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Media Petung Bumi Based on Contextual Approach Effectively Used in Mathematics Learning

Ni Luh Jegeg Sinta Rahayu[1]*, I Wayan Wiarta[2], Made Vina Arie Paramita[(3)]

[1,2,3] Department of Elementary Education, Ganesha University of Education, Singaraja, Indonesia

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ABSTRAK

Penggunaan media pembelajaran begitu penting untuk menarik perhatian siswa sehingga menumbuhkan semangat siswa dalam belajar, materi akan lebih jelas dipahami oleh siswa sehingga dapat membantu meningkatkan capaian pembelajaran peserta didik secara lebih maksimal. Akan tetapi di satuan pendidikan masih kurang inovasi media pembelajaran khususnya yang berbentuk digital yang dapat membantu guru dalam meningkatkan performa mengajar di mata pelajaran Matematika. Penelitian ini merupakan penelitian pengembangan dengan menggunakan model pengembangan ADDIE. Penelitian ini bertujuan untuk mengetahui rancang bangun, kelayakan, dan efektivitas multimedia interaktif "Petung Bumi" untuk muatan Matematika kelas V sekolah dasar. Subjek penelitian melibatkan: ahli rancang bangun, ahli isi/materi pembelajaran, ahli desain instruksional, ahli media, dan 19 orang siswa kelas V SD. Hasil validasi ahli isi/materi pembelajaran sebesar 98,33% (sangat baik), validasi ahli desain instruksional sebesar 95% (sangat baik), validasi ahli media pembelajaran 95% (sangat baik), uji perorangan 97,50% (sangat baik), dan uji kelompok kecil 95,55% (sangat baik). Efektivitas multimedia interaktif diuji dengan menggunakan statistika inferensial teknik one sample t-test dengan membandingkan rata-rata hasil post-test terhadap nilai KKTP (67). Diperoleh media Petung Bumi berbasis pendekatan kontekstual efektif digunakan pada muatan matematika materi operasi hitung bilangan bulat kelas V SD. Dengan demikian, media Petung Bumi layak dan efektif untuk diterapkan dalam pembelajaran Matematika siswa kelas V SD.

ABSTRACT

The use of learning media is very important to attract students' attention so that it fosters students' enthusiasm for learning; the material will be more clearly understood by students so that it can help improve students' learning achievements more optimally. However, in educational units, there is still a lack of innovation in learning media, especially in digital form, which can help teachers improve their teaching performance in Mathematics subjects. This study is a development research using the ADDIE development model. This study aims to determine the design, feasibility, and effectiveness of interactive multimedia "Petung Bumi" for Mathematics content for grade V of elementary schools. The research subjects involved design experts, content/learning material experts, instructional design experts, media experts, and 19 grade V elementary school students. The results of the validation of content/learning material experts were 98.33% (very good), validation of instructional design experts was 95% (very good), validation of learning media experts was 95% (very good), individual tests were 97.50% (very good), and small group tests were 95.55% (very good). The effectiveness of interactive multimedia was tested using inferential statistics using the one-sample t-test technique by comparing the average post-test results to the KKTP value (67). It was obtained that Petung Bumi media based on a contextual approach is effective for use in the mathematical content of integer arithmetic operations for grade V of elementary school. Thus, Petung Bumi media is feasible and effective to be applied in Mathematics learning for grade V elementary school students.

1. INTRODUCTION

Being a teacher in the era of globalization is required to be able to master technology. This ability is very important so that the education provided can keep up with the times and meet the increasingly diverse needs of students. Learning technology, teachers can utilize various digital tools and platforms to create learning experiences that are fun, effective, and can actively engage students. Given the importance of student skills in the 21st century, teachers need to be more creative and innovative in developing an appropriate learning design, making it easy and motivating students to learn independently in a fun way through the use of technology (Baharizqi et al., 2023) . So teachers must be able to

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*E-mail addresses: jegegsintarahayu@gmail.com (Ni Luh Jegeg Sinta Rahayu)

become facilitators and motivators for students to find and utilize learning resources through digital advances (Rosnaeni, 2021; Sadriani et al., 2023) .

With regard to technological developments, the use of learning media is needed to improve the quality of education in learning. In other words, active learning requires media support to deliver the material that students will learn. Learning media is a means that can be used by teachers to convey information to students related to learning so that it is easily understood (Wahyuningtyas & Sulasmono, 2023) . The function of learning media is to provide visual support in learning activities, encourage student learning motivation, clarify and simplify complex abstract concepts to be simple, more concrete, so that they are easily understood (Mulyosari & Khosiyono, 2023) . The use of varied learning media and learning resources reflects the creativity of teachers in designing and implementing the learning process. The use of learning media in the teaching and learning process can develop new interests and desires, arouse motivation, and even affect the psychological aspects of learning (Wulandari et al., 2023) . Based on these statements, it can be concluded that learning media is any form of communication tool that can be used to convey information from sources to students so as to create a conducive learning environment. Learning media can help the student learning process which is expected to achieve a successful level of student learning outcomes.

Interactive multimedia is a type of learning media that integrates various multimedia elements such as text, images, audio, animation and video to create an interesting and meaningful learning experience. By combining these elements, interactive multimedia not only presents information visually and audiotoriously, but also encourages active interaction between students and learning materials. In addition, interactive multimedia can be used during offline and online learning by utilizing available electronic devices (Pratiwi & Wiarta, 2021) . Through the use of interactive multimedia, it is hoped that an increase in the quality of education can be achieved, as well as assisting in the development of teacher professionalism. Because teachers can no longer teach with conventional learning strategies, but now teachers must be innovative by enriching and renewing knowledge and skills to be able to present interesting and interactive learning activities by utilizing technology (Indarta et al., 2022) .

Based on the results of interviews and observations that have been carried out with fifth grade teachers at SD Negeri 1 Beraban, East Selemadeg sub-district, Tabanan, it is known that there are problems in the process of learning mathematics, especially the material of integer counting operations. This can be seen from the learning results of mathematics knowledge competency of grade V students, especially in the scope of integer counting operation material, namely out of 19 students in grade V, 13 students out of the total number did not meet the KKTP set by the school. Similarly, the average student learning outcomes obtained only reached a value of 63.68 which can be categorized as low in the range of 40-64 based on Benchmark Assessment (PAP) on a scale of 5. Referring to the expectations and realities that occur, there is a gap between the researcher's goal of optimizing student learning at school, with the hope of achieving a completeness value in the range of 86-100%, and the fact that the average student learning outcomes in mathematics subjects, especially the material on integer counting operations, are on average 63.68. This value shows that students have not met the completeness, so it is necessary to do remedial work on the parts that have not been mastered.

The low student learning outcomes in integer arithmetic operation material are caused by several factors such as students considering math subjects difficult and unpleasant, lack of student understanding of integer arithmetic operation material, especially on story problems, teachers still use learning media that are less interactive which causes boredom and boredom for students in the learning process, teachers do not understand how to develop a learning media because of their limited ability to use technology. This problem will certainly have an impact on student learning outcomes because learning activities affect students' ability to build the knowledge they have, which then affects the level of student understanding.

In relation to the implementation of learning activities in primary schools, mathematics is one of the subjects at the primary school education level. Mathematics is an essential subject for students because it plays an important role in training reasoning skills, and has important objectives to meet practical needs, such as developing skills to use mathematics in solving various problems of everyday life. According to UNESCO, there are four main pillars in education that are important to develop, namely 1) *Learning to know*, 2) *Learning to do*, 3) *Learning to live together*, and 4) *Learning to be* (Priscilla & Yudhyarta, 2021) . Based on these four pillars, learning mathematics is not just *learning to know* (students' ability to understand), but also includes *learning* to do (students' ability to perform mathematical activities), *learning to be* (students' ability to achieve achievements in the field of mathematics), to *learning to live together* (students' ability to communicate mathematics in everyday life) (Manalu & Khairiah, 2021) . Many students think that math is a difficult subject, but in fact math will feel easy and fun if it is packaged through an interesting learning process and is easily understood by students (Rahmadani et al., 2023) . Intensive efforts are needed to improve students' mathematical concept understanding skills. One important aspect that needs to be considered in the learning process so that students' concept understanding is better is by applying a learning approach (Hidayat et al., 2020) . The application of the right approach can make it easier for students to understand and master mathematical concepts, so that their mathematical abilities can develop optimally.

One of the learning approaches that can be used in learning mathematics is the contextual approach. The contextual approach is defined as an educational process that aims to help students see the meaning of the school lessons they are learning by connecting these lessons with their context in everyday life. The contextual approach or commonly referred to as *Contextual Teaching and Learning* (CTL), is based on the philosophy of constructivism which emphasizes that our knowledge is our own construction (formation) (Supratman et al., 2023) . The contextual approach in mathematics learning focuses on the application of mathematical concepts in real-life situations. The goal is to help

students connect math concepts with their daily life experiences.

Based on the problems encountered in the field, the solution offered is the development of learning media that suits the needs of grade V elementary school students, especially for mathematics subjects with integer counting operation material. The media to be developed is packaged under the name Petung Bumi (Interactive Multimedia Integer Counting Operation) based on a contextual approach. The existence of Petung Bumi media based on a contextual approach makes it easier for students to use it because it can be accessed anytime and anywhere as an alternative solution in making the learning process more interesting. Learning by using multimedia involves several sensory organs because it is a combination of text, images, audio, and animated movements so that it is more attractive and able to assist in strengthening the material presented (Dwiqi et al., 2020) . Through the development of this learning media, students will feel that learning mathematics is fun, helping to increase students' enthusiasm and motivation in learning mathematics, so that students play an active role in learning which can improve the quality of learning and student learning outcomes.

2. METHOD

This type of *research* is a development research *(Research and Development)* using the ADDIE development model. The ADDIE development model consists of 5 steps, namely: analysis *(analyze)*, *design (design)*, *development (development)*, *implementation (implementation)*, and evaluation *evaluation)*. The product trial design of this research is an expert test, product development test, and product effectiveness test of the development results. The expert test consists of four stages, namely: design expert test, learning content expert test, instructional design expert test, and learning media expert test. The development product trial to students, consisting of individual trials and small group trials. Then the effectiveness test of the developed product was carried out on students. Expert test subjects were one design expert, one learning content expert, one instructional design expert and a learning media expert. Subjects of individual trials, small group trials, and effectiveness tests of the developed products involved fifth grade elementary school students.

The data collection methods in this study used test methods and non-test methods. The test method is a method used to measure students' knowledge or abilities through predetermined rules in the form of written questions that must be answered by students. The test method in this development research was carried out after the application of the media at the end of learning. While the non-test methods used in this study are interviews and observations. The data collection instrument in this study used a questionnaire / questionnaire and a test in the form of 20 multiple choice questions that had gone through the instrument trial stage (item validity test, reliability test, difficulty test, and differentiator test). The following is a lattice of test instruments used in this study.

Table 1. Test Instrument Grid

Learning Outcomes	Material	Problem Indicator	Cognitive Level	Many Questions
By the end of phase C, learners can read, write, order and compare whole numbers. Learners can apply whole number arithmetic operations and give estimates in solving problems (including those related to financial literacy).	Round Number Counting Operation	1. Learners are able to read negative whole numbers and positive whole numbers.	C2	4
		2. Learners are able to write whole number symbols from the contextual problem given.	C2	3
		3. Learners are able to sort whole numbers from smallest to largest or vice versa.	C3	7
		4. Learners are able to compare two negative integers, a positive integer with a negative one or vice versa.	C4	2
		5. Learners are able to solve problems in everyday life related to whole number calculation operations.	C4	4
		Number of Questions		**20**

This study used three data analysis techniques, namely: descriptive quantitative, descriptive qualitative and inferential statistical analysis techniques t-test. Quantitative descriptive analysis is a way of processing data by compiling in the form of numbers systematically so that general conclusions are obtained. This technique is used to process data

from expert test questionnaire assessments and trials. The data obtained is then analyzed and converted using qualitative descriptive data analysis techniques based on a 5-scale achievement level conversion table. The inferential statistical analysis method is a way of processing data carried out by applying *inferential statistical* formulas to test a research hypothesis proposed by the researcher, and conclusions are drawn based on the results of testing the hypothesis. Inferential statistical analysis of *the one sample t-test* technique was used in analyzing the results of the effectiveness test of the Petung Bumi multimedia based on a contextual approach by comparing the *post-test* results obtained by students with the KKTP value set by the school of 67. Before using this t-test technique, a prerequisite test was needed which consisted of *a post-test* normality test. After the *post-test* data is declared normal, the test can be continued with the *one sample t-test* technique.

3. RESULT AND DISCUSSION

Result

This research uses the ADDIE model which consists of 5 stages. In the first stage, namely analysis *(analyze)*, the process of analyzing the needs in learning is carried out to determine the media that needs to be developed. The second stage is *design*, which is done by designing the product concept based on the results of the previous analysis, and continued with an assessment of the product design by competent experts to ensure its quality.

The third stage is *development* to make the product in accordance with the predetermined design. The finished product will go through several stages of testing, including feasibility assessment by learning material/content experts, instructional design experts, and learning media experts. In addition, the feasibility of using Petung Bumi media products was also tested through individual trials and small group trials involving students. This stage aims to determine user responses to the Petung Bumi media developed. Input in the form of notes, comments, and suggestions from readers during this procedure is used as a basis for improving and refining the product to better suit learning needs. The following is a recapitulation of the results of the trial and assessment of Petung Bumi media presented in table 2.

Table 2: Recapitulation of the Results of the Media Trial of Petung Bumi

No.	Subject	Percentage	Qualification	Description
1.	Design Expert	93,18%	Very good	Feasible to use
2.	Learning Content/Material Expert	98,33%	Very good	Feasible to use
3.	Instructional Design Expert	95%	Very good	Feasible to use
4.	Learning Media Expert	95%	Very good	Feasible to use
5.	Individual Trial	97,50%	Very good	Feasible to use
6.	Small Group Trial	95,55%	Very good	Feasible to use

After the Petung Bumi media product development process is complete, the next stage is the *implementation* stage. This stage aims to apply Petung Bumi media based on the contextual approach in the learning process, to determine its effectiveness in supporting learning. Furthermore, students were given treatment using Petung Bumi media during learning activities. After that, students were given *post-test* questions to determine students' knowledge competence in the mathematics content of whole number counting operation material after using Petung Bumi media

The last stage is the *evaluation* stage. In this research, the evaluation stage is formative evaluation and summative evaluation. Formative evaluation is carried out after data from the implementation stage is collected, by assessing the product based on the results of expert validation and trials conducted by students. The results of this evaluation are used to revise and improve the learning media developed. Meanwhile, the summative evaluation aims to determine the feasibility and effectiveness of the developed product, as well as to expand the range of product use to more students. This evaluation is carried out by testing the effectiveness through giving *post-test* questions to students.

The data collected is the average *post-test* score which is then tested for normality of the data distribution before proceeding to the inferential statistical test. The normality test is carried out to present data that the sample really comes from a normally distributed population. The normality test in this study was carried out on 19 students from the mathematics learning outcomes of whole number counting operation material obtained from student learning outcomes after using Petung Bumi media based on a contextual approach

Based on the t-test results, $t_{count} = 17.148$ was obtained. Then t_{count} is compared with t_{table} with a significance level of 5% for dk = (n-1) = 19-1 = 18 which is 1.734. This means that t_{count} 17.148 ≥ t_{table} 2.101 so that H_0 is rejected and H_1 is accepted. Based on the test criteria, if H_0 is rejected and H_1 is accepted, it means that there is a significant difference (5%) after using Petung Bumi media based on the contextual approach. So it can be concluded that the Petung Bumi media product based on the contextual approach is effectively applied to the mathematics content of whole number counting operation material in grade V elementary school.

Discussion

This research produces a product in the form of Petung Bumi media based on a contextual approach to the mathematics content of grade V SD, which has been declared valid based on the design expert test, learning

content/material expert test, instructional design expert test, learning media expert test, individual trial, and small group trial, and has been tested effective based on the effectiveness test. The development of Petung Bumi media based on the contextual approach can help students, especially grade V students, to obtain meaningful learning. Students not only learn mathematical concepts theoretically, but they can also apply these concepts in everyday life. The use of Petung Bumi media helps students understand math concepts while linking theory with practice. Petung Bumi media integrates text, images, animations, and learning videos that make students involved in the learning process interactively (Muhartini et al., 2022; Putra, 2023) . Through this way, students' interest in learning increases, and students can experience a more meaningful learning experience.

The contextual approach in mathematics learning emphasizes the connection between the concepts learned and the real experiences of students (Rahmadani et al., 2023; Tsabitah et al., 2024) . This approach aims to improve understanding of concepts by linking them to everyday life, so that students not only memorize formulas, but also understand their use in various situations (Astri et al., 2022) . Thus, learning becomes more relevant and interesting for students, and helps them in applying mathematical concepts in everyday life such as in financial calculations, measurements, or data-based problem solving.

The effectiveness of the Petung Bumi media development research based on the contextual approach in the fifth grade mathematics content of SD Negeri 1 Beraban Tabanan was carried out by the test method in the form of 20 multiple choice questions with all fifth grade students of SD Negeri 1 Beraban Tabanan with a total of 19 students. The test questions given are questions that have been tested for validity, reliability, difficulty level, and differentiation of each item. Data to test the effectiveness was obtained from the students' *post-test* results, which is a test conducted after the application of the product in learning. The average student *post-test* results > KKTP (91.58 > 67), this proves that there is an increase in student learning outcomes after using Petung Bumi media which makes students interested in learning and understanding integer counting operation material. Based on the results of hypothesis testing with the one-sample t-test formula at the 5% significance level for dk = n-1 = 19-1 = 18, namely 1.734. This means t_{count} 17.148≥ t_{table} 1.734 so that H_0 is rejected and H_1 is accepted. Based on this calculation, it proves that there is a significant difference (5%) after the use of Petung Bumi media based on the contextual approach. So it can be concluded that Petung Bumi media based on contextual approach is effectively used in math content of whole number counting operation material in grade V SD Negeri 1 Beraban Tabanan.

The use of learning media that can accommodate a variety of student learning styles helps teachers to convey mathematical concepts more easily. Teachers can no longer fully rely on conventional learning strategies, but now teachers must be innovative and continue to develop skills, and utilize technology to create interesting and interactive learning (Indarta et al., 2022). Learning mathematics with Petung Bumi media based on contextual approach makes students very enthusiastic to learn independently, so that they are able to build their own knowledge according to their respective learning styles. The display and features presented in Petung Bumi media make learning interactive because students can participate directly in the use of Petung Bumi media.

Petung Bumi media based on contextual approach is effectively applied to the mathematics content of whole number counting operations. The use of multimedia can improve the overall quality of mathematics learning. This finding is reinforced by previously conducted research that interactive multimedia is suitable for use in the learning process in elementary schools (Dharmayani et al., 2022; Donna et al., 2021) . This is because multimedia is able to combine visual, audio, and interactivity elements in one interesting unit (Rahmijati, 2023; Sutarwiyasa et al., 2024) . Children at elementary school age tend to understand concepts more easily through direct experience and strong visual stimulation. With multimedia, abstract concepts in mathematics can be visualized in the form of images, animations, or interactive simulations that help students understand the material more deeply (Siregar et al., 2024) . In addition, multimedia can also increase learning motivation because it is interesting and not monotonous compared to conventional learning methods. Another advantage of this media is its flexibility in supporting various student learning styles, whether they are predominantly visual, auditorial, or kinesthetic, so that all students can more easily absorb the material according to their learning preferences.

Petung Bumi media is designed to be accessible through various devices, both laptops and cellphones, thus providing flexibility for students and teachers in the learning process. With the support of web-based technology or applications, students can learn anytime and anywhere without being limited by the classroom. This ease of access also allows students to repeat the material they have learned, so they can understand math concepts better. In addition, compatibility with various devices makes Petung Bumi Media more inclusive and can reach more students, including those who have limitations in accessing certain devices. With interactive features that remain optimal across multiple screens, Media Petung Bumi is an innovative solution to support more effective and engaging math learning.

The contextual approach to learning emphasizes that students must understand concepts through real experiences that are relevant to their lives (Widyaputri & Agustika, 2021) . In learning mathematics, this approach aims to make students not only memorize formulas and procedures, but also understand the meaning and application of concepts in various everyday situations (Supratman et al., 2023) . By using interactive multimedia, the contextual approach is more effective because it is able to present a more real and meaningful learning experience. In addition, multimedia based on the contextual approach allows students to explore concepts independently and actively, so that they are not only recipients of information, but also involved in a more dynamic learning process (Dasi & Putra, 2022; Wijayanti et al., 2021) . With the interactive features, students can experiment with various values in the equation and see the changes in the results directly, so that they more easily understand the concept of whole number operations

calculation . This approach also supports various learning styles, whether visual, auditory, or kinesthetic, making it more inclusive for all students. Thus, the use of multimedia based on the contextual approach not only makes learning more interesting and fun, but also significantly improves students' understanding and learning outcomes.

This study supports previous research which states the use of interactive multimedia in learning activities of course can increase motivation and interest in learning students so that has a good impact on student learning outcomes (Wedayanti & Wiarta, 2022) . In addition, web-based multimedia has a significant effect in increasing student learning motivation (Rahmawati & Hidayati, 2022) . The development of interactive learning multimedia is needed to motivate students to learn mathematics with components that are fulfilled including: clear competencies and learning objectives, clear instructions for use, material delivery activities that are clarified with images and animations, interesting games as exercises such as games and quizzes, and are interactive with interaction between the program and the user through reciprocal responses to make learning more interesting and fun (Kusumawati et al., 2021) . The use of this contextual learning approach can also make it easier for students to understand learning, because students can connect their knowledge with applying it in real life (Devi & Wiarta, 2024) . The novelty in this research is on the basis of the approach in multimedia, the material chosen, and also the subjects in the study.

The implication of the results of this study is empirically, it is proven that the Petung Bumi media based on the contextual approach to mathematics content is valid/worthy to be used in the learning process. Petung Bumi media based on contextual approach is able to support the learning of grade V students. This is indicated by the increased activity and interaction of students while using Petung Bumi media as learning media. Petung Bumi media based on contextual approach in math content is developed to train students to be able to find and build their knowledge independently about whole number counting operation material in particular. Students not only learn the theory, but also gain meaningful learning experiences, so that they can apply it to everyday life through examples that have been presented and presented on Petung Bumi media based on this contextual approach. Research on the development of Petung Bumi media based on a contextual approach to mathematics content can be an inspiration for teachers to create and utilize learning media that are in line with technological developments.

4. CONCLUSION

Based on the results and discussion of this study, it proves that there is a significant difference of 5% after the use of Petung Bumi media based on a contextual approach in the learning process. This can be seen from the *post-test* results of 91.58 which is greater when compared to the KKTP determined by the school which is 67. So it can be concluded that the Petung Bumi media based on a contextual approach is feasible and effective in using the mathematics content of whole number counting operations in grade V SD.

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