



## Engaging Education: Interactive PUB MABAR for Second Graders at MIN 1 Tulungagung

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**Abstract:** This research is based on the lack of media variations in learning, lessons are still run conventionally because teachers still use conventional learning media in delivering material, and the media is still abstract and concrete media is needed. So that many students still lack mastery of the material taught. The objectives of this study are 1) To describe the process of developing Pop Up Box Mathematics Bangun Ruang (PUB MABAR) media for grade II students of MIN 1 Tulungagung. 2) To describe the feasibility of developing Pop Up Box Mathematics Build Space (PUB MABAR) media for grade II students of MIN 1 Tulungagung. The type of research used in this study is Research and Development (R&D) which refers to the ADDIE development model. The ADDIE development model consists of five stages, namely Analysis, Design, Development, Implementation, and Evaluation. The instruments used in this research are observation, interviews, documentation, questionnaires, and tests (pret-test and post-test). The types of data in this study are qualitative data, namely the results of interviews and validator comments, and quantitative data in the form of validation scores, readability scores, and test results (pret-test and post-test). Data analysis used descriptive analysis and N-Gain test. The results of this research and development are 1) This development

research process goes through the stages of analysis, design, development, implementation, and evaluation. This process begins with performance analysis, analysis of learning objectives, analysis of student characteristics, needs analysis, compiling validation instruments, compiling learning strategies, formulating learning objectives, compiling tests, designing storyboards, making teaching modules, developing products, product validation, product trials, distributing feasibility questionnaires, and product revisions. 2) Based on the results of validation by media experts I obtained a total score of 62 and an average percentage of 82% and media experts II amounted to 60 and an average percentage of 80% with the category "Valid / Usable". Validation results by material experts I obtained a total score of 72 and an average percentage score of 96%, and material experts II obtained a total score of 67 and an average percentage score of 89.3% with the category "Very Valid / Very Feasible to Use ". The overall result of the student response questionnaire in class II A was 92.6%, in class II B was 90.8%, and in class II C was 91.5% with the category "Very Valid/Very Worth Using".

***Keywords:*** *Learning Media, Pop Up Boxes, Mathematics, Building Spaces*

**Abstrak:** Penelitian ini dilatar belakangi pada permasalahan kurangnya variasi media dalam pembelajaran matematika, pelajaran masih berjalan secara konvensional karena guru masih menggunakan media pembelajaran konvensional dalam penyampaian materi, dan media masih abstrak dan dibutuhkan media kongkrit. Sehingga banyak siswa yang masih kurang menguasai materi-materi yang diajarkan. Tujuan penelitian ini adalah 1) untuk mendeskripsikan proses pengembangan media Pop Up Box Matematika Bangun Ruang (PUB MABAR) pada siswa kelas II di MIN 1

Tulungagung. 2) untuk mendeskripsikan Kelayakan pengembangan media Pop Up Box Matematika Bangun Ruang (PUB MABAR) pada siswa kelas II di MIN 1 Tulungagung. Jenis penelitian yang digunakan dalam penelitian ini adalah Research and Development (R&D) yang mengacu pada model pengembangan ADDIE. Model pengembangan ADDIE terdiri dari lima tahapan, yaitu Analysis, Design, Development, Implementation, dan Evaluation. Instrumen yang digunakan dalam penelitian ini adalah observasi, wawancara, dokumentasi, angket, dan tes (pret-test dan post-test). Jenis data dalam penelitian ini terdapat data kualitatif yaitu hasil wawancara dan saran komentar validator, serta data kuantitatif berupa skor validasi, skor keterbacaan, dan hasil tes (pret-test dan post-test). Analisis data menggunakan analisis deskriptif dan uji N-Gain. Hasil dari penelitian dan pengembangan ini adalah 1) Proses penelitian pengembangan ini melalui tahap analisis, desain, pengembangan, implementasi, dan evaluasi. Proses ini diawali dengan analisis kinerja, analisis tujuan pembelajaran, analisis karakteristik siswa, analisis kebutuhan, menyusun instrument validasi, menyusun strategi pembelajaran, merumuskan tujuan pembelajaran, meyusun tes, merancang storyboard, membuat modul ajar, mengembangkan produk, validasi produk, uji coba produk, penyebaran angket kelayakan, serta revisi produk. 2) Berdasarkan hasil validasi oleh ahli media I diperoleh jumlah skor sebesar 62 dan rata-rata presentase sebesar 82% dan ahli media II jumlah sebesar 60 dan rata-rata presentase sebesar 80% dengan kategori "Valid/Layak digunakan". Hasil Validasi oleh ahli materi I diperoleh jumlah skor 72 dan skor rata-rata presentase sebesar 96%, dan ahli materi II diperoleh jumlah skor 67 dan skor rata-rata presentase sebesar 89,3% dengan kategori "Sangat Valid/Sangat Layak Digunakan". Hasil keseluruhan angket tanggapan siswa pada kelas kelas II A adalah 92,6%, pada kelas II B sebesar 90,8%, dan pada kelas II

C sebesar 91,5% dengan kategori “Sangat Valid/Sangat Layak Digunakan”.

***Kata Kunci:*** *Media Pembelajaran, Pop Up Box, Matematika, Bangun Ruang*

## INTRODUCTION

Education plays an important role in improving and developing human quality from various aspects such as knowledge, skills and attitudes in order to prepare humans to become individuals who are able to provide benefits and contribute sustainably (Zaman, 2019) . Education should be designed as a process of preparing the skills needed to become a responsible human being and be directly involved in solving problems in the future in accordance with changes and developments over time (Susanto, 2016) . How to improve and develop human qualities can be done by providing mathematics learning at school (Zulfikar & Dewi, 2021) .

Mathematics has a very important role in life now and in the future. And it is one component of a series of subjects that have an important role in the world of education (Permatasari, 2021) . Mathematics is also one of the subjects that supports the development of science and technology. Therefore, the role of mathematics learning is needed (Samura, 2015) . Apart from that, there are many reasons for the need to study mathematics. Among these are to facilitate problem solving in daily life, have the ability to think clearly and logically, have the ability to think clearly and logically, have the ability to recognize relationship patterns and generalize experiences, increase awareness of cultural developments and develop facilities (Huriyanti & Rosiyanti, 2017) .

There are three basic skills needed in learning mathematics, including (1) recognizing shapes and spaces, (2) recognizing symbols or images, and (3) the ability to count. However, these three skills are also one of the difficulties that students encounter in learning mathematics (Karso & Pd, 2014) . This statement shows

that students who experience mathematics difficulties cannot carry out several important activities in learning mathematics such as calculating, drawing, and determining size and shape. Because of this, until now there are still many students who don't like mathematics subjects. They think that mathematics is a terrible subject. Apart from being scary, mathematics is also considered a boring subject which only studies formulas, numbers, pictures and also arithmetic operations (Fitriana & Aprilia, 2021) . This is what teachers should pay particular attention to in order to create a learning atmosphere that is not boring and enjoyable (Rohman, 2023).

Teachers as facilitators have an important role in the learning process so that the knowledge taught can be well received by students (Naibaho, 2018) . In order to achieve effective learning objectives, teachers are expected to be able to apply and use media that is appropriate to the material being taught. Media is one of the tools needed by teachers to attract students' attention and material can be delivered easily to students (Ekayani, 2017) . Apart from that, learning media has a very important position, even parallel to learning methods, because the learning methods used in the learning process will require what media will be integrated and adapted to the conditions faced in learning. The learning process in mathematics subjects must be delivered through an intermediary and media that is used to truly understand concepts in mathematics (Maimunah, 2016) .

Based on an interview with one of the class II Mathematics teachers at MIN 1 Tulungagung, namely Mrs. Lailatul Masrifah, S.Pd.I. and observations made by researchers show that teachers have difficulty explaining the concept of space to students. Teachers more often use the lecture method and teachers do not use appropriate learning media in explaining spatial material, teachers still use conventional learning media such as blackboards and textbooks as media and learning resources when the mathematics learning process takes place due to the lack of learning media

facilities available in school. Apart from that, the lack of teacher creativity in using media is due to the teacher's very limited time and many other activities so that it can take up the teacher's time and create time to create learning media that is appropriate and suitable for use in the learning process. Researchers also saw and concluded that during the mathematics learning process, students were easily bored and tended to be passive because teachers more often explained the material using the available learning media around the class. By looking at the characteristics of these students, interesting learning media are needed that are able to stimulate student activity in the mathematics learning process.

One of the materials in the Class II Odd Semester Mathematics subject is "Building Space". Building space is one of the basic mathematical materials that students must learn. Space geometric material is a scope of geometric material that must be mastered by students as a basic knowledge in studying advanced geometric concepts of geometric shapes. A spatial shape is a three-dimensional geometric shape that has space and volume with boundaries that are flat or curved (Arina et al., 2020) . There are several things studied in phase A in class II in spatial construction material such as ; recognize various forms of spatial shapes, name spatial shapes, characteristics and properties of spatial shapes, and classify various objects according to the shape of spatial shapes. In connection with this, teachers are required to teach material clearly and have innovations such as the use of learning media. This material requires learning media in concrete form such as 3-dimensional media .

One of the innovative media in 3 dimensions is *the Pop Up Box*. A *pop-up box* is media in the form of a box which when the lid is opened a 3D *Pop Up page appears* which seems to be moving so as to amaze the reader (Frima et al., 2022) . The use of *Pop Up Boxes* was chosen by researchers because *Pop Ups* have advantages, among others. Therefore, with the development of *Pop Up Box media* , it is hoped that the process will be practical when used and

easy to carry and can increase students' enthusiasm when using this media (Yanto et al., 2023) . So that learning can run smoothly so that students' assumptions about the difficulty of learning mathematics can be resolved and students can easily understand the concept of space in the learning process.

## **METHOD**

*Research and Development (R&D)* research . The development model used in this research uses the *ADDIE model*. This model has five steps which are carried out in stages, namely *Analysis* (Analysis), *Design* (Design/Planning), *Development* (Development), *Implementation* (Implementation), *Evaluation* (Evaluation) (Rayanto, 2020) . The advantages of the *ADDIE* research model can be seen from its systematic working procedures at each step which always refer to previous steps which have been improved to produce effective products.

This research was conducted at MIN 1 Tulungagung with research subjects all students in class II A, II B, and II C, totaling 90 students. The techniques used in this research used data collection techniques: observation, documentation, interviews, questionnaires and tests. Research data was collected through a validation sheet instrument which included validation by media experts, validation by material experts, and validation by test experts, as well as a response questionnaire for students using PUB MABAR media.

## **RESULTS AND DISCUSSION**

Based on the results of research conducted in developing the *Pop Up Box Mathematics Build Space (PUB MABAR)* media for class II students at MIN 1 Tulungagung, it refers to the ADDIE stages, namely *the analysis, design, development, implementation and evaluation stages*. The aim of developing this media is to produce mathematics learning media for phase A geometric geometric material in class II MI that is interesting, creative and innovative and

can achieve meaningful learning activities that are in line with learning objectives.

### **Analyze**

This analysis stage is to collect initial data and information in the development of creating a learning media product, namely *Pop Up Box* Mathematics Build Space (PUB MABAR) media. The first step in conducting research on this procedure was interviewing class II mathematics teachers at MIN 1 Tulungagung, distributing needs questionnaires to students in classes II A II B and II C, and observing learning activities and the students' learning environment. The purpose of the interview was with one of the class II mathematics teachers, namely Mrs. Lailatul Masrifah S.Pd.I. namely to analyze the geometric material of geometric shapes in class II and the learning objectives that are in accordance with the independent curriculum set out in MIN 1 Tulungagung, then analyze the teaching materials and learning media, the media used in the learning process of mathematical geometric shapes is very limited and still abstract, the teacher uses media The basics are a whiteboard and markers. In delivering material on Mathematics for building shapes for class II at MIN 1 Tulungagung, the teacher explained by describing the shapes of space shapes on the blackboard without giving examples of concrete shapes. By using this media, students are less interested in participating in learning and they get bored easily so that some students do not understand the material being taught.

Next, analyzing the characteristics of students, class III students at MIN 1 Tulungagung have various characters. During this period, it is a concrete operational period where they require special attention. They are very realistic as learning with real things can be seen, heard and messed with. There are several children who still lack understanding, one of which is the mathematical material of geometric shapes. Then analyze the needs of students and expectations for the development of learning media. Students

need new media innovation by developing a spatial mathematics learning media that is designed to be as attractive as possible according to the needs of students, the characteristics of low class students according to the media developed by researchers, namely media. *Pop Up Box* math building space namely media in a concrete 3-dimensional form, which is colorful and has a *spinner game* containing questions and answers which are used to support students' mastery of concepts and understanding of the material. So that this media can make it easier for teachers and students in the learning process, students can understand spatial building material correctly, and create meaningful learning for class II students at MIN 1 Tulungagung.

### ***Design***

This stage includes formulating learning objectives, determining learning strategies by combining appropriate methods, models and steps in learning. This is contained in the learning tool (Teaching Module). Develop a test which aims to determine the level of students' understanding after and before using the media developed in the form of multiple choice questions, develop media assessment instruments whose validity is tested, namely, media expert validation instruments, material expert validation instruments, and test expert instruments. Develop a media design that is developed by determining the materials and tools that will be used in making PUB MABAR media, determining the size of each component that will be used in developing PUB MABAR media, assembling the product according to the specified learning, compiling learning evaluations and designing *storyboards*.

### ***Development***

*PUB MABAR* learning media products, validating learning media with media experts, material experts and teachers who teach class II Mathematics, as well as small-scale trials in class II A MIN 1 Tulungagung. In the process of making PUB MABAR learning media products using the *Pop Up technique V-Folding* and *Parallel Slide*.

The materials used are duplex as the main material with size A3+ (32 cm x 48 cm), glossy sticker paper for background printing paper and 310 g sm Art Paper for printing Pop Up images. The following are the results of the development of Pop Up Box Mathematics Build Space (PUB MABAR) media for class II students at MIN 1 Tulungagung.

Figure 1 . PUB MABAR media cover display



The coloring and images on the cover of this learning media are designed with the theme of the surrounding environment in accordance with the main material of mathematics, geometry, geometric shapes, space shapes, phase A , class II MI, so that students can easily understand the material. The media content consists of four boxes designed with the Canva application. The first, second and third boxes contain material presentation and the fourth box contains a spinner game as an evaluation.

Figure 2 . First Display of Material from the Media Contents Section of PUB MABAR



In the presentation section of the PUB MABAR media content, the first section contains an introduction to cubes and blocks. When

drawn, the geometric shapes give a 3-dimensional or embossed effect, so that students can easily understand the original shape of cubes and blocks. In the section on the characteristics of geometric figures, when drawn, a different display will appear so that students will be impressed when reading, which contains various characteristics of cubes and blocks, such as having 8 vertices, 6 sides and 12 edges and is equipped with descriptions of pictures of the ribs and sides. and corner points so that students can easily understand the material on the characteristics of cubes and blocks. In the section, various objects in the form of cubes and blocks are displayed using the *Pop Up parallel slide* technique which, when pulled, will display images of various objects in the shape of cubes and blocks, so that students will easily remember and understand the material correctly.

**Figure 3.** Second material display from the PUB MABAR media content section



In the presentation section of the PUB MABAR media content, the second section contains an introduction to cone and tube geometric shapes. When drawn, the shape of the cone and tube shapes gives a 3-dimensional or embossed effect, and illustrations of traffic scenes are provided which contain pictures of road cones and tube trash cans so that students can easily understand the original shape of the cone and tube shape shapes. In the section on the characteristics of geometric shapes, when pulled, a different display will appear so that students will be impressed when reading, which contains various characteristics of cones and cylinders using the *Pop Up parallel slide technique* , which when

pulled will display pictures of various cone and tube shaped objects. vary.

**Figure 4.** Third Material Display from the Media Contents Section of PUB MABAR



In the content section, the third material display presents material on building spherical space. The material for building a ball space is presented with an illustration of the atmosphere on a football field in 3 dimensions. Contains the characteristics of the ball and is equipped with a description of the side of the ball. In this section, various objects in the form of spherical shapes are also displayed using the *Pop Up parallel slide technique*.

**Figure 5.** Learning Evaluation Display on PUB MABAR Media



The closing part as an evaluation of learning on PUB MABAR media is equipped with a *spinner game*. This learning evaluation is given with the aim that students can remember and repeat geometric mathematics material regarding geometric shapes. Next, the researcher validated the learning media with 2 media experts and 2 material experts, as well as a small-scale trial in class II A MIN 1 Tulungagung, totaling 23 students.

### ***Implementation***

At this stage, a trial of the PUB MABAR media product was carried out to determine the effectiveness of the media being developed. Learning media is said to be effective if there is an increase in student learning outcomes before and after treatment and based on student learning completeness. This stage begins by preparing teachers to introduce the features contained in learning media, the objectives of developing learning media, how to operate learning media properly and correctly, the learning strategies and learning evaluation used. Apart from that, researchers prepare students to sit closely with friends, analyze pre-requisite material, and provide apperception regarding whole number counting operations material as well as preparing a comfortable learning environment for students in the learning process. Researchers carried out this field trial on class II B students totaling 27 students and class II C totaling 26 students at MIN 1 Tulungagung. At this stage, product trials are carried out by the teacher by giving *pretest questions*, then giving PUB MABAR media *treatment*, giving *posttest questions*, and giving questionnaires on student responses to the learning media.

### ***Evaluation***

Researchers use evaluation to determine the advantages and disadvantages of the product being developed. At this stage there is a formative evaluation and a summative evaluation. Formative evaluation is carried out for feedback to make improvements. Formative evaluation in this research was carried out by giving validation questionnaires to media experts and material experts, to determine the suitability of the media and students' responses to the *Pop Up Box Math Bangun Ruang (PUB MABAR)* learning media. The summative evaluation is intended to determine the level of effectiveness of the learning media by analyzing the criteria for increasing *the N-Gain Score* and *N-Gain Percent* of students before

and after implementing the *Pop Up Box* Mathematics Build Space (PUB MABAR) learning media using SPSS version 25.

*Pop Up Box (PUB MABAR)* media was determined through the validation stage by media experts, material experts, and the responses of class III A, B, and C MIN 1 Tulungagung students to the PUB MABAR learning media. The validators chosen were 2 media expert lecturers, 1 material expert lecturer, and 1 class II mathematics teacher.

Based on the results of the assessment of student responses in the table above in the student response questionnaire, it can be seen that the average value of the overall results of the student response questionnaire in class II A is 92.6%, in class II B it is 90.8%, and in class II C amounting to 91.5%. Based on the results, the validity is at the "Very Valid" level. In the questionnaire regarding students' responses to the *Pop Up Box* Math Building Space (PUB MABAR) media, there were also very good comments, namely that the media was interesting and unique, because there was no media like this. Those who commented regarding the material said that the material was easy to understand. With the results of the data in the table, it can be seen that the *Pop Up Box Mathematics Building Spaces (PUB MABAR)* learning media is very suitable for use in the geometric mathematics learning process for building materials in Phase A Class II MI.

The effectiveness of the learning media was determined through the pretest and posttest experimental design of the *Pop Up Box* Mathematics Building Space (PUB MABAR) learning media which was carried out in classes II B and II C. To show an increase between the pretest and posttest scores, it will be analyzed using the *N-improvement criteria. Gain Score* and *N-Gain Percent* using SPSS version 25. The following is the effectiveness data from the results of the *N-Gain Score* and *N-Gain Percent* in the form of *Descriptive Statistics* in classes II B and II C:

**Figure 6.** Descriptive Statistical Results of the Class II B Media Effectiveness N-Gain Test

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Ngain_score	27	.25	1.00	.7625	.19160
Ngain_percent	27	25.00	100.00	76.2522	19.16045
Valid N (listwise)	27				

**Figure 7.** Descriptive Statistical Results of the Class II C Media Effectiveness N-Gain Test

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Ngain_score	26	.43	1.00	.7786	.16713
Ngain_percent	26	42.86	100.00	77.8571	16.71340
Valid N (listwise)	26				

Based on Figure 4.11, the average value (*Mean*) in class 2 B obtained is 0.7625, this value is greater than 0.70, so the category obtained is high, which means the effectiveness is high. For N-Gain, the percentage value obtained was 76.2%, which can be seen from the *N-Gain effectiveness category* in percentage form, the value of 76.2% is greater than 76%, which can be interpreted as being effective. And in Figure 4.12 the average value (*Mean*) in class 2 C obtained is 0.7786. This value is greater than 0.70, so the category obtained is high, which means the effectiveness is high. For N-Gain, the percent value obtained was 77.8%, which can be seen from the *N-Gain effectiveness category* in percentage form, the value of 77.8% is greater than 76% which can be interpreted as being effective. So, it can be concluded that the *Pop Up Box* Mathematics for Building Spaces (PUB MABAR) learning media is effective when used in the learning process for mathematics for geometric shapes at the MI class II phase A odd semester level.

## CONCLUSION

The Pop Up Box (PUB MABAR) media development process includes five stages: analysis, designing, development, implementation, and evaluation. During the analysis stage, learning materials, media, student characteristics, and needs are examined. The designing stage involves creating media design, formulating objectives, determining strategies, and developing tests and storyboards. In the development stage, the PUB MABAR media is created, validated by experts, and tested on a small scale. The implementation stage involves large-scale testing with pre-tests and post-tests for classes II B and II C. The evaluation stage assesses the product's strengths and weaknesses through formative and summative evaluations. The PUB MABAR media received validation from four experts, with media experts rating it "Valid/Suitable for use" without requiring revisions, and material experts rating it "Very Valid/Very Suitable for Use" with minor revisions based on feedback.

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