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Development of A Learning Video on The Discovery of Integer Numbers to Improve Mathematical Problem-Solving Abilities and Creative Thinking Abilities of Grade VI Students

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Abstract

This study aims to develop a discovery-based mathematics learning video on integer material that can improve mathematical problem-solving skills and creative thinking skills of grade VI elementary school students. This study uses the Research and Development (R&D) method with the ADDIE development model consisting of five stages: Analysis, Design, Development, Implementation, and Evaluation. The subjects in this study were grade VI students at an elementary school in Punggul Gedangan. The instruments used included validation sheets from materials experts, design experts, media experts, and mathematics teachers, student response questionnaires, and problem-solving and creative thinking ability tests. The validation results showed that the developed learning video was included in the very valid category. Limited trials showed that the video was effective in improving students' problem-solving and creative thinking abilities. Thus, the developed learning videos are suitable for use as alternative learning media in mathematics learning, especially integer material, and can support students' high-level thinking skills.

Keywords Learning Video Development, Integers, Problem Solving, Creative Thinking

INTRODUCTION

Mathematical ability is an ability that focuses more on problem solving and problem elicitation.(Risky Anggraeni, 2019). One of the objectives of learning mathematics according to the Minister of National Education Regulation is that students can solve problems, including understanding problems, designing models, solving them, and interpreting solutions.(Rudhito et al., 2020). Solving mathematical problems is not an easy thing for students, especially when it comes to analyzing or knowing the source of the problem, therefore steps are needed to solve the problem in order to obtain optimal results as conveyed by Polya, the steps in solving the problem are understanding the problem, implementing the solution plan, planning the

solution, and re-checking the final result (Pramesthya R. et al., 2021),(Marselina & Muhtadi, 2019),(Sugiarti et al., 2025).

Apart from that, to deepen knowledge in mathematics, it is necessary to have a basic ability to solve problems that must be mastered. Problem solving is a basic medium for increasing mathematical understanding (Son & Fatimah, 2020). This is because so far, mathematics learning has seemed to have less touch on the substance of problem solving.(Rokhim & Patahuddin, 2020). Problem solving according to Sriwahyuni, et al.(Sriwahyuni & Maryati, 2022), is a process of overcoming difficulties encountered in order to achieve desired goals. Each individual's mathematical problem-solving abilities are certainly different, therefore, each individual requires creative thinking skills to be able to solve problems.(Hartanti et al., 2020). Creative thinking ability is the ability to think with intuition, imagination that can give rise to new ideas, discover a variety of fascinating thoughts, and inspire thoughts beyond our own desires.(Mutia, 2025)Creative thinking refers to the ability to generate new ideas by using one's imagination and intuition to create new creations or works that are different from those that have come before. Creative thinking is the power of an individual's intellect to organize new ideas based on various perspectives, knowledge, and experiences.(Winarto & Nurbaiti, 2020),(Azuhra Harahap & Fitriah Dwi, 2024)

Individuals who have creative thinking will have various alternative answers to a problem/issue. Creativity can be developed into five levels of hierarchy adjusted to the level, namely: creative thinking level 4 (very creative), thinking level 3 (creative), thinking level 2 (quite creative), creative thinking level 1 (less creative), and creative thinking level 0 (not creative). If someone is at the fourth level, which is the very creative level, then that person must master the four indicators of creative thinking: fluency, flexibility, originality, and novelty (elaboration). As conveyed by Masfufah, the indicators of creative thinking(Masfufah & Nurdyansyah, 2023). Mathematical skills emphasize problem solving and problem elicitation.(Cahyani et al., 2021). One of the goals of learning mathematics is for students to be able to solve problems through systematic steps, as proposed by Polya.(Salsabila et al., 2023)However, in practice, many students experience difficulty understanding and solving math problems, particularly those involving negative integers. One of the main causes is students' low creative thinking skills.(Cape, 2025).

Creative thinking is essential for generating varied and original solutions to mathematical problems. Indicators of creative thinking include fluency, flexibility, originality, and elaboration.Fazria & Linggo Wati (nd). Based on the evaluation results at SDN Punggul 2, it was found that 80% of students still did not reach the KKM in questions related to integer operations, indicating weak problem-solving and creative thinking abilities. As a solution, the discovery learning approach is considered effective because it encourages students to be active, creative, and think critically in discovering the concepts they are learning themselves. To support this learning, the use of learning video media is considered capable of helping students understand abstract materials such as integers. Therefore, researchers developed

discovery learning video media to improve the mathematical problem-solving and creative thinking abilities of sixth-grade students at SDN Punggul 2.

METHODS

This study uses a research and development (R&D) model with the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. This approach is used to produce a product in the form of a learning video on the discovery of integers that aims to improve mathematical problem-solving and creative thinking skills of sixth-grade elementary school students. The trial subjects in this study were 25 sixth-grade students of Punggul 2 Elementary School as the main data source, as well as class teachers and experts (material experts, media experts, and design experts) as product validators. The research data consisted of quantitative and qualitative data. Quantitative data were obtained from student pretest and posttest results, expert validation questionnaires, teacher and student response questionnaires. Qualitative data were obtained from observations of learning activities and input from validators. Data collection techniques included questionnaires, tests (pretest and posttest), and observations during the learning process using the developed videos.

Data analysis techniques used were descriptive quantitative and qualitative. Pretest and posttest data were analyzed using N-Gain calculations to determine improvements in students' problem-solving and creative thinking skills. Questionnaire data were analyzed by calculating the percentage of media feasibility and practicality, while observation data and validator input were analyzed descriptively to determine product strengths, weaknesses, and improvements before and after implementation.

FINDINGSAND DISCUSSION

This research resulted in a development product in the form of a guided discovery-based learning video on integers designed to improve the problem-solving and creative thinking skills of sixth-grade students at SDN Punggul 2. This development not only produced learning media in the form of videos, but also other learning support tools such as Lesson Plans (RPP), Student Worksheets (LKS), textbooks, and assessment instruments that are integrated into the learning process. All development was carried out using the ADDIE model which includes the stages of analysis, design, development, implementation, and evaluation. In the analysis stage, a learning needs assessment was conducted, encompassing curriculum analysis, student characteristics analysis, and materials analysis. Based on the curriculum analysis, learning at SDN Punggul 2 uses the Independent Curriculum, so the development of learning tools must be aligned with the established learning outcomes. The results of the learning outcomes analysis for integers are presented in Table 1.1 (KI and KD for Integers). These results indicate that integers constitute a basic competency that sixth-grade students must master as a foundation for understanding more complex mathematical concepts at the next level.

Table 1 (KI and KD for Integer Material)

Component	Code	Description / Indicators
Core Competencies	KI. 3	Understand and apply knowledge (factual, conceptual, procedural) based on curiosity about science, technology, art, culture, related to visible phenomena and events.
Core Competencies	KI. 4	Processing, reasoning, presenting, in the concrete realm (using, analyzing, assembling, modifying, and making) and the abstract realm (writing, reading, calculating, drawing, and composing) in accordance with what is learned at school and other sources that have the same point of view/theory.
Basic competencies	3.6	Explain and perform addition, subtraction, multiplication, and division operations involving negative integers.
Indicator	3.2.1	Know how to add and subtract negative integers.

Furthermore, the analysis of student characteristics revealed that the mathematics learning process in sixth grade is still dominated by direct instructional methods (teacher-centered learning), resulting in low student engagement in the thinking process. This impacts students' low creative thinking skills, particularly in solving open-ended problems or those requiring more than one solution. This situation indicates a gap between the current learning environment and the demands of the Independent Curriculum, which emphasizes active, creative, and student-centered learning. Furthermore, although students have had experience learning about integers, their conceptual understanding remains procedural and indefinite.

In the material analysis stage, integer operations were chosen because of its close connection to everyday life and the potential for developing problem-based learning. This material also has significant potential to develop students' creative thinking skills through questions that require reasoning, exploration, and independent concept discovery. In the design and development stage, researchers designed a guided discovery-based learning video combined with a double-loop problem-solving approach. The initial product that had been developed was then validated by media experts, material experts, and design experts to assess the feasibility of content, appearance, and pedagogical suitability. The results of the expert validation showed that the product was categorized as very suitable for use in learning. The average validation score obtained reached 90%, indicating that the product generally met the quality standards for good learning media. The results of the expert validation are shown in Table 1.2 (Media, Material, and Design Expert Validation Results).

Table 2. Validator's Criticism and Suggestions

No	Validator	Criticism and suggestions	Information
1	Media Expert	On the front page the color of the writing is not bright enough.	It has been revised
		In the image, the lines are clarified and added color so that the image is not pale.	It has been revised
2	Design Expert	On the front page, the title text is changed to a light color.	It has been revised
		In the image structure it is better to group and name each material.	It has been revised
3	Subject Matter Expert	In the integer material that is created, the concept must be determined first.	It has been revised

Table 3. Media Expert Validation Results

No	Rated aspect	Score (√)	Criteria
1	Creative and innovative	√	Interesting
2	The video design is very interesting and can provide motivation to students.	√	Interesting
3	Clarity in the image	√	Very interesting

4	Easy to understand	√	Very interesting
5	The color composition is very supportive of being an educational reinforcement.	√	Very interesting
6	The image theme used is easy to understand	√	Interesting
7	The image pattern used is clearly visible	√	Interesting
8	Elaboration in creating detailed drawings	√	Very interesting
9	The quality of the displayed image is good	√	Interesting
10	The background color matches the image	√	Very interesting

Percentage: **90%**

Criteria: Very interesting to use

Sebelum Revisi	Sesudah Revisi
	
Perbaikan gambar diperjelas garis dan diberi tambahan warna agar gambar tidak terlihat pucat	

Sebelum Revisi	Sesudah Revisi
	
Perbaikan penjelasan materi dan gambar.	

Although the product was generally deemed very suitable, several inputs were used for improvement. The content expert suggested increasing the number of practice questions and increasing them to a more challenging level, particularly those related to mixed numbers and contextual questions. The design expert suggested improvements to the visual aspects, specifically the color selection, which was previously too bright and uncomfortable to view, and was then revised to a darker, more contrasting color. Meanwhile, the language expert noted that the video instructions should be made clearer, more concise, and in accordance with good language rules. The results of the product revisions based on these inputs are

Sebelum Revisi	Sesudah Revisi
	
Perbaikan cover depan warna tulisan kurang cerah	

shown in Figure 3 (Results of the Learning Video Product Revision).

In addition to expert validation, the product was also validated by field practitioners, namely mathematics teachers. The results of the practitioner validation showed that most assessment aspects were in the very feasible category, with a percentage of 73.3% stating very feasible and 26.7% stating feasible. This indicates that the product is practically easy to use in learning and is appropriate to classroom conditions. The results of the practitioner validation data are shown in Tables 4.8 and 4.9 (Teacher/Practitioner Validation). Input from practitioners emphasized aspects of learning implementation, especially the ease of use of videos in the teaching process and the suitability of the worksheets to student activities.

Table 4 Results of Practitioner or Teacher Assessment of Mathematics Learning Videos on Addition and Subtraction of Integers

No	Statement	Score	Max Score	P (%)	Eligibility Criteria	Note
1	Clarity of the formulation of the content of the material in the development of Mathematics learning videos on integer material	4	4	100	Very Worthy	No revision
2	The suitability of the material presented in the development of Mathematics learning videos on integer material	4	4	75	Worthy	No revision
3	The suitability of the formulation of learning objectives for Mathematics on integer material presented is in accordance with the formulation of basic competencies that have been determined.	4	4	75	Worthy	No revision

Table 5 Frequency Distribution of Validity Levels of Mathematics Learning Media Practitioners

Validity Level	f	%
Very worthy	11	73.3
Worthy	7	26.7

The next stage was product trials, conducted on two scales: small group and large group. The small group trials involved 10 sixth-grade students at Punggul 2 Elementary School. The results showed a positive response from students to the use of instructional videos, with 80% stating they were very suitable and 20% stating they were suitable. This demonstrates that the developed media was able to capture students' attention and help them understand the material more easily.

A large-group trial was conducted on 15 sixth-grade students at Punggul 2 Elementary School. Results showed that 70% of students stated that the learning media was very suitable and 30% stated that it was suitable. Although there was a slight decrease in percentage compared to the small group, overall student responses remained positive towards the learning media used. Qualitative responses indicated that learning became more enjoyable, the material was easier to understand, and they were more motivated to learn mathematics. To determine the effectiveness of the product, a comparison was conducted between student learning outcomes before and after using the learning video. The results showed an increase in scores after using the learning media, indicating that the developed learning video was

not only theoretically feasible but also effective in improving student learning outcomes. The comparative learning outcome data is shown in Table 4.15 (Pretest and Posttest).

Table 6 Grade VI Student Scores at Punggul 2 Elementary School

No	Name	Pre-Test	Post Test
1	AFIFA NOVARINA	23	91
2	ALMA NAWATUS ZAHRA	9	91
3	ATHA ZAHIRA PUTRI ARDISYA	13	91
4	BAGASKARA SATRIA GUNANDRA PUTRA	0	54
5	DAVIAN RAFIF ZIKRHAZIQ	42	82
6	EMIL AZ ZAHRA	0	48
7	GISELLA PUTRI AFLIANI	0	82
8	INAYAH TALITA ZAHRAH	38	73
9	INDIRA KIRANA MAHESTRI	0	91
10	IVANDER REYHAN ARYASEVA PRADHIATAMA	18	82
11	JEZA CELLO SADewa	18	82
12	KAFFA SON OF ARIRA	57	97
13	M. ARYA FARENDRA RAFSANJANI	29	100
14	MARFEL RIZKY ADYTIA	18	82
15	MUHAMMAD ALFAN TRIHUDIYONO	57	82
16	MUHAMMAD ANASRULAH NUR IKHSAN	78	82
17	MUHAMMAD FAKHRI AL AKBAR	18	82
18	MUHAMMAD DIANDA SAKTI RIZKY	10	100
19	THE BEAUTIFUL NADA ADILA	0	91
20	NADHIRAH BILQIS NAURAH	0	73
21	NAFIHA AZKAZIO AUSHAF	0	91
22	NUNN ALDIVINO	18	82
23	RAHMABILLA NABILA	0	91
24	REZA ALFIANO PUTRA	16	100
25	SALWA ZAHRO AZ-ZAHRA	0	90
26	YULIA DWI FAJARINA	65	81
27	ZAAHIRA SABITAH ISNANI	13	82

Overall, the research results indicate that the guided discovery-based learning video developed for integers meets the criteria of validity, practicality, and effectiveness. This aligns with constructivist learning theory, which emphasizes that students will more easily grasp concepts if they are actively involved in the concept discovery process. Therefore, the use of learning videos in this study not only improves understanding of mathematical concepts but also contributes to enhancing students' creative thinking skills through more meaningful learning experiences.

CONCLUSION

Based on the results of data analysis, the development of a learning video for finding integers to improve mathematical problem-solving and creative thinking skills of sixth-grade students of SDN Punggul 2 was carried out using the ADDIE model which includes the stages of analysis, design, development, implementation, and evaluation. The analysis stage includes analysis of the curriculum, student needs, and materials; the design stage includes designing concepts, instruments, and media assessment; the development stage consists of

making learning videos; the implementation stage is carried out through trials in small and large groups by comparing use before and after using the media; while the evaluation stage aims to determine the advantages and disadvantages of the media developed.

The results of the study indicate that the developed learning video has a very high level of practicality. Teacher responses at SDN Punggul 2 showed a practicality percentage of 8.5% with very practical criteria, while student responses reached a percentage of 93.9% with very practical criteria. Thus, the learning video media for finding integers is suitable for use in the learning process because it is able to support student engagement and facilitate understanding of the material. The suggestions that can be given are that teachers are expected to be able to organize learning by choosing appropriate strategies and media and supported by the provision of facilities from the school; researchers need to adjust media development to the characteristics and needs of students; and future researchers are expected to be able to develop more innovative learning media to be more effective and efficient.

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