produce original answers, new, distinctive, diverse, and add new knowledge, (4) can apply the knowledge he has obtained, (5) invite students to complete in accordance with problem-solving procedures, able to make analysis, synthesis, and are required to make evaluations of the results of the solution, (6) activities that are important for students, not only involving one field of study, but many fields of study, can involve other lessons outside school lessons, can stimulate students to use all their abilities. It is important for students to face their lives now and in the future (Aisyah et al., [2018](#)).

However, currently students experience difficulties in learning mathematics, especially problem-solving ability. In research conducted by Ayu et al. ([2021](#)) stated that the difficulties in learning mathematics experienced by students are difficulties in applying fraction concepts, difficulties in calculating skills, and difficulty solving problems, especially in story problems. Seifi et al. ([2012](#)) states that students' difficulties, especially in solving problems according to the teacher's view, are caused by the difficulty of students understanding the problem, making plans in solving the problem, describing and relating to previous knowledge. In addition,

students also have difficulty understanding the sentences listed in the problem, are less familiar with the problems presented and are less able to apply strategies to solve problems.

So that education practitioners need to do various ways so that learning can run well, namely effectively changing the learning process by using learning media, because learning media is one of the factors that cause students difficulties in the learning process. This is supported by the results of interviews in research Geni et al. (2020) which states that the lack of learning media is the main obstacle faced by teachers in teaching that can support the explanation of material during learning. Apriyanto & Hilmi (2019) states that there is a tendency for students to not be able to remember the material learned because during the learning process they do not use media that can facilitate the learning process.

In addition, the government also continues to make changes and innovations in an effort to improve the quality of education. One of the changes made is a change in the learning curriculum, currently the latest curriculum is the merdeka curriculum. The merdeka curriculum is a learning design that provides opportunities for students to learn calmly, relaxed, fun, free of stress and pressure to show their talents, where independent learning focuses on freedom and creative thinking (Rahayu et al., 2022). The merdeka learning curriculum frees teachers to create educational and fun learning (Ariga, 2022). Teachers are also given the mandate as a driving force to plan, implement, evaluate and follow up on the evaluation (Sutrisno et al., 2022). The advantages of the Merdeka Curriculum are explained by Kemdikbud (2021) Focusing on essential material and developing student competencies in its phases so that students can learn more deeply, meaningfully and fun, not in a hurry. Learning is much more relevant and interactive through project activities providing wider opportunities for students to actively explore actual issues such as environmental issues, health, and others to support the development of character and competence of the Student Profile Pancasila.

In addition, the implementation of the merdeka curriculum focuses more on the use of technology and learning communities to share good practices between teachers, students, and academics (Nugraha, 2022). Mastery of technology itself is one of the things that need to be owned in the current era of globalization. With the development of information technology can be used for development in the learning process. One way of using technology in learning is the use of technological resources as a media in the learning process (Akhmadan, 2017). Interactive learning media has great potential to stimulate students to respond positively to the learning material delivered (Istiqlal, 2017).

One of the interactive learning media that uses technology is video-based learning media as a tool in delivering material or references used by teachers and students (Saputra et al., [2021](#)). The use of animated videos can help students understand and accept the learning process in the digital age (Khaira, [2020](#)). But currently, video learning has not developed optimally, one of the obstacles is that educators are less expert and not optimal in developing media in the form of technology, in research Fransisca & Mintohari ([2018](#)) revealed that in the learning process teachers use videos downloaded from Youtube which makes learning ineffective and inefficient because the material in the Youtube video is not in accordance with the basic competencies and indicators to be achieved. In addition, teachers do not have qualified knowledge and abilities in making learning videos. Teachers do not know what software can be used and how to use it to make learning videos (Wicaksono et al., [2021](#)).

Here are the results of previous research on animated videos, based on research conducted by Lukman et al. ([2019](#)) shows that the development of animated videos based on local wisdom in grade V science lessons in elementary schools is stated to be very interesting and practical, with an attractiveness level of 4.65 and a practicality level of 4.6. However, in previous research, researchers have not carried out the effectiveness of the products developed. In addition, on research Andriani ([2019](#)) shows that animated video learning media products with the theme material "Kegemaranku" are effective for improving students' higher order thinking skills (HOTS), and research conducted by Harefa & La'ia ([2021](#)) shows that the use of audio-visual learning media can affect students' mathematical problem-solving abilities. However, the animated video product is only limited to the material of addition and subtraction of integers.

Based on this, it is necessary to develop interactive media as one of the learning innovations in the current era of globalization. The learning media developed are animated videos based on a merdeka curriculum that can help students and teachers in the learning process and equip students with problem-solving ability in measurement materials.

METHODS

This research is an R&D (Research and Development) research to produce a particular product and also test the validity, practicality, and effectiveness of the product (Sugiyono, [2017](#)). The media produced from this research is in the form of animated videos based on the merdeka curriculum. The design used for research and development refers to the stages of research and development of ADDIE. The stages of the ADDIE development model consist of (1) Analyze, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation

(Kurniawan et al., 2018). Stages of research and development of ADDIE as shown in [Figure 1](#).

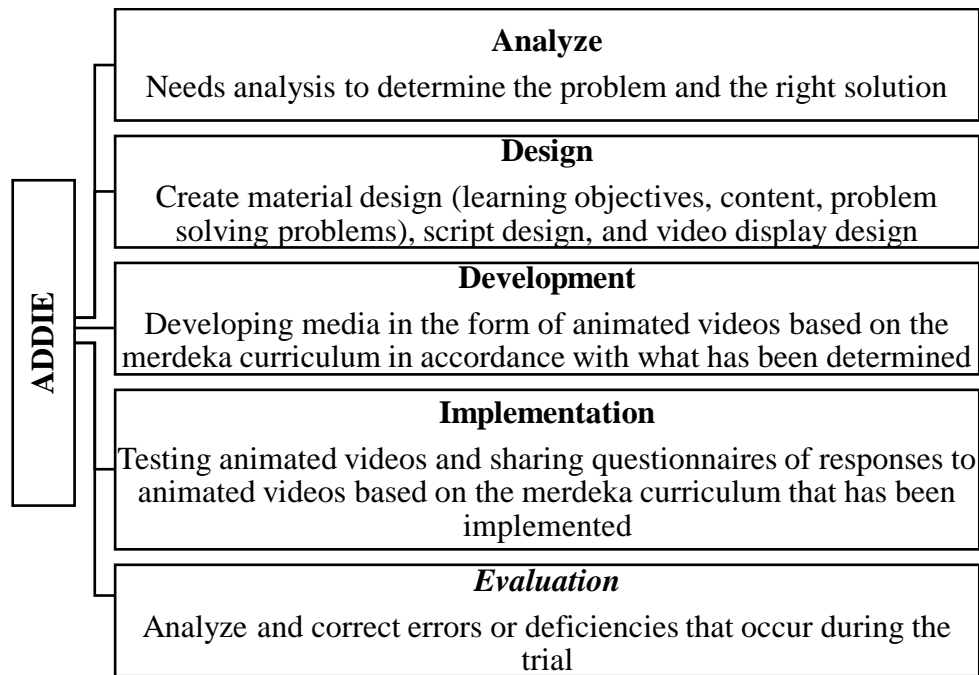


Figure 1. Stages of research and development of the ADDIE model

Analyze is an early stage in the development of ADDIE. This analysis stage is in the form of problem analysis, analysis of media needs and availability and analysis of student characteristics in order to adjust the product to be developed. Based on observations made at SDN Cemerlang Kota Sukabumi, most students have difficulty in doing problem-solving problems regarding measurements which can be seen from the students' answers in [Figure 2](#).

Question item:

Ayah mempunyai pigura berbentuk persegi yang mempunyai keliling 120 cm. Berapakah sisi-sisi yang terdapat pada pigura tersebut dalam satuan mm? (Ana, 2019)

Student Answer:

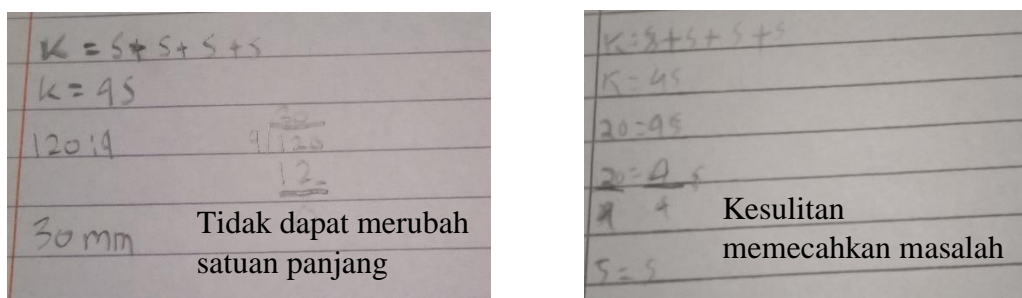


Figure 2. Student Answer

From the results of students' answers, it can be seen that most students in doing the questions given only use the fourth step in the problem-solving stage, namely implementing

strategies, but the strategies used by students are not right. In addition, students cannot solve the given questions with problem-solving ability measures, namely students do not identify or understand the given problem, students do not mention known information and ask questions, students cannot determine the right strategy for solving and students do not correct the results of their work. This shows that students have not met the indicators of problem-solving ability.

Design, at the design stage, it is carried out by preparing product needs to find out the things that need to be included in animated videos, starting from the selection of material to be used in animated videos that are adjusted to the structure of the merdeka curriculum and the development phase, then selecting software to be used in developing products, researchers also collect various references related to the material, practice questions, and the characters to be used in animated videos from various references, then arranged in the form of video scripts. **Development**, the activities carried out are making illustrative images, sound records and so on, followed by the preparation of learning media in the form of animated videos with the help of software needed in accordance with the video script that has been made. During the preparation of animated videos, researchers also compiled research instruments in the form of validation sheets, response questionnaires and tests of mathematical problem solving abilities. The animation video developed is then consulted first to the supervisor, then validated by experts. **Implementation**, the implementation stage is carried out when all instruments have gone through a validation process by the validator as well as through a revision process in accordance with the directions given by the validator. This stage is carried out to obtain an evaluation of the effectiveness and practicality assessment of animated videos. **Evaluation**, the last stage is the evaluation stage which includes formative evaluation and summative evaluation. Formative evaluation is carried out to collect data at each stage of ADDIE for the improvement of the product developed while summative evaluation is carried out at the end to determine the results of student achievement and learning quality (Tegeh & Kirna, [2013](#)).

There are two types of this research data, namely qualitative data and quantitative data. Qualitative data was obtained from the results of the distribution of validation questionnaires to experts and response questionnaires to students and teachers in the form of responses to animated videos developed. While quantitative data is obtained from the results of questionnaire answers that have been disseminated and calculated using the Likert scale. Validity analysis can be calculated using formulas (Arikunto, [2010](#)).

$$\text{Eligibility Percentage (\%)} = \frac{\text{Validate result score}}{\text{Ideal maximum score}} \times 100\%$$

The calculated data is then interpreted using eligibility criteria or validity according to Arikunto (2010) as in [Table 1](#).

Table 1. Product eligibility criteria

Category	Percentage
Very Decent	81% - 100%
Decent	61% - 80%
Quite Decent	41% - 60%
Not Decent	21% - 40%
Very not decent	0% - 20%

According to Subekti (2014), A product can be declared valid or decent if the average score reaches 61% - 80% in the decent or valid category. As for the analysis of the practicality of the product, it can be calculated using the formula (Ja'far et al., 2014).

$$P = \frac{f}{N} \times 100\%$$

Information:

P = The value of practicality

f = Number of scores obtained

N = Maximum number of scores

The calculated data is then interpreted using practicality criteria according to Sulistyningrum (2017) as in [Table 2](#).

Table 2. Product practicality criteria

Category	Percentage
Very Practical	81% - 100%
Practical	61% - 80%
Quite Practical	41% - 60%
Impractical	21% - 40%
Very impractical	0% - 20%

Menurut Subekti (2014) A product can be said to be practical when the average score of students and teachers reaches 61% - 80% or in the practical category. Not only from student and teacher response questionnaires, quantitative data was also obtained from the results of pretest and posttest assessments. It is used to measure the effectiveness of the products developed and the improvement of students' mathematical problem-solving abilities.

The effectiveness of the product to determine the effect of using merdeka curriculum-based animated videos on mathematical problem solving ability can be calculated using the Paired Two Sample T Test analysis, while to determine the increase in test results on

mathematical problem solving ability, you can use N-Gain analysis with a formula developed by Hake (Subakti et al., [2021](#)).

$$t = \frac{\bar{D} - d_0}{\frac{S_D}{\sqrt{n}}} \sim t(n - 1)$$

$$N - Gain = \frac{Posttest\ Score - Pretest\ Score}{Max\ Score - Pretest\ Score}$$

After that, the data is interpreted using criteria according to Sarasati et al. ([2016](#)) as in [Table 3](#).

Table 3. N-Gain Criteria

Score	Criteria
N-Gain > 7	High
3 ≤ N-Gain ≤ 7	Medium
N-Gain < 3	Low

RESEARCH RESULTS

Analyze

Based on the results of observations that have been made related to problems in the learning process, it was found that students are classified as active when the learning process uses learning media that makes students more active and independent than learning that only listens to explanations from the teacher.

Design

At this stage design the product by creating a flowchart as a video creation flow as shown in [Figure 3](#).

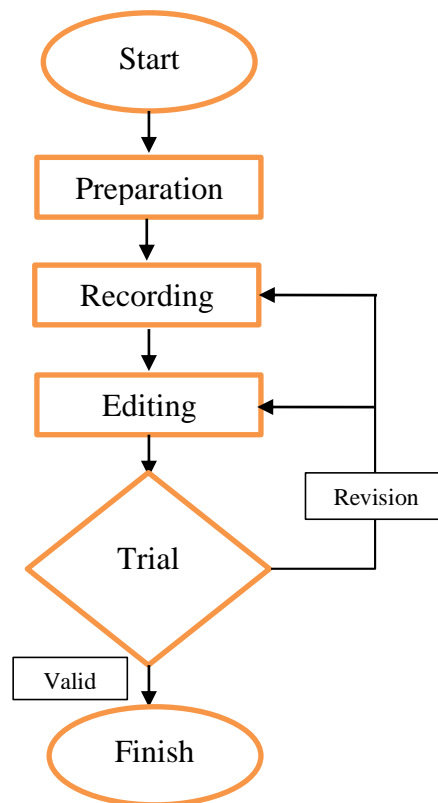


Figure 3. Flowchart of animated video design

In the design stage, it begins with making an initial product design and video script from the material to be presented, namely measuring the length and area adjusted to the structure of the merdeka curriculum and the phase of student development, then choosing images and characters that are in accordance with the material and the process of recording sound using mobile phones. After the material and recording results are collected, the next is the editing process using software. The software chosen in product development is the Canva and Filmora applications as shown in [Figure 4](#).

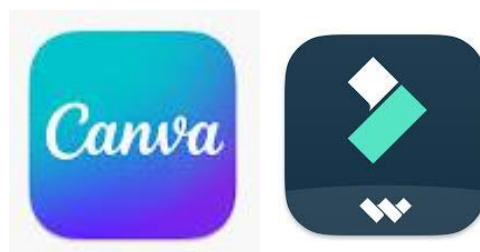


Figure 4. Canva and Filmora apps

This editing process includes the development stage, after completion of video editing is tested to validators, then it can be used after being validated and revised. The initial design in making animated videos as shown in [Figure 5](#).

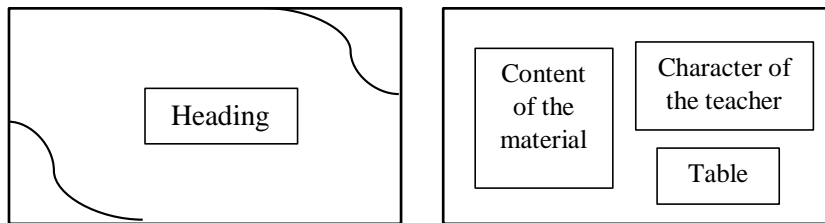


Figure 5. Initial design of the video

Development

- *Create Animated Videos Based on the Merdeka Curriculum and Compile Research Instruments*

The product developed is in the form of a merdeka curriculum-based animation video with a predetermined design as shown in [Figure 6](#).



Figure 6. Development products in the form of animated videos

The instruments in this study are: (1) material expert validation sheets as many as 16 statements and media experts as many as 14 statements, (2) teacher response questionnaires as many as 14 statements and student response questionnaires as many as 20 statements, and (3) student mathematical problem solving ability tests for 3 points of description questions for pretest and 3 points of description questions for posttest.

- *Validation of Animated Videos Based on the Merdeka Curriculum*

This merdeka curriculum-based animation video before being tested on students, the product is validated first by experts and the validation results that have been carried out in the form of assessments along with criticism and suggestions in order to complement the shortcomings contained in the animated video and produce quality products that are in accordance with student needs in order to improve students' mathematical problem solving ability. The validation of animated videos based on the merdeka curriculum was carried out by two media

experts and two material experts. Qualitative and quantitative data from the results of animation video validation by validators as in [Table 4](#) and [Table 5](#).

Table 4. Qualitative data from the validation of material experts and media experts

No	Validation	Validators	Decision
1	Material Expert	Material Expert 1	Valid or decent of use without revision, with comments on the appearance of interesting animated videos, appropriate audio and visuals and clear material.
		Material Expert 2	Valid or decent to use with several revisions, namely the duration of time in the presentation of assignments, shortened presentations and the use of punctuation that needs attention
2	Media Expert	Media Expert 1	Valid or decent of use with revisions i.e. there are some fonts in animated videos that are less clear.
		Media Expert 2	Valid or decent to use with several revisions, namely the selection of appropriate characters that can move such as lip movements and hand movements, as well as in shooting teacher animations when explaining can be zoomed so as not to make the audience bored.

Table 5. Quantitative data from the validation of material experts and media experts

Validators	Number of Scores	Average % Score	Average % Total Score	Criteria
Material Expert 1	61	95%	88%	Highly Valid
Material Expert 2	51	80%		
Media Expert 1	49	88%	86%	Highly Valid
Media Expert 2	47	84%		

The next step is to calculate the average of the score percentage results in order to obtain the final result, namely:

$$\text{Average overall score} = \frac{\text{Total score percentage sum}}{\text{Number of Validators}} = \frac{174}{2} = 87\%$$

Based on the results obtained from material experts and media experts, a value of 87% was obtained which was in the range of 81-100% with a very valid or very decent category. Display of animated video before and after revision as shown in [Figure 7](#).



Figure 7. Tampilan video animasi sebelum dan setelah revisi

Implementation

The application of animated videos based on the merdeka curriculum was carried out in grade V of SDN Cemerlang Kota Sukabumi with a total of 23 students.

- *Animated Video Assessment Results Based on Teacher and Student Response Questionnaires*

Analysis of animated video assessments is carried out after students use the animated video in the learning process. The assessment in the form of a response questionnaire is to determine the practicality of the animated videos that have been developed. The response questionnaire was distributed to teachers and 23 students who had used the animated video. The results of the animated video assessment based on response questionnaires as in [Table 6](#) and [Table 7](#).

Table 6. Animated video assessment results based on student response questionnaires

Assessed aspects	Statement Item	Score		Percentage	Criteria
		Total	Hope		
Material	7	1829	2300	80%	Practical
Student Interest	5				
Benefit	4				
Language	1				
Display	3				

Table 7. Results of animated video assessment based on teacher response questionnaire

Assessed aspects	Statement Item	Score		Percentage	Criteria
		Total	Hope		
Material	4	59	70	84%	Very Practical
Student Interest	2				
Benefit	3				
Language	1				
Display	4				

Based on the table, the data obtained is that the average score of students and teachers is 82%, which means that the product developed in the form of animated videos based on the merdeka curriculum is on very practical criteria.

- **Pretest and Posttest Results**

The questions used in this test are three description questions for the pretest and three description questions for the posttest. The problems are arranged based on indicators of mathematical problem-solving ability. Grades obtained from students' pretest and posttest results as in [Table 8](#).

Table 8. Student pretest and posttest results

Pretest Results		Posttest Results	
Range of Score	Number of students	Range of Score	Number of students
$0 \leq \text{Score} \leq 20$	20	$0 \leq \text{Score} \leq 20$	0
$21 \leq \text{Score} \leq 40$	3	$21 \leq \text{Score} \leq 40$	3
$41 \leq \text{Score} \leq 60$	0	$41 \leq \text{Score} \leq 60$	6
$61 \leq \text{Score} \leq 80$	0	$61 \leq \text{Score} \leq 80$	12
$81 \leq \text{Score} \leq 100$	0	$81 \leq \text{Score} \leq 100$	2
Total Students	23		23

Based on the results obtained from the pretest and posttest values, the next step is to analyze using the Paired Two Sample T Test and N-Gain Test with the condition that the data is normally distributed. Results of the T Test of Two Paired Samples and N-Gain as in [Table 9](#) and [Table 10](#).

Table 9. T test results of two paired samples

Paired two-sample t-test	Sum of D = Posttest – Pretest	1120,02
	Average D	48,697
	Varians D	358,332
	Standard deviation D	18,930
	T count	12,337
	T table	1,717

Table 10. N-Gain Results

N-Gain Test	Average N-Gain score	5,73
	Percentage	57%
	Criteria	Medium

The results obtained from the value analysis using the Paired Two Samples T Test are 12,337 which is greater than the table t value of 1,717. So, H_0 It is rejected that animated videos based on the Merdeka Curriculum affect students' mathematical problem-solving abilities, and an N-Gain result of 5,73 with a percentage of 57% means that students' math problem-solving ability test results have improved with moderate criteria. So that the animated videos based on the merdeka curriculum developed can be declared effective for students' mathematical problem solving abilities.

Evaluation

The results of the implementation of animated videos based on the merdeka curriculum on mathematical problem solving ability are evaluated for advantages and disadvantages based on the results of teacher and student response questionnaires that have been given. From the response questionnaire data, most respondents like the products developed on the measurement material to get a positive response. The suitability of animated videos for the learning process is interesting and practical and makes it easier for students to understand the material.

DISCUSSION

This research produces a product in the form of an merdeka curriculum-based animation video which is expected to improve the mathematical problem solving ability of elementary school students with the material presented in the animated video focusing more on length and area measurement material. The activities in the animated video are (1) learning to change the unit of length and unit of area, (2) solving measurement problems using indicators of problem-solving ability, and (3) students presenting the results of the work.

The results showed that the animated videos based on the merdeka curriculum developed were valid, practical and effective in learning. This is based on the results of the needs analysis with the developed model, namely the ADDIE development model systematically declared valid with an average percentage of 87%, practical with an average of 82% and effective with a percentage of 57%. This is in line with research (Kurniawan et al., [2017](#); Siddiq et al., [2020](#); Anwariningsih & Ernawati, [2013](#); Ariantini et al., [2019](#)) which states that the development of animated videos that refer to the ADDIE development model is effective which has implications for the feasibility of the products produced in the development process and is able to help the overall learning process and obtain a very good percentage.

The use of animated videos that are adapted to the structure of the merdeka curriculum can be used anytime, anywhere and provide learning motivation to students because it is associated with daily life and in accordance with the learning desired by students. Research results (Ariani et al., [2021](#); Dewi et al., [2021](#)) stated that the use of animated video media can improve learning outcomes and student learning motivation, able to facilitate understanding and strengthen student memory by understanding the material in animated videos that are associated in everyday life. Another research is that learning videos can help increase student motivation and facilitate teachers in the learning process (Hendrawati et al., [2013](#); Karyani et al., [2013](#))

In addition to increasing student learning motivation, learning using media in the form of animated videos can have an influence on improving students' mathematical problem solving abilities from the results of hypothesis tests and N-Gain. This is supported by the results of research (Susilawati et al., [2017](#)) Learning using media is significantly better than conventional learning on the material of adding and subtracting the number of months to improve students' mathematical comprehension and problem solving skills. Other studies state that the use of audio-visual learning media in the form of learning videos can affect students' mathematical problem-solving abilities (Harefa & La'ia, [2021](#))

The peculiarity of the product developed is an animated video based on an merdeka curriculum that gives freedom to students to be able to organize and develop ways of learning independently, focus on essential material and student development according to its phases to be simpler, learning becomes more meaningful and fun.

CONCLUSION

From the results and discussion, it can be concluded: (1) Based on the results of assessments by media experts and material experts, merdeka curriculum-based animation videos on students' mathematical problem solving abilities that have been developed based on the ADDIE model are declared very valid (2) Based on the results of the distribution of student and teacher response questionnaires, merdeka curriculum-based animation videos on students' mathematical problem solving abilities are declared very practical. (3) Based on the results of hypothesis testing, the results of the mathematical problem solving ability test obtained students have improved with moderate criteria. So that the animated videos based on the merdeka curriculum developed can be declared effective for students' mathematical problem solving abilities.

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