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DEVELOPMENT OF MAGIC BOX PEEK-A-BOO TO IMPROVE THE NUMERACY SKILLS OF THIRD-GRADE STUDENTS ON MEASUREMENT

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ABSTRACT

This study aims to determine the validity, practicality, and effectiveness of the *Magic Box Peek-a-Boo* learning media in improving students' numeracy skills in measurement material for Grade III students at SDN Mrican 3. This study employed a Research and Development (R&D) approach using the ADDIE development model, which consists of five stages: analysis, design, development, implementation, and evaluation. The development of this learning media was intended to create an innovative learning medium that could help students understand measurement concepts in a more engaging and interactive way. The validity of the media was assessed through validation by material and media experts. The validation results showed that the *Magic Box Peek-a-Boo* learning media had a very high level of validity, with a percentage score of 90% from the material expert and 87.5% from the media expert; therefore, it was considered valid for use in learning. The practicality of the media was demonstrated by the results of the teacher response questionnaire, which obtained a percentage of 92.5%, as well as student responses of 90% in the limited-scale trial and 93% in the large-scale trial, indicating that the media was highly practical. The effectiveness of the media was demonstrated by an improvement in students' numeracy skills, with N-Gain scores of 0.87 in the limited-scale trial and 0.89 in the large-scale trial, both of which were categorized as high. Thus, the *Magic Box Peek-a-Boo* learning media was proven to be valid, practical, and effective in improving elementary school students' numeracy skills.

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1. INTRODUCTION

Mathematics education in elementary schools should not focus solely on mastering mathematical concepts and computational procedures but should also develop students' ability to apply mathematical concepts to understand and solve problems encountered in everyday life [1]. One of the abilities related to this objective is numeracy. Numeracy refers to the ability to use mathematical knowledge and skills to understand, interpret, and solve problems in various real-life contexts. Mathematical thinking is an important goal of mathematics education and is closely related to mathematical literacy [2]. Literacy and numeracy are also essential competencies that students need to develop [3]. Therefore, mathematics education in elementary schools should provide students with opportunities not only to understand concepts and perform calculations but also to apply mathematical concepts to real-world and contextual situations.

One of the mathematics topics closely related to these abilities is measurement. Measurement in Grade III requires students not only to recognize units and measuring instruments but also to use measurement results, understand relationships between units, perform unit conversions, and solve

measurement-related problems. Understanding relationships between units is important because students need to recognize the sequence of units and determine the rules for converting one unit to another. Measurement learning that focuses solely on memorizing the sequence of units and computational procedures may cause students to experience difficulties when applying these concepts to different problems. Therefore, learning experiences are needed that allow students to observe objects directly, use measuring instruments, understand relationships between units, and apply measurement concepts to problem-solving.

These conditions were identified in Grade III mathematics learning at SDN Mrican 3, Kediri City. Based on an interview with the Grade III teacher, students experienced difficulties in converting units from one form to another. They were still confused about determining the correct sequence of units and conversion rules, resulting in some students mixing units or making errors when determining conversion results. Mathematics instruction was also still dominated by lecture-based methods and the use of textbooks as the primary learning resources. Consequently, students had limited opportunities to interact directly with measurement objects. In addition, conventional learning practices caused some students to become easily bored and less interested in participating in learning activities. These findings indicate that measurement learning requires more concrete and interactive learning experiences that actively engage students in the learning process.

The problem is further supported by students' report card data on the measurement topic. Of the 27 Grade III students, 19 had not yet achieved the Learning Objective Completion Criteria of 75, while 8 students had achieved or exceeded the criterion. These data indicate that students' learning achievement in the measurement topic still needs to be improved. The report card data were used to describe students' learning achievement in measurement and were not directly used as a measure of students' numeracy skills. In this context, learning is needed to help students understand measurement concepts while also providing opportunities to apply these concepts to solve mathematical problems in contextual situations.

One approach that can be taken to support such learning is the use of concrete and interactive learning media. Learning media can help present concepts that are difficult to understand abstractly in a more concrete and observable form for students [5][6][7]. The appropriate use of learning media can also enhance students' motivation and engagement in the learning process while providing more meaningful and authentic learning experiences [8][9]. In measurement learning, concrete media can provide students with opportunities to identify and use measuring instruments, observe units, and relate measurement concepts to objects in their surroundings. The results of the student needs analysis also showed that 90.36% of students expressed greater interest in participating in learning when supported by learning media. This percentage was obtained from the needs analysis conducted before the use of the Magic Box Peek-a-Boo media and was therefore used to describe students' preferences and needs for media support in learning, rather than as evidence of increased enthusiasm after using the Magic Box Peek-a-Boo. These findings indicate a need for learning media that can provide concrete and engaging learning experiences while actively involving students in the learning process.

One of the media developed to address these needs is the Magic Box Peek-a-Boo. This media is a concrete learning medium in the form of a box designed based on the peek-a-boo concept, in which certain parts of the media can be opened and closed, allowing students to discover the learning components progressively. On the left and right sides, the media features doors that can be opened and closed. Inside, there are measurement-unit ladders for length and weight designed to help students understand the relationships between units. Each door contains an envelope with questions related to the measurement topic. Students select a question, record their answers, and then solve it by utilizing the information or tools provided in the media. The back of the media is equipped with two drawers: one containing length measuring instruments and the other containing pictures of weight measuring instruments. The top of the media is equipped with a timer to set a time limit for completing the tasks. The students' work is subsequently checked and discussed together to reinforce and clarify the answers obtained.

These characteristics enable students not only to receive explanations of measurement concepts but also to engage directly in learning activities, such as identifying measuring instruments, determining appropriate units, understanding relationships between units, performing unit conversions, and solving numeracy problems. The peek-a-boo element of the media provides an exploratory learning experience through the activity of opening specific sections to discover questions or learning components. Thus, the Magic Box Peek-a-Boo serves not merely as a medium for presenting learning materials but is designed as a learning activity medium that integrates concrete objects, exploration, measurement activities, numeracy tasks, and time constraints into a single learning medium.

Previous studies have shown that the use of Magic Box media can help teachers deliver learning materials in a more relevant and comprehensible manner because of its tangible and concrete form [10]. Other research has indicated that Magic Box media designed in a three-dimensional form can increase students' direct engagement and create an active and enjoyable learning environment [11].

However, these studies have not specifically developed a Magic Box based on the peek-a-boo concept for teaching measurement to Grade III students while integrating length and weight measurement-unit ladders, measuring instruments, questions, and a timer into a single learning medium. Furthermore, previous studies have not specifically positioned the application of measurement concepts to solve numeracy problems as an integral part of media use. Therefore, there is a need to develop learning media that not only presents measurement concepts but also provides students with opportunities to interact with concrete objects and apply measurement concepts to solve problems.

The novelty of this study lies in the development of the Magic Box Peek-a-Boo as a concrete and interactive learning medium that integrates measurement content. The media consists of several components that can be opened and explored by students, including length and weight measurement-unit ladders to help students understand relationships between units, length measuring instruments and pictures of weight measuring instruments to provide concrete learning experiences, envelopes containing questions, and a timer to set a time limit for learning activities. Through the integration of these components, students are encouraged to learn through activities such as opening, discovering, observing, using information or measuring instruments, matching and converting units, and solving measurement-related problems. With these characteristics, the Magic Box Peek-a-Boo differs from the Magic Box used in previous studies by combining the peek-a-boo exploration element, concrete measurement experiences, and numeracy activities into a single learning medium specifically designed for Grade III students on the measurement topic.

Based on the identified learning problems, students' report card data, student needs analysis, and the research gaps identified in previous studies, this study aims to develop the Magic Box Peek-a-Boo as a learning medium to improve students' numeracy skills in the measurement topic for Grade III students at SDN Mrican 3. The developed media is expected to serve as a concrete, engaging, and interactive learning alternative that helps students understand measurement concepts through direct learning experiences. In addition, the use of the media is expected to provide students with opportunities to apply measurement concepts in solving learning-related problems, thereby supporting the improvement of their numeracy skills.

2. RESEARCH METHOD

This study employed a Research and Development (R&D) approach, which is a research and development method primarily aimed at creating and testing an innovative learning product, in this case, the Magic Box learning medium.

In this study, the ADDIE development model was employed, which is one of the most widely used instructional design models due to its systematic and logical nature and its adaptability to various educational needs. The model consists of five core stages: Analysis (analysis of learning needs and context), Design (media and strategy design), Development (product development), Implementation (application in the learning environment), and Evaluation (assessment to determine the effectiveness and quality of the product). Each stage is interconnected and plays an important role in producing a high-quality learning product.

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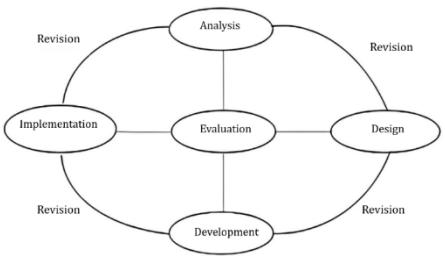


Figure 1. ADDIE Development Model

The validity data in this study were obtained through validation questionnaires administered to material and media experts to assess the feasibility of the developed learning media. Practicality data were obtained from teachers' and students' responses to the use of the learning media to determine its ease of use and applicability in the learning process. Meanwhile, effectiveness data were obtained through an analysis of the *N-Gain* scores calculated from students' *pretest* and *posttest* results during the large-scale trial. The scoring criteria used for expert validation and teacher responses are presented in Table 1.

Table 1. Assessment Scores

Score	Category
4	Strongly Agree
3	Agree
2	Disagree
1	Strongly Disagree

The practicality data were obtained through response questionnaires administered to the teacher and students to determine the practicality of using the *Magic Box Peek-a-Boo* as a learning medium for the measurement topic in Grade III. The practicality data based on students' responses to the use of the *Magic Box Peek-a-Boo* were subsequently analyzed using the following calculation formula:

Table 2. Student Practicality Scoring

Score	Category
1	Yes
0	No

The assessments conducted by the material and media expert validators used a Likert scale and were presented in the form of statements. The final validation results were calculated using the following formula:

$$Expert\ Validation\ \ (v-ah) = \frac{Tse}{Tsh} \times 100\%$$

Meanwhile, the results of the teacher and student responses were calculated using the following formula:

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

The percentage of the assessment results was calculated using the following formula, adopted from [12]:

Table 3. Scoring Criteria

Score (%)	Category
0% - 25%	Very Invalid
26% - 50%	Invalid
51% - 75%	Valid
76% - 100%	Very Valid

Effectiveness data were obtained from students' *pretest* and *posttest* results. To assess the effectiveness of the *Magic Box Peek-a-Boo*, the students' *pretest* and *posttest* scores were analyzed. The percentage of effectiveness was calculated using a specific formula. According to [13], the formula used is as follows:

$$\text{N-Gain} = \frac{\text{Spostest} - \text{Spretest}}{\text{Sideal} - \text{Spretest}}$$

The calculation results were then categorized based on the level of effectiveness interpretation.

Table 4. Normalized Gain Criteria

N-Gain Value	Interpretation
0,70 ≤ g ≤ 1,00	High
0,30 ≤ g < 0,70	Moderate
0,00 ≤ g < 0,30	Low
g = 0,00	No Improvement
-1,00 ≤ g < 0,00	Decrease

The effectiveness interpretation obtained was then used to determine the effectiveness criteria based on the percentage presented in the following table.

Table 5. Criteria for Determining the Level of Effectiveness

Percentage (%)	Interpretation
< 40	Ineffective
40 – 55	Less Effective
56 – 75	Moderately Effective
> 76	Effective

3. RESEARCH RESULTS AND DISCUSSION

This study produced a learning medium in the form of *Magic Box Peek-a-Boo* for the measurement topic, which was designed to improve elementary school students' numeracy skills. The development of the learning medium employed the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation. Each stage is described as follows.

3.1 Research result

Analysis Stage

The analysis stage is the initial step in the development of the learning medium and includes needs analysis, curriculum analysis, and student characteristics analysis as the basis for designing the media. Based on observations, interviews, and questionnaires conducted in Grade III at SDN Mrican 3, it was found that learning on the measurement topic was still dominated by conventional teaching methods, with limited use of interactive learning media. This condition resulted in suboptimal student engagement and understanding of the measurement topic. In addition, the questionnaire results showed that 90.36% of students were more enthusiastic about learning when supported by learning media, indicating the need for more engaging and interactive media innovations.

The curriculum analysis in this study refers to the *Merdeka Curriculum*, with a focus on the measurement topic for Grade III elementary school. Based on the learning outcomes, students are expected to be able to measure length and weight accurately using standard measuring instruments and units, as well as understand the relationships between measurement units. Therefore, the learning objectives were designed to enable students to recognize standard units, determine appropriate measuring instruments, and perform unit conversions through contextual learning activities to improve their numeracy skills.

The analysis of student characteristics showed that Grade III students are at the concrete operational stage and therefore tend to understand learning materials more easily through real experiences, visual representations, and concrete objects. Therefore, the development of the *Magic Box Peek-a-Boo* was selected as a learning solution because it presents measurement content in a concrete, engaging, and everyday-life-related manner. This approach is expected to help improve students' conceptual understanding and numeracy skills more effectively.

Design Stage

At the product design stage, the researcher began developing the learning media design using the Canva application. The *Magic Box Peek-a-Boo* was designed in the form of a box made of wood, measuring 60 cm × 40 cm, with doors on the left and right sides that can be opened and closed, as well as two drawers at the back. The media was designed with blue as the dominant color and decorated with attractive images to increase students' attention and interest in learning. Subsequently, the researcher prepared questions to be placed on both sides of the media doors, with 16 questions on the right side and 16 questions on the left side. In addition, the top of the media is equipped with a *timer* that functions to measure the time taken by students to complete the tasks during the learning activities.

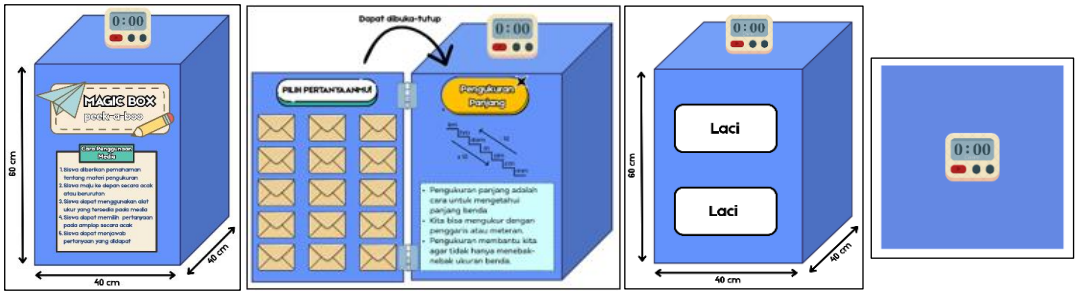


Figure 2. Learning Media Design

Development Stage

After the design stage was completed, the researcher proceeded to the development stage of the learning medium based on the design established in the previous stage. At this stage, the researcher began realizing the concept of the media by referring to the design that had been prepared, including the selection of materials, determination of the size and form of the media, and other supporting components required in the production process. The development stage plays an important role in transforming the design developed in the previous stage into a learning product. At this stage, an initial product was produced and subsequently subjected to validation and trials before being used in the learning process [14]. The results of the learning media development are presented in the following figure.



Figure 3. Learning Media Development Results

After the Magic Box Peek-a-Boo was developed, the learning medium underwent a validation process involving two validators: a media expert and a material expert. Based on the calculations conducted by the researcher, the media expert validation obtained a percentage of 87.5%, which was categorized as very valid. Meanwhile, the material expert validation obtained a percentage of 90%, which was also categorized as very valid. Thus, the expert validation results indicated that the Magic Box Peek-a-Boo was suitable for use in supporting the improvement of elementary school students' numeracy skills.

Implementation Stage

The implementation stage involved applying the Magic Box Peek-a-Boo learning medium after it had undergone validation and revision by the experts. At this stage, the revised product based on the validation results was subsequently tested in learning activities to determine its validity, practicality, and effectiveness [15]. The implementation was conducted in Grade III at SDN Mrican 3 on the measurement topic to determine the applicability of the media in the learning process. The implementation stage consisted of two trials: a limited-scale trial involving 5 students and a large-scale trial involving 22 students. Both trials were conducted to determine the practicality and effectiveness of the developed learning medium. Based on the results of the limited-scale and large-scale trials, data on students' responses to the developed learning medium were obtained, as presented in the following table.

Table 6. Results of the Student Response Questionnaire

Trial	Score Percentage
Limited-Scale Trial	90%
Large-Scale Trial	93%

The teacher response questionnaire was completed by the Grade III teacher as the respondent in the large-scale trial. The results showed a score percentage of 92.5%, indicating that the developed learning medium was practical for use in the learning process.

During the implementation stage, the researcher also assessed the effectiveness of the developed learning medium. The effectiveness assessment was conducted through a pretest and posttest administered during the large-scale trial involving 22 students. The pretest and posttest results were used to determine the improvement in students' numeracy skills in the measurement topic after using the developed learning medium. The effectiveness was then analyzed using the predetermined N-Gain formula. The results of the N-Gain calculation are presented in the following table.

Table 7. N-Gain Results of the Large-Scale Trial

No.	Student Initials	Score			
		Post-Pre	Maks-Pre	N-Gain	N-Gain Score (%)
1	AGTR	48	56	0,85	85,71
2	ASA	36	36	1	100
3	ARA	48	52	0,92	92,30
4	ARF	44	48	0,91	91,66
5	AD	44	52	0,84	84,61
6	ASF	40	40	1	100
7	BGB	48	60	0,8	80
8	DFZ	44	48	0,91	91,66
9	FGA	48	56	0,85	85,71
10	FRO	40	48	0,83	83,33
11	GZP	48	52	0,92	92,30
12	HNS	48	56	0,85	85,71
13	JON	32	32	1	100
14	KAK	44	52	0,84	84,61
15	MDRA	44	48	0,91	91,66
16	MD	48	56	0,85	85,71
17	NSAJ	48	60	0,8	80
18	NJAR	40	48	0,83	83,33
19	NPA	48	56	0,85	85,71
20	NAFA	48	52	0,92	92,30
21	RSAA	48	56	0,85	85,71
22	NAA	28	28	1	100
Average		**43,8**	**49,6**	**0,89**	**89,17**

Based on the results of the large-scale trial involving 22 Grade III students at SDN Mrican 3, the average pretest score was 50, while the average posttest score was 94, resulting in an N-Gain score of 0.89, which was categorized as high. These results indicate that the Magic Box Peek-a-Boo learning medium was effective in supporting the improvement of students' numeracy skills.

Evaluation Stage

The evaluation stage is the final stage of the development model, which aims to assess the quality of the Magic Box Peek-a-Boo learning medium after its implementation in Grade III at SDN Mrican 3. The evaluation was conducted based on the implementation results to determine the validity, practicality, and effectiveness of the media in supporting learning on the measurement topic [16]. At this stage, the researcher analyzed data obtained from expert validation, observations of learning implementation, teacher and student response questionnaires, and students' learning assessment results.

The evaluation results were used as a basis for identifying the strengths and weaknesses of the Magic Box Peek-a-Boo learning medium so that further product refinement could be carried out if any difficulties were identified during the learning process. Thus, the developed medium is expected to serve as a valid, practical, and effective learning tool for improving students' numeracy skills in the measurement topic for Grade III students at SDN Mrican 3.

3.2 Discussion

This development study was conducted through several stages to determine the validity, practicality, and effectiveness of the Magic Box Peek-a-Boo learning medium. Before being used in the learning process, the media underwent a validation stage to ensure the feasibility of the product [17]. The material expert validation obtained a percentage of 90%, while the media expert validation obtained 85%, indicating that the Magic Box Peek-a-Boo was categorized as very valid. These results indicate that the media met the aspects of material suitability, appearance, content quality, ease of use, and media attractiveness. This validity also indicates that the Magic Box Peek-a-Boo is suitable for helping students understand measurement concepts through concrete and interactive learning experiences.

The practicality of the media was determined based on teacher and student responses after using the Magic Box Peek-a-Boo. The teacher response questionnaire obtained a percentage of 92.5%, while the student responses obtained percentages of 90% in the limited-scale trial and 93% in the large-scale trial. These results indicate that the media was categorized as very practical for use in learning. The practicality of the media was supported by its concrete form, the availability of usage instructions, and its components that enabled students to engage directly in learning activities, such as opening parts of the media, finding questions in the envelopes, using measuring instruments, and matching measurement units.

The effectiveness of the Magic Box Peek-a-Boo was determined based on the pretest and posttest results. In the limited-scale trial, the students' average score increased from 56.8 to 94, with an N-Gain score of 0.87, which was categorized as high. In the large-scale trial, the average score increased from 50 to 94, with an N-Gain score of 0.89, which was also categorized as high. These improvements indicate that the use of the Magic Box Peek-a-Boo was effective in supporting the improvement of students' numeracy skills in the measurement topic. This effectiveness was supported by the characteristics of the media, which provided students with opportunities to learn through concrete activities, such as using measuring instruments, understanding measurement units, and solving numeracy questions.

The findings of this study are consistent with previous research showing that Magic Box-based media have a high level of validity. The study obtained material expert validation of 79% and media expert validation of 82%, with an average of 80.5%, and was declared suitable for use in teaching numeracy skills to Grade I elementary school students [18]. Another study obtained media expert validation of 86.55% and material expert validation of 93.33%, both of which were categorized as very valid. These results indicate that the Magic Box media met the aspects of content quality, appearance, interactivity, and the suitability of mathematics content for the needs of elementary school students [19]. Another study also showed that the Magic Box media was categorized as very valid because it met the aspects of material accuracy, design, and ease of operation [20].

Based on the research findings and comparisons with previous studies, the Magic Box Peek-a-Boo meets the three aspects targeted in its development: validity, practicality, and effectiveness. The distinctive feature of the media lies in the use of the peek-a-boo concept through the left and right side sections that can be opened and closed with an element of surprise, complemented by length and weight measurement-unit ladders, envelopes containing numeracy questions, measuring instruments, pictures of weight measuring instruments, and a timer. These characteristics provide a concrete and interactive learning experience, enabling students not only to receive learning materials but also to engage directly in measurement activities and numeracy tasks. Therefore, the findings indicate that the Magic Box Peek-a-Boo is suitable for use as a learning medium to support the improvement of students' numeracy skills in the measurement topic.

4. CONCLUSION

Based on the results of the research and development conducted, it can be concluded that the *Magic Box Peek-a-Boo* learning medium developed for the measurement topic in Grade III elementary school has fulfilled the aspects of validity, practicality, and effectiveness. The media was assessed as highly valid by the material and media experts and received positive responses from teachers and students. The trial results also showed an improvement in students' numeracy skills after using the *Magic Box Peek-a-Boo* learning medium.

These findings indicate that the use of the *Magic Box Peek-a-Boo* learning medium not only resulted in a feasible learning medium but also demonstrates that concrete media designed to involve activities such as opening, discovering, observing, and using the components within the media can help students understand measurement concepts in a more tangible and engaging manner. The characteristics of the media, which allow students to interact directly with objects and learning questions, can support student engagement in the learning process and help connect measurement concepts with concrete learning experiences.

Therefore, the *Magic Box Peek-a-Boo* can be used as an alternative mathematics learning medium for the measurement topic in Grade III elementary school, particularly to support more concrete and interactive learning that is oriented toward improving students' numeracy skills.

5. AUTHOR CONTRIBUTIONS STATEMENT

This journal uses the Contributor Roles Taxonomy (CRediT) to recognize individual author contributions, reduce authorship disputes, and facilitate collaboration.

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

6. AI Disclosure Statement

During the preparation of this manuscript, the author used ChatGPT to assist with grammar editing and translation. The author thoroughly reviewed and revised the entire manuscript and takes full responsibility for its content and the overall publication.

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