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Developing Smart Nusantara Stairs Media Based On PBL As A Strategy To Improve Addition And Subtraction Learning Outcomes Of Grade 1 Elementary School Students

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Abstract. This study aims to produce smart ladder media for Indonesian language and to determine the development and feasibility of smart ladder learning media for Indonesian language based on Problem-Based Learning (PBL) as a strategy to improve the learning outcomes of addition and subtraction of grade 1 elementary school students. The use of smart ladder media for Indonesian language based on Problem-Based Learning (PBL) is a suitable medium to improve student activity because the presentation is concrete and avoids verbalism, so students will be active in the learning process. The type of research used is development research or Research and Development (R&D) which refers to the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation). The subjects of the study were media experts, material experts, learning experts, teachers, and students. The research instruments used were interviews and questionnaires. The results of the development in the form of Tangga Pintar Nusantara learning media based on the assessment results of media experts obtained a score of 78.12 (good). Material experts got a score of 88.75 (very good). Learning experts got a score of 78.94 (good). The results of trials I and II of the teacher questionnaire assessment obtained a score of 97.36 (very good). The assessment of the student response questionnaire in the first trial obtained a result of 78.07, in the second trial it was 89.92 with an average value in both trials of 83.99 (very good), a pretest value of 54.58 and a post-test value of 84.58. Therefore, it can be concluded that the smart ladder learning media for the Indonesian language based on Problem-Based Learning (PBL) is suitable for use by students.

Keywords: Indonesian Smart Ladder Media, PBL, Addition and Subtraction

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INTRODUCTION

Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have spiritual religious strength, self-control, personality, intelligence, noble morals, and skills needed by themselves, society, nation and state (Law of the Republic of Indonesia Number 20 of 2003). Education is very important because the benchmark of humans who understand how their true nature as humans is determined by education. However, the quality and quantity of education to date is still the most prominent problem in every effort to renew the national education system.

Education is certainly inseparable from learning activities. This means that good learning activities will have a positive impact on the quality of education. One way to improve the quality of learning is to utilize interesting and enjoyable media and learning models. Media and learning models play an important role in helping educators achieve learning goals, including Mathematics subjects.

Mathematics is a subject that is usually considered difficult by students, especially at the elementary school level. However, in reality, learning mathematics is very important because

mathematics is widely used in life. The goal of learning elementary school mathematics is so that students are able to apply mathematical concepts in everyday life (Lestari, 2021). There are many concepts in mathematics where these concepts are interrelated with each other. Therefore, if students cannot understand the previous material, they will automatically have difficulty understanding the next material. This is what makes mathematics designated as a subject that must be studied since elementary school.

Difficulty in learning mathematics is influenced by the lack of students' numeracy skills. Because numeracy is the main capital for students in learning mathematics. Numeracy is a person's basic ability related to arithmetic operations such as addition, subtraction, multiplication, and division. The causes of the lack of numeracy include students having difficulty performing arithmetic operations, students being less careful in calculating, and students being less interested in calculations (Charli et al., 2018). Students must have numeracy skills as a provision for studying further mathematical concepts.

According to Piaget (Heruman, 2010), elementary school students are still in the concrete operational period, namely the ability in the thinking process to operate logical rules, although still bound to concrete objects. Because of the abstract nature of Mathematics learning, students need aids in the form of media and teaching aids that can clarify what the teacher will convey so that it is more quickly understood and comprehended by students, especially lower-class students. The use of learning media is very important. Hamalik (Arsyad, 2015) stated that the use of learning media in the teaching and learning process can arouse new desires and interests, arouse motivation and stimulate learning activities, and even bring psychological influences to students. Well-designed media and the use of interesting learning models will greatly help students achieve learning goals (Nurseto, 2011).

Based on the results of observations at SD Negeri 3 Karangwuni, on May 13 to May 31, 2024, it can be seen that students still have difficulty understanding addition and subtraction material in the second semester. Not fully understanding the number symbols has an impact on students not being fluent in calculating, and the development of media, especially in addition and subtraction materials, has not been maximized. The media used by teachers is limited to pictures in textbooks.

This is a problem for teachers to choose teaching methods or media that attract students' attention in learning so that it will create interest and motivation for students to excel which will also support the results of learning Mathematics. Because by learning Mathematics, we will learn to reason critically, creatively, and actively (Susanto, 2013).

The Nusantara Smart Ladder Media is a media made to resemble a 3-dimensional ladder. 3-dimensional art, or what we usually call 3D art, is art that is limited by 3 sides, namely the

length, width and height or in its meaning, a work of art that has volume and is in a space. Three-dimensional media is a suitable media to increase student activity because its presentation is concrete and avoids verbalism, so that students will be active in the learning process (Jonkenedi, 2017). Some materials in Mathematics that use the shape of a ladder as a media illustration are convection materials for units of length, units of mass, units of area and units of volume.

As a counting medium, the Smart Ladder media is equipped with illustrated sticks as a counting medium. This is to make students actively participate in learning through the use of learning media. Then, so that the smart ladder media is more interesting and can provide insight to students about Indonesian archipelago culture, the smart ladder media is attached with various pictures of traditional Indonesian houses in Indonesia such as traditional houses of Central Java, Sumatra, Bali, and so on.

Research on the development of 3-dimensional ladder-shaped media has been conducted by Hayati & Rahmawati (2017) elementary school children are still in the concrete operational thinking period, so they need concrete media in the teaching and learning process. The three-dimensional PBL-based Tangga Pintar Nusantara learning media has met two characteristics, namely students play an active role and there is learning media.

On the other hand, the learning process cannot be separated from the learning model, which can be interpreted as our starting point or perspective on the learning process. The expected learning model is one that is able to make students active during the learning process. One of them is the Problem Based Learning or PBL learning model.

Problem Based Learning or PBL uses real-world problems as a context for students to learn about critical thinking and problem-solving skills, as well as to acquire the essential knowledge and concepts of the subject matter. Problem-based learning trains students to solve a problem through the stages of the scientific method, so that students can learn knowledge related to the problem so that students have the skills to solve problems.

Problem Based Learning helps students work on authentic problems with the intention of constructing their own knowledge, developing inquiry and higher-order thinking skills, developing independence and self-confidence. This learning model refers to other learning models such as project-based learning, learning based on authentic learning experiences and meaningful learning.

Based on the identification of the problems above, the objectives of this study can be formulated as follows: to determine the development and feasibility of smart ladder media for addition and subtraction of Mathematics for grade I elementary school.

METHODOLOGY

This research is a type of media development research for learning or Research and Development (R&D). It is a research method used to produce stories in products and test the effectiveness of the product. This research refers to the ADDIE model, according to Robert Maribe Branch Sugiyono (2015) which stands for Analysis, Design, Development, Implementation, Evaluation.

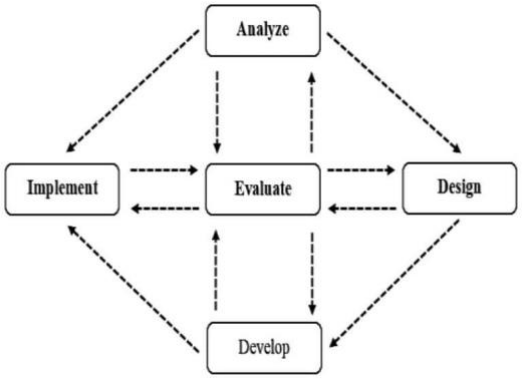

Figure 1. ADDIE Research and Development Steps

The development procedure of this research includes analysis, design, development, implementation, and evaluation activities. The analysis stage is the stage where researchers analyze the need for learning media development and analyze the feasibility and requirements for development. There are three stages in this analysis stage, namely initial analysis (needs analysis), curriculum analysis, and student character analysis.

The second stage of the ADDIE model is the design stage. After conducting the analysis, the next step is planning to create a smart ladder learning media design for addition and subtraction. In the planning stage, the researcher took several steps to create a material design, a smart ladder learning media design, and a design for using smart ladder learning media for addition and subtraction.

Then, the design results that have been made are validated by experts. Design validation is carried out by media experts. Then, for the selection of materials will be validated by material experts. In the learning flow section will be validated by learning experts. In this study, a learning media design that has been developed is created, namely the smart ladder learning media for addition and subtraction.

The third step is development, which is the process of creating smart ladder learning media for addition and subtraction according to the design steps that have been made. In addition, researchers validate the smart ladder learning media for addition and subtraction. At this stage, product trials are also carried out on experts and improvements or revisions to the product based on expert assessments and reviews. Experts who validate the smart ladder learning

media for addition and subtraction function to determine the quality of the learning media in terms of design, appearance, and whether or not it is suitable for use in the learning process.

In addition, experts also function as quality control of the smart ladder learning media for addition and subtraction before being tested in terms of content or accuracy of the material to be delivered. This aims to be a basis for determining the feasibility of the quality of the smart ladder learning media for addition and subtraction that is developed so that the learning media product becomes a feasible product.

Implementation stage, product trials will be conducted at SD Negeri 3 Karangwuni. The subjects of the trial in this study were grade I students of SD Negeri 3 Karangwuni. The purpose of this trial is to obtain student responses to the smart ladder learning media for addition and subtraction. In this implementation, it will be carried out through product trials on students, in addition to providing questionnaire sheets for students on how to respond to the smart ladder learning media for addition and subtraction.

This evaluation stage is the stage of evaluating the entire product development process up to product trials. At this stage, data analysis is carried out that has been obtained from product trials. The goal is that the data obtained is analyzed to determine the revisions that need to be made and to analyze whether the product being developed can be said to be practical and feasible to use.

After knowing the development steps, the next is the product trial stage. There are several things in the product trial stage that need to be known, namely through the trial design, trial subjects, and types of data. The trial design stage, in this study the product trial is shown in several steps as follows. Create a product design or initial product; carry out product validation to media and material experts; carry out product validation to education practitioners/teachers; revise the initial product by considering input from media experts, materials and education practitioners; carry out product tests to students and distribute questionnaires to obtain data on the products developed from students; make revisions by considering the results of the questionnaire given to students; and the final results include the final development product.

The subjects of the trial in this study were 24 students in grade I of SD Negeri 3 Karangwuni. The types of data used in this development research consist of two types, namely qualitative data and quantitative data. Quantitative data are in the form of suggestions, input, criticism, and comments on the media being developed. Quantitative data are in the form of scores from the distributed questionnaires. The scoring guidelines are as follows:

Table 1. Scoring Guidelines

Description	Score
Very Appropriate (VA)	4

Appropriate (A)	3
Fairly Appropriate (FA)	2
Not Appropriate (NA)	1

Data collection instruments are a way to collect data. The data obtained will later be used as a result of media assessment. Observation sheets addressed to media experts, material experts, learning experts, class teachers, and student responses addressed to assessment questionnaires. Data collection in the form of interview instruments and media assessment questionnaires. Data analysis techniques, data collection techniques are obtained from media expert feasibility test instruments, material expert feasibility test, learning expert feasibility test for student responses. The scores that have been obtained are then determined into the formula according to Arikunto (2011):

$$x = \frac{Total\ Score\ Obtained}{Maximum\ Score}\ x\ 100$$

Description:
x = percentage of media feasibility or quality

After obtaining the assessment scores from each validator, the average is found using the formula according to Arikunto (2011):

$$x = \frac{\sum x}{N}$$

Description:
$\sum x$ = Total score
x = Average
N = Number of raters (evaluators)

Quantitative data obtained using the formula above is then converted as follows according to Arikunto, (2011).

Table 2. Ideal Assessment Criteria

Description Score	Classification
Scores between 81 – 100	Very Good
Scores between 61 – 80	Good
Scores between 41 – 60	Fair
Scores between 21 – 40	Poor
Scores less than 20	Very Poor

Based on the calculation categories above, it can be seen that the Smart Ladder learning media product is declared feasible if it has a feasibility score between 61 - 80, namely in the Good category.

RESULT AND DISCUSSION

Results

1. Trial Results

The data obtained from the results of this study are qualitative data and quantitative data. Qualitative data are in the form of comments or suggestions given by media experts, material experts, learning experts, student responses, and teacher responses.

a. Media Expert Validation Result Data.

Media expert validation of smart ladder media was carried out by one of the teachers at SD Negeri 3 Karangwuni who has competence in the field of learning technology. Based on the results of the media expert validation test of the smart ladder learning media, a total score of 50 was obtained and calculated using the formula, a value of 78.12 was obtained with the criteria of "Good". The formula for calculating the value by the media expert.

$$x = \frac{Total\ Score\ Obtained}{Maximum\ Score}\ x\ 100$$

$$x = \frac{50}{64}\ x\ 100$$

$$= 78.12$$

The conclusion from the media validation results is that the smart ladder media for addition and subtraction is suitable for product trials with revisions.

b. Results of Validation by Material Experts

The validation of the material expert on the smart ladder media was carried out by one of the teachers at SD Negeri 3 Karangwuni who has competence in the field of elementary school Mathematics learning. Based on the results of the validation of the material expert on the smart ladder learning media for addition and subtraction, the score obtained was 71. The value obtained was 88.75 with the criteria of "Very Good". The following is the formula for calculating the value from the material expert.

$$x = \frac{Total\ Score\ Obtained}{Maximum\ Score}\ x\ 100$$

$$x = \frac{50}{64}\ x\ 100$$

$$= 78.12$$

The conclusion from the results of the validation by material experts is that the smart ladder learning media is worthy of being tested as a product through the revision stage.

c. Expert Learning Validation Results.

The validation of the learning expert was carried out by one of the teachers of SDN 3 Karangwuni who has competence in the field of elementary school Mathematics material. Based on the results of the validation test of the learning expert on the smart ladder media for addition and subtraction, a score of 60 was obtained. Through this score, a value of 78.94 was obtained with the category "Good". The following is how to calculate the value of the results of the validation test of the learning expert.

$$x = \frac{Total\ Score\ Obtained}{Maximum\ Score}\ x\ 100$$

$$x = \frac{60}{76}\ x\ 100$$

= 78.94

The conclusion from the results of the validation by material experts is that the smart ladder learning media for addition and subtraction is suitable for product testing by going through the revision stage.

Table 3. Results of Expert Assessment of Media

No	Evaluator	Score	Category
1	Media Expert	78.12	Good
2	Material Expert	88.75	Excellent
3	Learning Expert	78.94	Good
	Total	245.81	Excellent
	Average		Excellent

In addition to being seen in table form, the assessments from the experts are also seen in diagram form. The following is a diagram of the results of the expert assessment of the smart ladder media that was developed

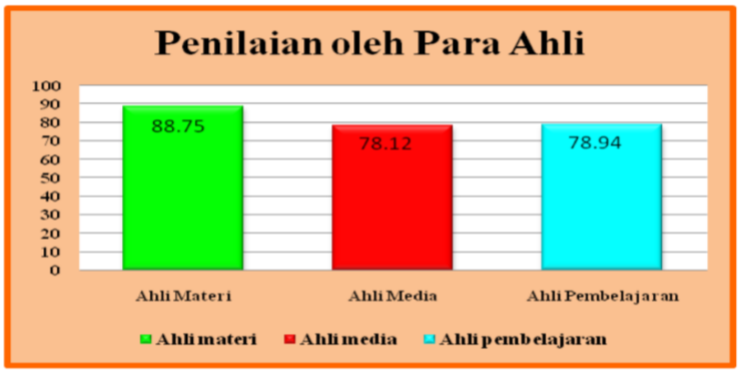

Figure 2. Diagram of Expert Assessment of Smart Ladder Learning Media Development

d. Student Response Results

1. Obtaining student response questionnaires.

Table 4. Results of Student Response Questionnaire

No	Assessment	Score	Category
1	Student response to trial I	78.12	Good
2	Student response to trial II	88.75	Excellent
	Total	167.99	Excellent
	Average	83.99	Excellent

In addition to the table, the results of the student response assessment can also be seen in the form of a diagram. The follow- up is a diagram showing the results of the student's response.

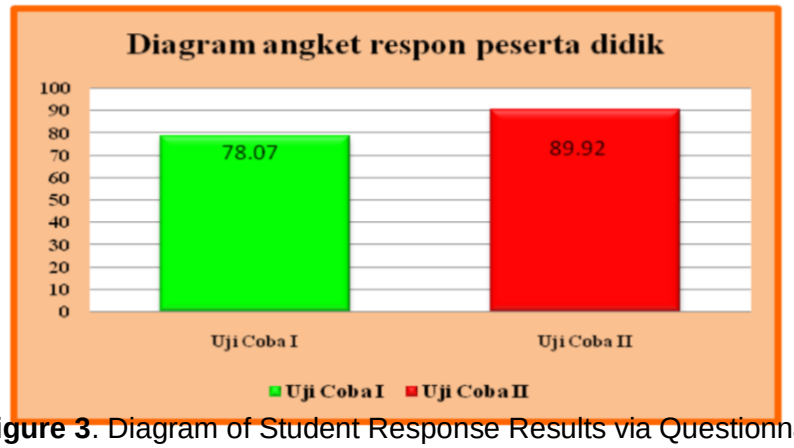

Figure 3. Diagram of Student Response Results via Questionnaire

average score obtained by students in grade I during trial I was 78.07, which is included in the good category. In the results of trial II, the average score obtained by students was 89.92, which is included in the very good category. Based on the trial, the smart ladder learning media product is suitable for use in the learning process. The process of calculating the score is as follows.

$$\sum x = 78,07 + 89,92$$

$$X = \frac{\sum x}{N}$$

$$= \frac{169,99}{2}$$

$$= 83,99$$

The average value obtained from trial I and trial II was 83.99, which is included in the very good category, so it is used in the learning process.

2. Pretest and Posttest Results

In order to find out the differences between the results of the pretest and posttest that have been carried out, in addition to being presented in the form of a table, it is also presented in the form of a diagram. The following is a picture of the diagram of the results of the pretest and posttest of students.

Figure 4. Diagram of Student Pretest and Posttest Results

CONCLUSION

Based on the results of research and development of smart ladder media for addition and subtraction for grade I elementary school, it can be concluded that. The development of smart ladder learning media in mathematics subjects on addition and subtraction (numbers 1 to 10 and their symbols) for grade I elementary school uses the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation); Learning media for smart ladder learning media in mathematics subjects on addition and subtraction (numbers 1 to 10 and their symbols) for grade I elementary school, is declared "suitable" for use as a mathematics learning media. This is based on the assessment of media experts, material experts, learning experts, teachers, and students, as follows:

The assessment by media experts got a score of 78.12 with a good category; The assessment by material experts got a score of 88.75 with a very good category; The assessment by learning experts got a score of 78.94 with a very good category. The results of trial I and trial II conducted at SD Negeri 3 Karangwuni. The average student response questionnaire assessment score was 83.99, pretest 54.58, posttest 84.58 included in the very good category. Meanwhile, the teacher questionnaire assessment was 97.36 included in the very good category.

REFERENCES

Abidin, M. (2017). Teacher Creativity Using Learning Models to Improve Student Learning Outcomes. Didactics: Journal of Education, Tarbiyah Department, STAIN Watampone, 11 (2), 225-238.

Andika, C., & Zham-Zham, LM (2022). The urgency of developing an independent learning curriculum for an independent campus according to the provisions of Law Number 20 of 2003 concerning the national education system. Lawnesia Journal, 1(1), 38–41

Arikunto, S. (2011). Basics of Educational Evaluation (Revised Edition). Jakarta: Bumi Aksara.

Arsyad, A. (2015). Learning Media. Jakarta: PT Raja Grafindo Persada.

Erviana, VY, & Muslimah, M. (2019). Development of smart ladder learning media for addition and subtraction material for grade I elementary school. Journal of Educational Science Research, 11(1),58–68. https://doi.org/10.21831/jpipfip.v11i1.23798

Fadillah, A. (2018). Development of Comic Learning Media on Student Learning Motivation. JTAM Journal of Mathematics Theory and Application, 2(1), 36. https://doi.org/10.31764/jtam.v2i1.259

Hayati, PN, & Rahmawati, I. (2017). The Influence of Tangsapan Media on Learning Outcomes on Length Measurement Material for Grade 3 Students, Theme 6, Subtheme 1, SDN Babatan I Surabaya. JPGSG, 05(02). Retrieved from http://jurnalmahasiswa.unesa.ac.id

Heruman. (2010). Mathematics Learning Model in Elementary School. Bandung: Rosdakarya Youth.

Indriana, D. (2011). Various Learning Media Aids. Yogyakarta: DIVA Press.

Jonkenedi. (2017). The Use of Three-Dimensional Media to Increase Student Activeness in Science Lessons. Elementary School Teacher Education Journal, 6th Edition, Year 6. Retrieved from http://journal.student.uny.ac.id/ojs/index.php/pgsd/article/viewFile/7081/6 775

Nurrita, T. (2018). Development of Learning Media to Improve Student Learning Outcomes. MISYKAT: Journal of Al-Quran, Hadith, Syari'ah and Tarbiyah Sciences, 3(1), 171. https://doi.org/ 10.33511/misykat.v3n1.171

Nurseto, T. (2011). Creating Interesting Learning Media. Journal of Economics & Education, 8(1). Retrieved from http://journal.uny.ac.id

Rohmah, H.N., Suherman, A., & Utami, IS (2021). Implementation of STEM-Based Problem Based Learning on Optical Instrument Material to Improve Students' Critical Thinking Skills. Journal of Physics Learning Research, 12(2), 117–123. https://doi.org/10.26877/jp2f.v12i2.7900

Santri, FS (2016). Mathematics Learning for Elementary School Teacher Education. Yogyakarta: MATHEMATICS.

Sugiyono. (2015). Educational Research Methods: Quantitative, Qualitative, and R&D Approaches. Bandung: Alphabeta.

Sugiyono. (2016). Research and Development Methods. Bandung: Alfabeta.

Susanto, A. (2013). Learning Theory & Teaching in Elementary School. Jakarta: Prenadamedia Group.

Thiagarajan, Sammel, & Sammel. (1974). Instructional Development for Training Teachers of Exceptional Children. Bloomington Indiana University.

Yuniawantika. (2016). Mathematics Learning in Elementary School Using the Indonesian Realistic Mathematics Approach (PMRI). Journal of Educational Theory and Practice Studies, (1). Retrieved from http://journal.um.ac.id/.