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Developing Calculating Box Media For Grade 1 Mathematics

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ABSTRAK

Permasalahan pembelajaran matematika di kelas I sekolah dasar ditandai dengan rendahnya respons dan kemampuan peserta didik dalam memahami konsep penjumlahan dan pengurangan. Kondisi ini disebabkan oleh pembelajaran yang masih didominasi metode konvensional, seperti ceramah, tanya jawab, dan pemberian tugas, sehingga keterlibatan siswa belum optimal. Penelitian ini bertujuan mengembangkan media pembelajaran Calculating Box yang layak digunakan untuk membantu siswa memahami materi penjumlahan dan pengurangan. Penelitian ini menggunakan metode Research and Development (R&D) dengan model ADDIE yang meliputi lima tahap. Tahap Analysis dilakukan melalui identifikasi kebutuhan pembelajaran dan karakteristik siswa. Tahap Design menghasilkan rancangan media berupa kotak berhitung yang dilengkapi komponen manipulatif untuk membantu siswa memahami operasi penjumlahan dan pengurangan secara konkret. Tahap Development menghasilkan prototipe media yang kemudian divalidasi oleh ahli materi dan ahli media serta direvisi berdasarkan masukan validator. Tahap Implementation dilakukan melalui uji coba produk terhadap 21 siswa kelas I MIS Guppi Roudlotut Tholibin. Selanjutnya, tahap Evaluation dilakukan untuk menilai kelayakan dan daya tarik media berdasarkan hasil validasi dan respons siswa. Data dikumpulkan melalui wawancara, angket, dan studi dokumentasi. Hasil penelitian menunjukkan bahwa media memperoleh persentase validasi sebesar 93,75% dari ahli materi dan 98,81% dari ahli media, sedangkan hasil respons siswa mencapai 96,74%. Seluruh hasil tersebut termasuk dalam kategori sangat valid dan sangat menarik. Dengan demikian, media Calculating Box dinyatakan layak digunakan sebagai alternatif media pembelajaran matematika untuk materi penjumlahan dan pengurangan di kelas I sekolah dasar.

ABSTRACT

Mathematics learning in Grade 1 of elementary school is characterized by students' limited responses and difficulties in understanding the concepts of addition and subtraction. This situation is attributed to the continued dominance of conventional teaching methods, such as lectures, question-and-answer sessions, and assignments, which result in suboptimal student engagement. This study aims to develop Calculating Box instructional media that is suitable for helping students understand addition and subtraction. The study employed a Research and Development (R&D) approach using the ADDIE model, which consists of five stages. The Analysis stage involved identifying students' learning needs and characteristics. The Design stage produced a prototype concept of a counting box equipped with manipulative components to help students understand addition and subtraction operations through concrete learning experiences. The Development stage involved producing the instructional media prototype, which was subsequently validated by subject matter and media experts and revised based on their feedback. The Implementation stage involved testing the product with 21 first-grade students at MIS Guppi Roudlotut Tholibin. The Evaluation stage assessed the media's feasibility and attractiveness based on expert validation results and student responses. Data were collected through interviews, questionnaires, and documentation. The results showed that the media obtained validation scores of 93.75% from subject matter experts and 98.81% from media experts, while the student response score reached 96.74%. All results were classified as highly valid and highly engaging. Therefore, the Calculating Box instructional media is considered suitable as an alternative mathematics learning resource for teaching addition and subtraction to Grade 1 elementary school students..

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INTRODUCTION

Mathematics is a foundational subject that plays an important role in developing students' logical, systematic, and critical thinking skills. At the primary school level, mathematics instruction provides the basis for understanding various mathematical concepts and computational skills that will be applied in subsequent stages of education. One of the fundamental topics that first-grade students are expected to master is addition and subtraction. Proficiency in these operations is essential for developing early numeracy skills and establishing a foundation for more complex mathematical concepts. Citing the National Council of Teachers of Mathematics (NCTM), Hafriani emphasizes that mathematics instruction should provide opportunities for students to develop conceptual understanding, mathematical reasoning, problem-solving abilities, and connections between different mathematical representations (Hafriani 2021). This perspective indicates that mathematics learning should not focus exclusively on obtaining correct numerical answers but should also develop students' understanding of the processes and relationships underlying mathematical operations. Therefore, teaching addition and subtraction in the first grade needs to emphasize conceptual understanding through learning activities that are appropriate to students' developmental characteristics.

However, mathematics instruction in the early grades of primary school continues to face challenges, particularly in helping students understand abstract numerical concepts. First-grade students generally require concrete, engaging, and interactive learning experiences to understand mathematical operations. According to Piaget's theory of cognitive development, children at this age are generally transitioning toward the concrete operational stage, in which logical thinking develops through interactions with objects and observable situations (Rahanubun et al. 2026). This theoretical perspective suggests that students need opportunities to manipulate physical objects to understand numerical relationships and mathematical processes. Similarly, Bruner's theory of learning representation identifies three interconnected stages: enactive, iconic, and symbolic representation (Mahardiyanti and Setiati 2026). Enactive representation involves learning through direct physical manipulation, iconic representation involves understanding through pictures or visual representations, and symbolic representation involves the use of numbers and mathematical symbols. These stages provide an important theoretical foundation for designing mathematics instructional media. In the context of addition and subtraction, students can first manipulate counting objects to represent numerical changes, subsequently observe their visual representations, and finally translate these experiences into mathematical symbols. Thus, the integration of concrete

objects, visual representations, and numerical symbols can help students develop a more comprehensive understanding of mathematical operations.

Learning media plays an important role in facilitating the delivery of instructional content and supporting students' active participation. Citing Arsyad, Lusiana explains that instructional media function as tools for conveying information and stimulating students' attention, interest, and thinking during the learning process (Lusiana, Janah, and Muhajirin 2026). In mathematics instruction, concrete instructional media provide opportunities for students to understand numerical concepts through direct activities, such as observing, counting, grouping, moving, and manipulating objects. This approach is consistent with Bruner's perspective that direct experiences provide an important foundation for developing conceptual understanding before students move toward pictorial and symbolic representations (Maulidhina et al. 2026). The relationship between concrete instructional media and cognitive development becomes particularly relevant when students learn addition and subtraction. For example, adding objects to a group allows students to observe how quantities increase, while removing objects illustrates how quantities decrease. Through these activities, students do not merely memorize arithmetic procedures but also develop an understanding of why and how mathematical operations produce particular results. Therefore, concrete instructional media can serve as an effective instructional alternative for connecting students' physical experiences with mathematical concepts.

The need for such instructional media was also identified through preliminary observations and interviews with the first-grade teacher at MIS Guppi Roudlotut Tholibin. The preliminary findings indicated that the instructional media used in mathematics lessons were still limited, primarily consisting of pictures that had not been optimally integrated into students' learning activities. Consequently, learning interactions tended to depend on teacher explanations, while opportunities for students to manipulate objects and explore numerical relationships remained limited (Nisa et al. 2026). Although most students were able to perform basic addition and subtraction calculations, some still experienced difficulties understanding the underlying concepts, particularly the processes through which quantities increase or decrease. To provide a more specific illustration of this condition, the preliminary data were provisionally estimated at 18 first-grade students, with approximately 7 students (38.9%) experiencing difficulties in understanding addition and subtraction concepts, while 11 students (61.1%) had demonstrated relatively adequate initial understanding. These figures are illustrative assumptions and require verification against the school's actual preliminary assessment records. The identified problem indicates that students' ability to calculate does

not necessarily reflect their conceptual understanding. In addition, the limited availability of manipulative learning media creates a need for instructional tools that encourage students to participate directly in mathematical activities. This empirical condition provides a basis for developing the Calculating Box as an alternative medium that addresses the specific learning difficulties identified in the classroom.

In response to these conditions, this study develops Calculating Box media as a concrete instructional tool for teaching addition and subtraction to first-grade students. The media is designed as a counting box that combines visual elements with manipulative learning activities, allowing students to engage directly in mathematical operations. Its instructional mechanism is based on the integration of concrete manipulation, visual observation, and numerical representation. Through the manipulation of objects, students can demonstrate addition by combining quantities and subtraction by removing quantities from an initial group. The resulting numerical changes can then be connected to visual representations and mathematical symbols. This mechanism establishes a direct relationship between the characteristics of the media and Piaget's and Bruner's theories. From Piaget's perspective, the use of manipulable objects provides concrete learning experiences that support the development of logical understanding. From Bruner's perspective, the activities facilitate the transition from enactive experiences to iconic and symbolic representations. (Rohman, Saputra, and Hayeemaming 2026) explain that Calculating Box media provides opportunities for students to perform counting activities using the objects or components available within the media. Ratih and Nirmala also relate the use of such media to Bruner's emphasis on direct learning experiences and Piaget's emphasis on concrete activities in children's cognitive development (Ratih and Nirmala 2026). Accordingly, the Calculating Box is not merely intended to attract students' attention through its physical appearance but also to provide a structured learning experience that connects concrete activities with the mathematical concepts being taught.

Previous studies have provided empirical support for the development of counting-box-based instructional media. Mustaqiem and Hidayati developed a Counting Box learning tool to improve first-grade students' understanding of addition and subtraction using the ADDIE development model (Mustaqiem and Hidayati 2025). Their findings indicated that the product obtained validation scores of 95.4% from subject matter experts and 97.9% from media design experts. Student responses also indicated a high level of engagement, while the effectiveness assessment produced an N-Gain score of 0.76, categorized as effective (Aziza et al. 2026). reported that counting-box media could facilitate students' understanding of

addition through concrete learning experiences, encourage active participation, and create a more enjoyable learning environment. These studies demonstrate that counting-box-based media have considerable potential to support early mathematics instruction. However, the findings primarily establish the feasibility and learning potential of counting-box media without fully explaining how the specific characteristics of the developed product can connect concrete manipulation, visual representation, and symbolic mathematical understanding. Furthermore, differences in school conditions, students' learning needs, and product design require instructional media to be developed and evaluated in accordance with the characteristics of the intended learning context.

Although the present study shares similarities with previous research in developing concrete counting media for elementary mathematics instruction, it offers a distinct development focus. The previous Counting Box research by Mustaqiem and Hidayati emphasized the feasibility and effectiveness of counting-box media in supporting addition and subtraction learning. In contrast, the present study specifically focuses on developing and evaluating the validity and attractiveness of the Calculating Box for first-grade students at MIS Guppi Roudlotut Tholibin. Its distinguishing aspect lies in the integration of manipulative counting activities and visual representations as a learning mechanism for introducing both addition and subtraction. Rather than treating the counting box merely as a physical aid for producing numerical answers, the developed media is intended to facilitate students' understanding of how quantities change through the direct manipulation of objects. This development approach connects the practical characteristics of the media with the enactive, iconic, and symbolic representations proposed by Bruner and the concrete learning experiences emphasized in Piaget's theory. Therefore, the novelty of this study lies in the contextual adaptation and theoretical integration of the Calculating Box development, particularly in examining its content and design validity as well as its attractiveness based on students' responses. The novelty does not rest solely on the use of a counting box, since similar media have previously been developed, but on the specific development orientation and evaluation focus applied in this study.

The development of instructional media requires systematic evaluation to ensure that the resulting product meets appropriate educational and technical standards. In this study, product quality is examined through expert validation and student response assessments. Expert validation focuses on the suitability of the instructional content, alignment with learning objectives, media design, visual presentation, construction quality, and appropriateness for first-grade students. Meanwhile, the attractiveness assessment focuses on

students' responses to the appearance of the media, ease of use, interest in participating in learning activities, and engagement during counting exercises. These two evaluation dimensions provide complementary information regarding the quality of the developed product. Validity establishes whether the media is appropriate in terms of its content and design, whereas attractiveness provides information about students' acceptance and interest in using it during mathematics instruction. By distinguishing these assessment dimensions, the study provides a more specific evaluation of the developed Calculating Box rather than relying solely on general perceptions of its usefulness.

Based on the identified classroom problems, theoretical considerations, and limitations of previous research, this study aims to develop Calculating Box instructional media for teaching addition and subtraction to first-grade students at MIS Guppi Roudlotut Tholibin. Specifically, the study seeks to determine the validity of the developed media based on expert assessments of its content and design and to examine its attractiveness based on students' responses during the trial process. The results are expected to provide an alternative concrete instructional medium that supports students' active participation and helps connect physical counting activities with the conceptual understanding of addition and subtraction. Furthermore, this study is expected to contribute to the development of contextually appropriate mathematics instructional media for early-grade elementary school students.

RESEARCH METHOD

This study employed a Research and Development (R&D) approach using the ADDIE model, consisting of five stages: Analysis, Design, Development, Implementation, and Evaluation. According to Branch, ADDIE provides a systematic, process-oriented framework for developing effective instructional products (Yulianto 2026). The research was conducted at MIS Guppi Roudlotut Tholibin, involving 21 first-grade students. Data were collected through interviews, observations, questionnaires, and documentation. The analysis stage identified learning needs, student characteristics, numeracy abilities, and instructional media requirements through teacher interviews and classroom observations. The design stage involved preparing the product specifications, learning materials, and research instruments. The Calculating Box was designed as a concrete three-dimensional learning medium consisting of a box, number cards, addition and subtraction symbols, counting objects, and number compartments. The development stage involved constructing the product and validating it through two experts: a subject matter expert (R.A.) with relevant expertise in

mathematics education and a media expert (D.I.A.) with expertise in instructional media development. Validation instruments used a four-point Likert scale (1 = very poor to 4 = very good), covering content accuracy, learning objectives, instructional clarity, visual design, material quality, functionality, ease of use, and safety. The implementation stage involved testing the revised product with 21 students during addition and subtraction lessons. Student responses were collected through a simple questionnaire using age-appropriate language to assess attractiveness, clarity, ease of use, and learning interest, with oral assistance provided when necessary. The evaluation stage involved reviewing expert assessments, student responses, and observation findings to determine necessary product revisions.

Quantitative data were analyzed using descriptive percentage analysis to determine product validity and attractiveness. The percentage was calculated using the formula (P=\frac{\sum X}{\sum X_{\max}}\times100%), where (P) represents the percentage score, (\sum X) represents the obtained score, and (\sum X_{\max}) represents the maximum possible score. The results were interpreted using the following criteria: 81–100% (very feasible), 61–80% (feasible), 41–60% (moderately feasible), 21–40% (less feasible), and 0–20% (not feasible). The product was considered suitable for use when it achieved at least the feasible category. Qualitative feedback from validators, teacher interviews, and classroom observations was analyzed descriptively to support product improvement. Research ethics were maintained by obtaining permission from the school, coordinating activities with the classroom teacher, conducting trials under teacher supervision, and protecting students' safety, privacy, and identities. Students were informed about the activities using age-appropriate language and were not forced to participate if they felt uncomfortable. In accordance with Sugiyono and Muid.(Sugiyono and Muid 2026). R&D research aims to produce specific products and examine their feasibility or effectiveness. Accordingly, this study focused on developing and evaluating the Calculating Box as a concrete mathematics learning medium through expert validation and classroom trials.

RESULT AND DISCUSSION

Results of the Needs Analysis

The needs analysis stage represents the initial step in the development of instructional media. It aims to identify existing learning conditions, problems encountered by teachers and students, and the need for instructional media that are appropriate to students' characteristics. This analysis was conducted in the first-grade Mathematics class at MIS Guppi Roudlotut Tholibin through an interview with the classroom teacher. Based on the interview results, the

class consisted of 21 students. In general, students demonstrated an interest in Mathematics; however, their levels of attention and abilities to participate in learning activities varied. The teacher explained that most students were able to follow the learning process, particularly when studying addition and subtraction. Nevertheless, some students still experienced difficulties in understanding and solving basic arithmetic operations. These conditions indicate that Mathematics instruction in the early grades of elementary school requires an approach that can accommodate differences in students' learning abilities.

Another issue identified concerned the use of instructional media. During the learning process, the teacher primarily used picture-based media as a tool to explain the instructional materials. Although such media could provide students with visual representations, they did not fully offer direct learning experiences through hands-on manipulative activities. In fact, first-grade elementary school students still require concrete and simple learning experiences involving direct activities to facilitate their understanding of mathematical concepts. Based on these conditions, there is a need for innovative instructional media that not only present information visually but also enable students to participate actively in the learning process. The teacher responded positively to the proposed development of the Calculating Box media, as it was considered a potential alternative for helping students understand addition and subtraction while creating a more enjoyable learning environment.

The results of the needs analysis served as the foundation for determining the characteristics of the product to be developed. The Calculating Box was designed as a counting-box instructional aid that enables students to perform arithmetic activities using objects or components provided within the media. Its use is expected to help students connect numerical concepts with concrete representations, allowing them to understand addition and subtraction through experiences that do not rely solely on the teacher's verbal explanations. Thus, the development of this media was based on actual classroom learning needs, particularly the need to provide an alternative instructional medium that is more interactive, engaging, and appropriate for the cognitive development of first-grade students.

Results of the Calculating Box Media Development

The development of the Calculating Box media was carried out based on the results of the needs analysis and the product design prepared during the preceding stage. This product was developed as Mathematics instructional media for teaching addition and subtraction to first-grade elementary school students. In terms of its physical design, the Calculating Box was constructed in the form of a counting box featuring an attractive visual appearance and

color combinations tailored to the characteristics of elementary school students. The exterior of the media features colored lettering, along with illustrations of a house and grass, which serve as decorative elements to create a more appealing appearance. Meanwhile, the interior is equipped with components designed to support counting activities, enabling students to engage in the learning process through more concrete and hands-on activities.

Media Design Overview



The media design was developed by considering visual appeal, ease of use, and suitability for the developmental characteristics of first-grade students. The use of colors and illustrations was intended to attract students' attention, while the counting box design provided a more tangible learning experience. Through this media, students were expected to participate in learning activities by observing, using, and manipulating the media components to solve addition and subtraction problems. For example, when learning the addition operation 3 + 2, students could use the counting components to represent the first number and then add components corresponding to the second number to obtain a total of five. In the subtraction operation 5 − 2, students could remove two components from the initial group of five, leaving three components. These activities help students visualize arithmetic operations through more concrete learning experiences.

After the product development process was completed, the Calculating Box media underwent validation by a subject matter expert and a media expert. The validation process was conducted to assess the suitability of the instructional content in relation to the learning objectives, as well as the product quality in terms of visual appearance, usability, and suitability as instructional media. The validators' assessments and recommendations were used as the basis for product revisions before the media was tested with students. Thus, the resulting product was developed not only to emphasize visual appeal but also to ensure content accuracy and the functional role of the media in supporting Mathematics learning activities.

Results of Subject Matter Expert Validation

Subject matter expert validation was conducted to determine the extent to which the content presented in the Calculating Box media aligned with the competencies and learning objectives of first-grade Mathematics, particularly addition and subtraction. The assessment was carried out using a questionnaire consisting of 12 items. The assessment aspects focused on content suitability, conceptual accuracy, clarity of presentation, and alignment between the instructional materials and the intended learning objectives.

Based on the validator's assessment, the Calculating Box media obtained a percentage score of 93.75%. This result indicates that the instructional content falls within the very high validity category according to the assessment criteria employed in this study. The percentage reflects the highly favorable evaluation given by the subject matter expert and indicates that the media is suitable for supporting first-grade Mathematics instruction. The high validation score also demonstrates that, in general, the content presented in the media is consistent with the scope of the instructional materials being developed.

Nevertheless, the subject matter expert recommended that the learning indicators and objectives be adjusted to correspond with the instructional sequence. This recommendation is important because instructional media should be developed based on a clear alignment among learning objectives, instructional content, learning activities, and expected learning outcomes. Learning indicators should not merely be included as administrative requirements but should serve as the foundation for determining the activities students undertake when using the media. Therefore, adjustments were made to ensure that counting activities using the Calculating Box were more closely aligned with the learning objectives for addition and subtraction.

The subject matter expert validation results indicate that the media development process has taken the instructional content into consideration. Content suitability is an essential factor because visually appealing media cannot necessarily support the achievement of learning objectives if the concepts presented are inaccurate. Through the validation process and revisions based on expert recommendations, the Calculating Box has established a stronger foundation of content validity for use in instructional activities.

Results of Media Expert Validation

Media expert validation was conducted to evaluate the quality of the Calculating Box product in terms of visual presentation, design, ease of use, safety, and the suitability of its characteristics for the learning needs of first-grade elementary school students. This

assessment aimed to ensure that the developed product was not only visually attractive but could also be appropriately used in instructional activities. The validation process was conducted using an assessment instrument designed based on the established criteria for instructional media suitability.

Based on the media expert's assessment, the Calculating Box product obtained a percentage score of 98.81%, placing it in the very high validity category. This result indicates that the product received a highly favorable evaluation from the validator across the assessed aspects. The high percentage suggests that the media design and characteristics have met the suitability criteria established in the research instrument. In terms of visual presentation, the use of colors and illustrations serves as a supporting element that can enhance students' visual interest. Meanwhile, the counting box design provides a distinctive feature that differentiates the product from instructional media that merely present pictures or information in a one-way format.

During the validation process, the media expert recommended expanding the grass section in the product design. This recommendation concerned improving the visual composition to ensure that the decorative elements of the media appeared more proportionate. The validator's suggestion was subsequently used as a basis for product design revisions. This improvement demonstrates that the validation process serves not only to assess the product but also to enhance media quality before it is introduced to students.

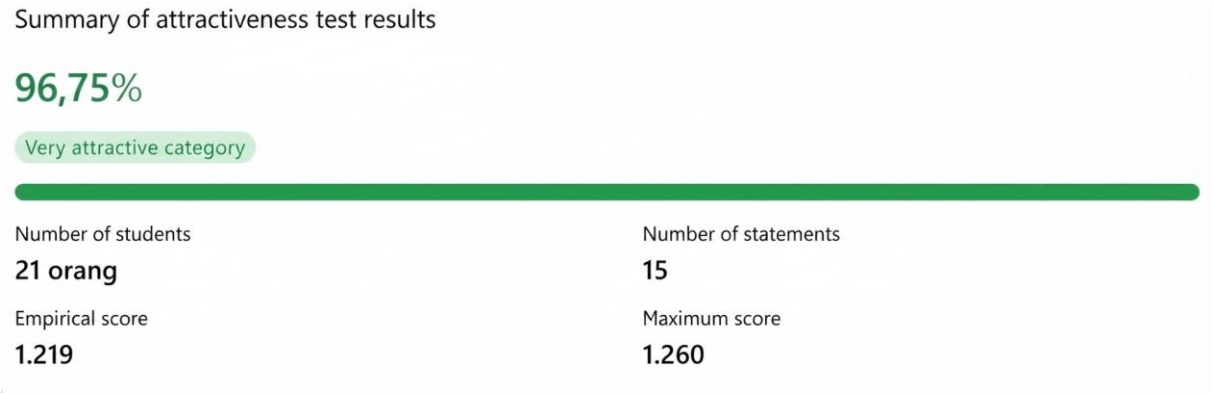
When compared with the subject matter expert validation results, the percentage obtained from the media expert was higher. The subject matter expert validation score was 93.75%, whereas the media expert validation score reached 98.81%. This difference indicates that the design and media quality aspects received a higher assessment than the instructional content aspect. Nevertheless, both validation results fall within the very high validity category. These findings demonstrate that the developed product received favorable evaluations in terms of both instructional content and media quality. Accordingly, the subject matter expert and media expert validation results provide a basis for proceeding with the Calculating Box to the student trial stage after incorporating the validators' recommendations.

Results of the Media Attractiveness Assessment

The media attractiveness assessment was conducted to examine students' responses to the use of the Calculating Box in Mathematics instruction, particularly in learning addition and subtraction. The trial involved 21 first-grade students at MIS Guppi Roudlotut Tholibin. Data were collected using a questionnaire consisting of 15 items. The questionnaire was

designed to obtain an overview of students' responses after participating in learning activities using the developed media.

Based on the completed questionnaires, the empirical score totaled 1,219 out of a maximum possible score of 1,260. The calculation yielded a media attractiveness percentage of 96.75%. According to the interpretation criteria applied in this study, this percentage falls within the very attractive category. This result indicates that, overall, students responded very positively to the Calculating Box media.



The percentage indicates that the Calculating Box learning media received a highly positive response from students. This positive response may be attributed to the characteristics of the media, which features colorful visuals, attractive illustrations, and a distinctive design compared with the picture-based media previously used in the learning process. Furthermore, the use of a counting box provides students with opportunities to engage in learning activities through direct interaction with the media components. Such activities can create more varied learning experiences than instructional approaches that rely solely on teacher explanations.

For first-grade students, the attractiveness of learning media plays an important role in supporting student engagement throughout the learning process. Children at this age are generally more easily attracted to objects that they can observe and manipulate directly. Therefore, the Calculating Box was designed by integrating visual elements with counting activities so that learning would not focus exclusively on material delivery but would also provide students with more active learning experiences. The highly positive responses from students indicate that the characteristics of this media are appropriate for the learning needs of first-grade students.

However, the results of the attractiveness assessment should be interpreted as an indication of students' responses to the product rather than as a direct measure of improvements in their numeracy skills. The percentage of 96.75% represents the level of

student response or media attractiveness based on the questionnaire administered. To determine the effect of the media on learning outcomes, further investigation is required through achievement tests, comparisons of scores before and after the implementation of the media, or an appropriate experimental research design. Thus, the attractiveness assessment in this study provides evidence that the media was very well received by students, while also serving as a basis for considering its implementation in Mathematics instruction.

Discussion

The findings indicate that the Calculating Box learning media received very high evaluations from both experts and students. The subject matter expert validation reached 93.75%, the media expert validation reached 98.81%, and the student attractiveness assessment reached 96.75%. These results indicate that the product fulfilled the assessment criteria regarding instructional content, media design, and student acceptance. The high validation scores can be attributed to the integration of relevant mathematical content, age-appropriate visual elements, functional components, and opportunities for direct interaction. The alignment between the learning objectives and the media components also contributed to the positive expert assessments. Meanwhile, the high attractiveness percentage suggests that students responded positively to the combination of colorful illustrations and manipulative learning activities (Baga 2021). However, these findings should be interpreted as evidence of product feasibility and attractiveness rather than proof of improved mathematical achievement.

The development of the Calculating Box was based on the learning needs of first-grade students, particularly their difficulties in understanding addition and subtraction through predominantly conventional and picture-based instruction. This finding can be explained through Piaget's theory of cognitive development, which emphasizes that children in the concrete operational stage develop logical thinking through interactions with real objects and observable experiences (Piaget, 1970). At the beginning of elementary education, mathematical symbols such as (+), (−), and (=) may remain difficult to understand when presented without meaningful experiences. The Calculating Box addresses this challenge by allowing students to physically manipulate counting objects, arrange quantities, and observe changes in numbers. For example, when solving 4 + 3, students first place four objects in the box and subsequently add three objects. They can then count the combined objects to establish that the result is seven. In subtraction activities, students begin with seven objects and physically remove three, allowing them to observe that four objects remain. Through

these processes, students experience addition as the combination of quantities and subtraction as the reduction of quantities. Consequently, the media provides opportunities to understand the underlying meaning of arithmetic operations rather than simply memorizing numerical results.

The learning mechanisms facilitated by the Calculating Box are also consistent with Bruner's theory of representation, which distinguishes three modes of knowledge representation: enactive, iconic, and symbolic (Arapu, Salim, and La Mela 2026). The enactive stage occurs when students manipulate counting objects to represent addition and subtraction. The iconic stage develops when students observe the arrangement and quantity of objects, enabling them to visualize the mathematical relationships. Subsequently, the symbolic stage occurs when students translate these concrete activities into numerical expressions, such as $4 + 3 = 7$ or $7 - 3 = 4$. These three forms of representation establish a meaningful connection between physical experiences, visual understanding, and mathematical symbols. Therefore, the instructional value of the Calculating Box lies not merely in its physical appearance but also in its capacity to facilitate the gradual transition from concrete experiences to abstract mathematical representations.

The subject matter expert validation score of 93.75% indicates that the mathematical content presented in the media was considered highly appropriate. This assessment reflects the importance of aligning instructional materials with learning objectives, students' developmental characteristics, and the sequence of mathematical concepts. The addition and subtraction activities were designed to introduce basic arithmetic operations through manageable quantities and concrete examples. Meanwhile, the media expert validation score of 98.81% demonstrates that the visual and technical characteristics of the product received highly favorable evaluations. The use of colors, house illustrations, and decorative elements such as grass was intended to create an appealing learning environment for first-grade students. In addition, the arrangement of the counting box and its supporting components provided opportunities for students to interact directly with the learning materials. The higher media validation score compared with the subject matter validation score suggests that the visual and technical aspects received slightly more favorable assessments, although both aspects achieved the very high category. These findings emphasize that instructional media development requires a balance between pedagogical accuracy and appropriate visual design.

The attractiveness assessment of 96.75%, obtained from an empirical score of 1,219 out of a maximum score of 1,260, further indicates positive student responses to the developed media. This result may be associated with the combination of visual attractiveness, concrete

objects, and opportunities for active participation during mathematics activities. Unlike instructional materials that primarily require students to observe pictures or listen to teacher explanations, the Calculating Box allows students to arrange, add, remove, and count objects directly. Such activities provide opportunities for students to become involved in the learning process and observe the consequences of each arithmetic operation. Nevertheless, student attractiveness should be distinguished from learning effectiveness. A positive response indicates that students accept and show interest in the media, but it does not necessarily demonstrate that their mathematical understanding or numeracy abilities have improved.

The findings of this study can also be discussed in relation to the development of Counting Box media conducted by Wandinni. Both studies share the basic principle of utilizing concrete counting media to support elementary mathematics learning (Pratiwi and Wandini 2026). This similarity indicates that manipulatives remain relevant instructional alternatives for introducing fundamental arithmetic concepts to young learners. However, the present study contributes a context-specific development of the Calculating Box, particularly through the integration of a box-shaped design, number cards, mathematical operation symbols, counting objects, and visual illustrations. Its development procedure also incorporated separate evaluations of subject matter validity, media quality, and student attractiveness. Furthermore, its classroom implementation focused on the use of the media by first-grade students in learning addition and subtraction. Thus, the contribution of this research is not simply the development of another counting box, but the adaptation of concrete manipulative media to specific learning needs, student characteristics, and instructional objectives. This distinction provides a basis for positioning the present product in relation to previous Counting Box research without assuming that the fundamental concept of counting media is entirely new.

From a practical perspective, the Calculating Box offers teachers an alternative for organizing mathematics lessons through concrete and student-centered activities. Teachers can begin by introducing mathematical problems, demonstrating the use of counting objects, and asking students to represent the operations independently. For example, teachers can provide different addition and subtraction problems and encourage students to explain how they obtain the results using the media. Students can subsequently translate their manipulative activities into written mathematical expressions. This instructional sequence allows teachers to observe students' problem-solving processes rather than focusing exclusively on their final answers. The media can also be incorporated into individual practice, small-group activities, or teacher-guided demonstrations. However, its implementation requires clear instructions,

appropriate classroom management, and supervision to ensure that students use the components according to the intended learning objectives. Accordingly, the Calculating Box should be regarded as supporting instructional media rather than a substitute for teachers' explanations and pedagogical guidance.

Despite its favorable evaluation results, this study has several limitations. First, the product trial involved only 21 first-grade students at one elementary school, meaning that the findings reflect a limited research context and cannot automatically be generalized to students with different characteristics or school environments. Second, the evaluation focused on expert validation and student attractiveness responses without conducting pretests, posttests, or comparisons with a control group. Therefore, the study cannot establish whether the use of the Calculating Box produces measurable improvements in mathematical understanding, numeracy skills, or learning achievement. Third, the product was developed specifically for basic addition and subtraction materials, so its suitability for other mathematical topics has not yet been established. Future research should involve larger and more diverse student samples, conduct experimental or quasi-experimental effectiveness testing, and examine the applicability of the media across different mathematical topics and educational settings.

Overall, the findings demonstrate that the Calculating Box achieved very high expert validation scores and positive attractiveness responses from first-grade students at MIS Guppi Roudlotut Tholibin. Its main contribution lies in providing concrete manipulative activities that connect physical experiences with visual representations and mathematical symbols. The integration of these characteristics makes the product a feasible alternative for supporting the teaching of addition and subtraction in lower elementary grades. Nevertheless, its effectiveness in improving students' mathematical achievement remains to be investigated through further empirical testing.

CONCLUSION

Based on the research and development findings, the Calculating Box instructional media for teaching addition and subtraction to first-grade elementary school students was successfully developed using the ADDIE model, which consists of five stages: analysis, design, development, implementation, and evaluation. The development process was based on students' learning needs and involved expert validation and student trials to assess the quality and attractiveness of the product. The validation results demonstrated that the media obtained a score of 93.75% from subject matter experts and 98.81% from media experts, both of which were classified as highly valid. Furthermore, the attractiveness assessment involving 21

students resulted in a score of 96.75%, indicating that the media was classified as highly engaging.

These findings indicate that the Calculating Box instructional media is highly suitable for supporting mathematics instruction, particularly in teaching addition and subtraction to first-grade elementary school students. Its development provides an alternative learning resource that can facilitate students' understanding of basic arithmetic concepts through concrete and interactive learning experiences. However, this study primarily focused on product development, validity, and attractiveness. Therefore, further research is recommended to investigate its effectiveness in improving students' mathematics learning outcomes through experimental or quasi-experimental research designs that measure students' learning achievements before and after the implementation of the media.

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