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Developing PATUNG BRANZ Media to Support Conceptual Understanding of Greatest Common Factors in Elementary Education

Pengembangan Media PATUNG BRANZ untuk Mendukung Pemahaman Konseptual Faktor Persekutuan Terbesar pada Pendidikan Dasar

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Abstract

This study aimed to develop a manipulative learning medium, PATUNG BRANZ, to support the teaching of Greatest Common Factor (GCF) in elementary mathematics education. The study employed a Research and Development (R&D) approach using the ADDIE model, consisting of Analysis, Design, Development, Implementation, and Evaluation stages. The analysis phase identified students' difficulties in understanding the abstract nature of GCF concepts. Based on these findings, an interactive learning board was designed and developed using simple, low-cost materials to facilitate the visualization of factors and numerical relationships. Initial implementation was conducted through demonstrations involving a supervising lecturer and university students, followed by observations and feedback collection. The findings indicate that PATUNG BRANZ provides a concrete, visual, and interactive learning experience that may support conceptual understanding and student engagement. The medium is affordable, easy to use, and adaptable to resource-limited educational settings. This study contributes a practical model for developing locally produced instructional media and recommends further classroom-based validation involving elementary school students.

Keywords: Manipulative Learning Media; Elementary Mathematics Education; Greatest Common Factor; Instructional Design; ADDIE Model

Abstrak

Penelitian ini bertujuan mengembangkan media pembelajaran manipulatif PATUNG BRANZ untuk mendukung pembelajaran Faktor Persekutuan Terbesar (FPB) pada pendidikan matematika sekolah dasar. Penelitian menggunakan pendekatan Research and Development (R&D) dengan model ADDIE yang meliputi tahap Analysis, Design, Development, Implementation, dan Evaluation. Tahap analisis mengidentifikasi kesulitan siswa dalam memahami konsep FPB yang bersifat abstrak. Berdasarkan temuan tersebut, dirancang dan dikembangkan media papan interaktif menggunakan bahan sederhana dan berbiaya rendah untuk membantu visualisasi faktor dan hubungan antarbilangan. Implementasi awal dilakukan melalui demonstrasi kepada dosen pembimbing dan mahasiswa, kemudian dievaluasi melalui observasi serta umpan balik pengguna. Hasil penelitian menunjukkan bahwa PATUNG BRANZ menyediakan pengalaman belajar yang konkret, visual, dan interaktif yang berpotensi mendukung pemahaman konseptual dan keterlibatan siswa dalam pembelajaran. Media ini juga ekonomis, mudah digunakan, dan dapat diterapkan pada sekolah dengan keterbatasan sumber daya. Penelitian ini menawarkan model praktis pengembangan media pembelajaran lokal dan merekomendasikan validasi lanjutan melalui uji lapangan di sekolah dasar.

Kata Kunci: Media Pembelajaran Manipulatif; Pendidikan Matematika Sekolah Dasar; Faktor Persekutuan Terbesar; Desain Pembelajaran; Model ADDIE

INTRODUCTION

Mathematics education is widely recognized as one of the most essential components of the elementary school curriculum. Far beyond its role as a theoretical discipline, mathematics permeates daily life in countless practical ways, from managing finances and measuring distances to solving complex logistical problems.[1] When students are introduced to mathematical reasoning at an early age, they develop critical cognitive competencies such as logical thinking, systematic problem-solving, analytical reasoning, and creative inquiry.[2] These competencies serve as indispensable intellectual foundations that prepare young learners to engage confidently and competently with the demands of modern life across diverse fields, including science, technology, economics, and health. It is therefore imperative that the quality of mathematics instruction at the elementary level receives sustained attention from educators, researchers, and policymakers alike.[3]

Despite its undeniable importance, the reality of mathematics education at the elementary level in Indonesia continues to face persistent and serious challenges.[4] One of the most prevalent problems is the widespread negative attitude that students hold toward mathematics, with many perceiving the subject as inherently difficult, intimidating, and unenjoyable.[5] This unfavorable disposition is not merely a product of the subject's inherent complexity, but is largely a consequence of the predominant use of conventional, teacher-centered instructional methods. In many elementary school classrooms, mathematics is still taught primarily through verbal explanations, rote memorization, and repetitive exercises on the blackboard, with little integration of engaging or interactive learning tools.[6] Such approaches render students passive recipients of information rather than active constructors of knowledge, ultimately undermining both their motivation to learn and their depth of conceptual understanding .[7]

This pedagogical inadequacy becomes especially apparent when students encounter topics such as the Greatest Common Factor (GCF), a concept that forms a core component of the mathematics curriculum for Grades IV and V in Indonesian elementary schools. GCF requires students to identify all factors of given numbers, compare these sets of factors across multiple

1 Nurul Rahmaini and Salsabila Ogylva Chandra, "Pentingnya Berpikir Kritis Dalam Pembelajaran Matematika," *Griya Journal of Mathematics Education and Application* 4, no. 1 (March 29, 2024): 1–8, https://doi.org/10.29303/griya.v4i1.420.

2 Elok Nafisah and Yunus Winoto, "Perpustakaan Digital Dalam Publikasi Jurnal Internasional : Digital Library in International Journal Publications :," *Nusantara Journal of Information and Library* … 5, no. 1 (2022): 1–14, http://119.235.17.41/index.php/JILS/article/view/1510%0Ahttp://119.235.17.41/index.php/JILS/article//1510.

3 Dedi Kuswandi et al., "Development Of Life-Based Curriculum Model Designs In The Global Era," in *Proceeding on International Conference of Science Management Art Research Technology (IC-SMART)*, vol. 1, 2020, 26–32, https://doi.org/10.31098/ic-smart.v1i1.23.

4 Sari Herlina and Dadang Juandi, "Systematics Literature Review: Pengembangan Mathematical Proficiency Dalam Pembelajaran Matematika," *Jurnal Cendekia : Jurnal Pendidikan Matematika* 6, no. 2 (2022): 2122–33, https://doi.org/10.31004/cendekia.v6i2.1417.

5 Nurdin Arifin and Eudia Fortuna, "Etnomatematika Pada Kebudayaan Suku Dayak Bentian Dalam Menumbuh Kembangkan Literasi Matematis," *Jurnal Pengabdian Ahmad Yani* 1, no. 1 (2021): 58–67, https://doi.org/10.53620/pay.v1i1.16.

6 Roslani Supinah and Joko Soebagyo, "Analisis Bibliometrik Terhadap Tren Penggunaan ICT Pada Pembelajaran Matematika," *JNPM (Jurnal Nasional Pendidikan Matematika)* 6, no. 2 (2022): 276, https://doi.org/10.33603/jnpm.v6i2.6153.

7 Elfi Rahmadhani, "Ethnomathematics Dan Permainan Tradisional Dalam Pendidikan Matematika," *JPMI – Jurnal Pembelajaran Matematika Inovatif* 5, no. 1 (2022): 81–94, https://doi.org/10.22460/jpmi.v5i1.81-94.

numbers, and determine the largest value they share in common.[8] When taught exclusively through abstract explanations and procedural drills, this multi-step conceptual process tends to overwhelm many students, leaving them confused and unable to apply the concept independently in problem-solving contexts.[9] The challenge is compounded by the fact that elementary-aged children are still in the process of developing their abstract reasoning abilities, making concrete, hands-on learning experiences essential rather than supplementary.

This developmental reality is well-grounded in established learning theory. Jean Piaget's theory of cognitive development posits that children between the ages of 7 and 12 are in the concrete operational stage, during which they rely heavily on tangible objects and direct sensory experiences to construct meaningful understanding of abstract ideas. Similarly, Jerome Bruner's theory of instruction emphasizes the importance of moving from enactive (hands-on) and iconic (visual) representations to symbolic understanding, particularly in the early stages of learning.[10] These theoretical perspectives collectively affirm that the use of physical, manipulative learning media is not simply a pedagogical preference, but a developmental necessity in elementary mathematics education. Learning media serve as cognitive bridges that connect abstract mathematical concepts to students' concrete experiential understanding.[11]

Recognizing both the theoretical imperative and the practical need for improved instructional tools, scholars and educators have devoted considerable attention to the development and evaluation of innovative learning media for elementary mathematics. Learning media is broadly defined as any tool, device, or material that a teacher uses to convey instructional content to learners in a way that facilitates clearer, more meaningful understanding.[12] Well-designed media not only simplifies complex content but also stimulates student curiosity, sustains attention, and fosters intrinsic motivation to engage with the learning process. Research consistently demonstrates that the integration of concrete, visually stimulating, and interactive media in mathematics classrooms produces significantly better learning outcomes compared to instruction relying solely on verbal and textual methods.[13]

Motivated by these considerations, a team of student researchers from the Elementary School Teacher Education (PGMI) study program at Institut Agama Islam Abuya Salek Sarolangun undertook the development of an innovative learning medium named "PATUNG BRANZ," an acronym derived from Papan Hitung Bima, Rani, Aziz, Nia, Zizah the names of the five team members. This medium was specifically designed to support the teaching and learning of Greatest Common Factor (GCF) for students in Grades IV and V of elementary school.

8 Yuni Azura et al., "Integrasi Deep Learning Dan Pendekatan Kontruktivisme Untuk Penguatan Karakter Islami Di Era Pembelajaran Abad 21," *Jurnal Pendidikan Dasar* 13, no. 2 (2025): 360–73, https://doi.org/10.46368/jpd.v13i2.4749.

9 Sanggiti Bawadi, Heni Pujiastuti, and Maman Fathurrohman, "Pemahaman Konsep Matematika Dengan Teknik Scaffoldıng: Systematic Literature Review," *MENDIDIK: Jurnal Kajian Pendidikan Dan Pengajaran* 9, no. 1 (2023): 7–18, https://doi.org/10.30653/003.202391.2.

10 M Haryani et al., "Studi Literatur: Penerapan Media Pembelajaran Augmented Reality Dalam Pembelajaran Matematika Guna Meningkatkan Kemampuan Pemecahan Masalah Siswa," *PRISMA, Prosiding Seminar Nasional Matematika* 7 (2024): 359–67, https://proceeding.unnes.ac.id/prisma/article/view/2975.

11 Jusuf Blegur et al., "Pelatihan Kepemimpinan Transformasional Calon Guru: Konsep, Integrasi, Dan Evaluasinya Dalam Pembelajaran," *Jurnal Visi Pengabdian Kepada Masyarakat* 5, no. 2 (August 10, 2024): 80–105, https://doi.org/10.51622/pengabdian.v5i2.2269.

12 Arif Rahman Hakim and Fauzi Mulyatna, "Sejarah Matematika: Perkembangan Bilangan Matematika Empiris," *Prosiding Diskusi Panel Nasional Pendidikan Matematika* 9, no. 80 (2023): 471–78, https://proceeding.unindra.ac.id/index.php/DPNPMunindra/article/view/6555.

13 Agung Prabowo et al., "Penyuluhan Cara Meneliti Dan Menulis Hasil Penelitian Bidang Matematika Bagi Guru-Guru MGMP Matematika SMP Kabupaten Banyumas," *ULIL ALBAB : Jurnal Ilmiah Multidisiplin* 2, no. 9 (July 18, 2023): 4100–4106, https://doi.org/10.56799/jim.v2i9.2119.

PATUNG BRANZ takes the form of a colorful, flannel-covered board equipped with numbered foam circles and multicolored pin nails, enabling students to physically identify and compare the multiples of given numbers in order to discover their greatest common factor. By transforming an abstract mathematical procedure into a tactile, visual, and interactive activity, PATUNG BRANZ aims to make the learning of GCF not only more comprehensible but also genuinely enjoyable for young learners.

The significance of this development effort extends beyond the immediate learning context of GCF. In a broader sense, PATUNG BRANZ represents a model for how educators with limited resources can design locally produced, low-cost instructional media that meaningfully enhance the quality of mathematics learning. The materials used in constructing this medium plywood, foam, flannel fabric, velcro, rope, and printed paper are inexpensive and readily available, making the medium both scalable and replicable in diverse school settings across Indonesia. This characteristic is particularly valuable given the resource constraints faced by many elementary schools, especially in rural and semi-urban areas where access to commercial educational materials may be restricted.[14]

The primary objectives of this research are threefold. First, to systematically develop the PATUNG BRANZ learning medium following a structured research and development methodology. Second, to describe in detail the design, construction, and operational features of the medium, including its instructional rationale, physical components, and usage procedures. Third, to critically analyze the strengths and limitations of the medium as an evidence base for future improvement and development. Through these objectives, this study seeks to contribute meaningfully to the growing body of knowledge on innovative instructional media design in elementary mathematics education, and to offer a practical and replicable model of media development that can inspire and guide similar initiatives in comparable educational contexts.

Method

This study employed a Research and Development (R&D) approach using the ADDIE model, which consists of five stages: Analysis, Design, Development, Implementation, and Evaluation.[15] The purpose of this study was to develop PATUNG BRANZ (Papan Hitung Bima, Rani, Aziz, Nia, dan Zizah) as a learning medium for teaching Greatest Common Factor (GCF) in elementary school mathematics. During the analysis stage, the researchers identified learning difficulties related to GCF concepts through curriculum review and literature studies. The design stage focused on preparing the blueprint of the medium, determining learning objectives, selecting materials, and designing interactive features that could help students visualize factors and multiples more effectively.

The development stage involved constructing the PATUNG BRANZ medium using plywood, flannel fabric, numbered circles, Velcro attachments, and colored pins. After the product was completed, it was demonstrated to a supervising lecturer and fellow students in the Elementary School Teacher Education (PGMI) program as an initial implementation activity. Feedback obtained during the demonstration was used to evaluate the practicality, visual appearance, and instructional potential of the medium. Data were collected through observation, documentation, and participant feedback. The collected data were analyzed descriptively to assess the feasibility, strengths, and limitations of the developed learning medium for elementary school mathematics instruction.

14 Arifin Karim and Joko Soebagyo, "Pemetaan Bibliometrik Terhadap Trend Riset Matematika Terapan Di Google Scolar Menggunakan Vosviewer," *Teorema: Teori Dan Riset Matematika* 6, no. 2 (September 30, 2021): 234–41, https://doi.org/10.25157/teorema.v6i2.5835.

15 John W Creswell and Cheryl N Poth, *Qualitative Inquiry and Research Design: Choosing among Five Approaches* (Sage publications, 2016).

RESULTS AND DISCUSSION

Development of PATUNG BRANZ Learning Media

The development of PATUNG BRANZ resulted in an interactive learning medium designed to facilitate the teaching of Greatest Common Factor (GCF) in elementary school mathematics. The medium was developed using the ADDIE model, which consists of Analysis, Design, Development, Implementation, and Evaluation stages. PATUNG BRANZ was created as a response to the need for instructional media capable of transforming abstract mathematical concepts into concrete learning experiences that are more accessible to elementary school students. The final product consists of a foldable board covered with green flannel fabric, numbered foam circles from 1 to 40, removable Velcro attachments, and multicolored pin nails used as learning aids during classroom activities.

During the analysis stage, the researchers identified several challenges in learning GCF concepts at the elementary level. Students often experience difficulties because GCF is commonly introduced through abstract explanations and procedural exercises, requiring learners to understand factors and numerical relationships without adequate visual support. As a result, many students tend to memorize procedures rather than develop conceptual understanding. These findings indicate the need for a practical and interactive learning medium that can help students observe and manipulate mathematical concepts directly.[16]

The design stage focused on developing a medium that was simple, attractive, durable, and affordable. The researchers designed PATUNG BRANZ as a hands-on learning tool that enables students to identify multiples and common factors through direct interaction with physical objects. Bright colors, detachable components, and a portable structure were incorporated to enhance student engagement and classroom usability. These design considerations are consistent with instructional media principles emphasizing visual appeal, accessibility, and suitability for learners' developmental characteristics.[17] The numbered circles and colored markers were specifically selected to support the visualization of numerical patterns and relationships.

The development stage involved constructing the prototype using locally available materials, including plywood, flannel fabric, foam circles, Velcro attachments, and colored pins. The completed medium was functional, easy to assemble, and did not require specialized technical skills for operation. The numbered circles were clearly visible, while the colored markers enabled users to distinguish different sets of multiples effectively.[18] The use of simple materials also demonstrated that educational media can be developed economically without reducing instructional value, making the product potentially applicable in schools with limited resources.

Following its development, PATUNG BRANZ was demonstrated before a supervising lecturer and fellow students as an initial implementation activity. During the demonstration, participants practiced identifying multiples and locating common values by placing colored pins on the

16 Prapti Octavia Ningsih et al., "Aktualisasi Nilai Al-Qur'an Bagi Generasi Muda Yang Berkulitas Dan Berwawasan," *ABDISOSHUM: Jurnal Pengabdian Masyarakat Bidang Sosial Dan Humaniora* 4, no. 2 (June 9, 2025): 140–50, https://doi.org/10.55123/abdisoshum.v4i2.5028.

17 Umar Dhani and Prapti Octavia Ningsih, "Upaya Guru Dalam Menegakkan Kedisiplinan Siswa Di Madrasah Ibtidaiyah Negeri 2 Sarolangun," *DIAJAR: Jurnal Pendidikan Dan Pembelajaran* 4, no. 4 (October 15, 2025): 743–51, https://doi.org/10.54259/diajar.v4i4.5451.

18 Ikhbariaty Kautsar Qadry, Awi Dassa, and Nurul Aynul, "Analisis Kemampuan Literasi Matematika Siswa Dalam Menyelesaikan Soal PISA Konten Space and Shape Pada Kelas IX SMP Negeri 13 Makassar," *Jurnal Matematika Dan Aplikasinya (IJMA)* 2, no. 2 (2022): 78–92, https://science.e-journal.my.id/ijma/article/view/99.

numbered board. This process allowed users to engage actively with the learning medium rather than relying solely on verbal explanations. The activity also encouraged interaction and discussion among participants, as they could directly observe numerical relationships represented on the board.[19] Feedback obtained during this stage provided valuable insights regarding the practicality and usability of the medium.

Overall, the development process successfully produced a learning medium that aligns with the instructional objectives established during the planning stage. PATUNG BRANZ combines visual, tactile, and interactive elements to support the learning of GCF concepts while remaining affordable and easy to use. The product demonstrates how simple and locally available materials can be transformed into meaningful educational resources that support active learning and mathematical understanding in elementary school settings.

Strengths and Limitations of PATUNG BRANZ Learning Media

One of the main strengths of PATUNG BRANZ is its ability to provide a concrete visualization of mathematical concepts that are often perceived as abstract by elementary school students. Through the use of numbered circles and colored markers, students can directly observe the relationships between multiples and common factors. Rather than relying solely on symbolic calculations, learners are encouraged to explore number patterns through hands-on activities. This visual representation helps reduce cognitive burden and supports a deeper understanding of GCF concepts.[20] The medium therefore functions as a bridge between abstract mathematical ideas and concrete learning experiences.

The educational value of PATUNG BRANZ can also be explained through established learning theories. According to Piaget's theory of cognitive development, elementary school students are generally in the concrete operational stage, where learning occurs more effectively through interaction with tangible objects. PATUNG BRANZ accommodates these developmental characteristics by allowing students to manipulate physical materials while exploring mathematical concepts. Similarly, constructivist learning theory emphasizes that knowledge is actively constructed through interaction and experience rather than passively received from teachers. The interactive nature of PATUNG BRANZ supports this learning process by encouraging students to discover mathematical relationships independently.[21]

The medium is further supported by Bruner's theory of representation, which proposes that learning progresses through enactive, iconic, and symbolic stages. PATUNG BRANZ facilitates these stages by allowing students to manipulate colored markers and numbered circles (enactive), observe visual representations of numerical relationships (iconic), and eventually understand mathematical concepts symbolically. Consequently, the medium serves not only as a teaching aid but also as a learning tool that promotes conceptual understanding through multiple forms of representation. This characteristic is particularly important in mathematics education, where students often struggle to connect abstract symbols with meaningful experiences.

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19 Miftahul Jannah and Miftahul Hayati, "Pentingnya Kemampuan Literasi Matematika Dalam Pembelajaran Matematika," *Griya Journal of Mathematics Education and Application* 4, no. 1 (March 30, 2024): 40–54, https://doi.org/10.29303/griya.v4i1.416.

20 Sunaryo Winardi et al., "PENGGUNAAN MOBILENET UNTUK INTELLIGENT CHARACTER RECOGNITION (ICR) PENILAIAN OTOMATIS OPERASI MATEMATIKA DASAR," *Jurnal TIMES* 12, no. 2 (December 18, 2023): 40–51, https://doi.org/10.51351/jtm.12.2.2023707.

21 Maulidi Arsih Umaroh Islamiah et al., "Analisis Pemecahan Masalah SPLTV Berdasarkan IDEAL Problem Solving Ditinjau Dari Gaya Belajar Visual-Auditorial-Kinestetik (VAK)," *Journal of Mathematics Education and Learning* 2, no. 1 (March 30, 2022): 74, https://doi.org/10.19184/jomeal.v2i1.25589.

Another notable strength of PATUNG BRANZ is its potential to enhance student motivation and participation. The incorporation of colorful components and interactive activities introduces elements of play, exploration, and discovery into the learning process. Such characteristics can help create a more enjoyable classroom atmosphere and reduce students' anxiety toward mathematics. Previous studies have highlighted the importance of learning motivation in supporting academic achievement, particularly in mathematics education.[22] In addition, the medium encourages collaborative learning by allowing students to work together, discuss solutions, and compare their findings, thereby promoting communication and mathematical reasoning skills.[23]

Despite its strengths, several limitations were identified during the evaluation process. First, the numerical range of the board is limited to numbers 1–40, which may restrict its application to more advanced mathematical topics. Second, the implementation of the medium requires adequate classroom space to ensure that all students can observe and participate effectively. Third, continuous use may affect the durability of certain components, particularly the Velcro attachments and foam circles, which may require periodic maintenance or replacement.[24] These limitations indicate areas that should be considered in future improvements of the product.

Overall, PATUNG BRANZ demonstrates considerable potential as a learning medium for teaching GCF in elementary school mathematics. Its strengths include visual clarity, interactivity, affordability, practicality, and alignment with established educational theories. Furthermore, the medium illustrates how locally available and inexpensive materials can be transformed into meaningful instructional resources that support active learning and conceptual understanding. These findings are consistent with previous studies highlighting the importance of innovative and contextually relevant learning media in mathematics education.[25]

CONCLUSION

This study developed PATUNG BRANZ as a manipulative learning medium designed to support the teaching of Greatest Common Factor (GCF) in elementary mathematics education through the ADDIE development framework. The development process resulted in a practical instructional medium consisting of a foldable board, numbered circles, and colored markers that enable learners to visualize factors and numerical relationships in a concrete and interactive manner. The findings indicate that the medium successfully transforms an abstract mathematical concept into a tangible learning experience that is more consistent with the cognitive characteristics of elementary school learners. Through its visual, tactile, and participatory features, PATUNG BRANZ demonstrates the potential to facilitate conceptual understanding, encourage active engagement, and support collaborative learning activities. The development

22 Asriyati Nadjamuddin and Evi Hulukati, "KemampuanLiterasi Numerasi Mahasiswa Dalam Menyelesaikan Masalah Matematika," *Jurnal Basicedu* 6, no. 1 (2022): 987–96, https://doi.org/10.31004/basicedu.v6i1.1999.

23 Prapti Octavia Ningsih et al., "Implementasi Media Pembelajaran Interaktif Berbasis Genially Untuk Meningkatkan," *Al-Irsyad Journal of Mathematics Education* 5, no. 1 (January 12, 2026): 352–64, https://doi.org/10.58917/ijme.v5i1.566.

24 Maulidiyah Tutut Nurjanah, Cholis Sa'dijah, and Susiswo Susiswo, "Representasi Skematis Siswa Dalam Menyelesaikan Masalah Trend in International Mathematics and Science Study (TIMSS) Ditinjau Dari Self Efficacy," *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan* 6, no. 4 (April 30, 2021): 622–34, https://doi.org/10.17977/jptpp.v6i4.14725.

25 Hasnawati Hasnawati, E Mujahiddin, and Hendri Tanjung, "Students' Ability in Writing Opinion Essay Using Writing Process Method and a Story Based on Adab Education," *AL-ISHLAH: Jurnal Pendidikan* 15, no. 3 (September 30, 2023): 364, https://doi.org/10.35445/alishlah.v15i3.3060; Yuni Azura Risma Chulashotud Diana, Prapti Octavia Ningsih, "Mathematics Learning In The Difusi Era: Strategies And Challenges In Madrasah Ibtidaiyah," *PIONIR Jurnal Pendidikan* 15, no. 1 (2026): 14–26, https://jurnal.ar-raniry.ac.id/index.php/Pionir/article/view/31707.

process further illustrates that meaningful mathematics learning media can be produced using simple, affordable, and locally available materials without requiring advanced technology or substantial financial resources.

The study contributes to the growing body of knowledge on instructional media development in elementary mathematics education in several ways. First, it provides a practical example of how manipulative learning media can be designed to bridge the gap between abstract mathematical concepts and students' concrete learning experiences. Second, it demonstrates the relevance of established learning theories, particularly those of Piaget, Bruner, and constructivist perspectives, in informing the design of instructional tools for young learners. Third, the study offers a replicable model for educators seeking to develop low-cost and contextually relevant educational resources in schools with limited access to commercial learning materials. By emphasizing accessibility, affordability, and learner-centered interaction, PATUNG BRANZ contributes not only to mathematics instruction but also to broader discussions concerning equitable educational innovation and resource-sensitive pedagogical design. These contributions highlight the importance of developing instructional media that are pedagogically meaningful while remaining feasible for implementation in diverse educational settings.

Despite these contributions, several limitations should be acknowledged. The implementation stage was limited to preliminary demonstrations involving a supervising lecturer and university students rather than the intended population of elementary school learners. Consequently, the study does not provide empirical evidence regarding the medium's effectiveness in improving students' learning outcomes, conceptual mastery, or long-term retention of mathematical knowledge. In addition, the numerical range incorporated into the current version of the medium remains relatively limited, and the durability of several physical components may require further refinement for sustained classroom use. Future research should therefore focus on expert validation, classroom-based field testing, and experimental or quasi-experimental studies involving larger groups of elementary school students. Further investigations may also examine students' learning achievement, engagement, mathematical reasoning, and attitudes toward mathematics after using the medium. In addition, future development could expand the numerical scope of the board, improve material durability, and explore digital or hybrid adaptations to increase flexibility and applicability across different mathematics topics and learning environments.

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