The Effectiveness of Rainbow Board Media in Enhancing Conceptual Understanding of Addition and Subtraction among Elementary Students

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Abstract

This research aims to improve students' low activity and ability in addition and subtraction using the "Rainbow Board" media. Using the Kemmis and McTaggart model of Classroom Action Research (PTK), this study systematically analyzed the impact of media intervention in two cycles involving 17 grade II students at MI Darussalam, Manding District, Sumenep. The study identified a significant increase in participation and cognitive learning outcomes: student activity increased drastically from 8 students in cycle I to 16 in cycle II, while learning completeness increased from 10 to 15 students, with a jump in grade average from 71 to 91. Theoretically, these findings confirm that the use of visual manipulative media serves as an effective "cognitive bridge" in aligning abstract mathematical logic with the student's concrete stages of operational development, as postulated by cognitive learning theory. These findings show that the use of Rainbow Board media successfully transforms classroom dynamics, making them more interactive, and effectively increases students' activity levels and basic counting ability.

Keywords: Rainbow Board Media; addition and subtraction; concrete operations.

Introduction

Education is the central pillar in creating quality human resources, both in terms of science and religion, to be able to compete in the midst of technological advances. As expressed,[1] Education is mandatory to produce an independent generation that does not depend on others. The rapid pace of change is a challenge in itself that requires the education world to continue innovating, both in methods, strategies, and the use of learning media. Ideally, learning should no longer be one-way or teacher-centered. Still, it should actively engage students and meet their diverse learning needs through relevant methods. .[2]

However, the reality on the ground shows a significant gap between ideal expectations for education and the actual implementation of learning.[3] The fundamental problem that often arises in the classroom is a decline in student concentration caused by teacher-centered instruction and monotonous lecture methods. Based on initial observations at MI Darussalam, the learning process tends to focus on packaged books and conventional methods, with no variety of media.

This condition triggers various serious learning problems when viewed from the perspective of experts. Identify that difficulties in learning mathematics in children are often not caused by low intelligence, but by failure to instill an understanding of basic concepts (conceptual) before entering the procedural realm.[4] When students are immediately presented with a number symbol without understanding its meaning, they experience perceptual barriers.[5] External factors exacerbate this, as Lumbantoruan notes that poor teaching methods, such as the presentation of uninteresting material, can turn students off. This loss of interest is fatal because, without attention, the process of transferring information into the student's long-term memory will be hampered.[6]

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[1] E Yayuk, *Pembelajaran Matematika Sekolah Dasar*, vol. 1 (UMMPress, 2019).
[2] Y Anggraini, "Analisis Persiapan Guru Dalam Pembelajaran Matematika Di Sekolah Dasar," *Jurnal Basicedu* 5, no. 4 (2021): 2415–22.
[3] Z Anwar, "Pelaksanaan Pembelajaran Matematika Di Sekolah Dasar," *Jurnal Penelitian Ilmu Pendidikan* 5, no. 2 (2012): 24–32.
[4] K Ismatullah, "Penerapan Metode Pembelajaran Resitasi Dalam Pembelajaran Matematika Dasar," *Edumatic: Jurnal Pendidikan Informatika* 1, no. 1 (2017): 24–28.
[5] J S Bruner, *In Search of Pedagogy Volume I: The Selected Works of Jerome Bruner, 1957–1978* (Routledge, 2006).
[6] F N M Jannah et al., "Penggunaan Aplikasi Canva Dalam Media Pembelajaran Matematika Di Sekolah Dasar," *Jurnal Pendidikan Dasar* 11, no. 1 (2023): 138–46.

Further, the incompatibility of these methods creates a crucial cognitive gap. Psychologically, grade II students in SD/MI (age 7–8 years) are, according to Jean Piaget, at the concrete operational stage.[7] In this phase, the child's logic is still tied to a real object. The lecture format is contrary to this need, leading to the so-called learning difficulties due to instrumental factors (lack of props). According to Jerome Bruner's Learning Theory, learning in elementary school should start with the enactive (manipulation of objects) and iconic (visual) stages before the symbolic stage. Neglect of this stage makes the material feel unfamiliar, triggering boredom, passivity, and lower learning outcomes, as defined by Bruner.[8] That optimal learning outcomes include holistic changes (cognitive, affective, psychomotor) that are not achieved when the process is ineffective.

To address the gap between the demands of the material and students' cognitive capacity, a measurable pedagogical intervention is needed through the use of appropriate learning media.[9] Define media as a tool for effectively communicating between teachers and students. The opinion reinforces this definition. Aminah & Pratiwi[10] and Bambang,[11] Which states that the media can stimulate interest in learning and facilitate students' understanding, and Suarta & Jaelani,[12] This emphasizes the media's vital role in delivering lesson messages.

The urgency of using this media becomes more crucial if analyzed through Jean Piaget's Theory of Cognitive Development. Grade II students in SD/MI, who are typically 7-8 years old, are at the concrete operational stage. In this phase, the child's logical ability is still tied to manipulating real objects; they have not been able to perform pure mental abstraction without visual aid. A gap occurs when the lecture method forces students to jump straight into abstract thinking. The presence of media is needed as a "cognitive bridge"

[7] J Piaget, "Piaget's Theory of Cognitive Development," in *Childhood Cognitive Development: The Essential Readings*, vol. 2, 2000, 33–47.
[8] J S Bruner, "Organization of Early Skilled Action," *Child Development*, 1973, 1–11.
[9] S Saviola and P Dewi, "Media Pabergiban Berbantuan Problem Based Learning Dalam Meningkatkan Keaktifan Siswa Kelas IV Materi Segi Banyak," *Jurnal Pelangi Pendidikan* 2, no. 1 (2024): 10–18.
[10] R N Aminah and E Y R Pratiwi, "Penerapan Media Papan Pintar Untuk Meningkatkan Keaktifan Siswa Dalam Materi Simbol Dan Penerapan Pancasila Di Kelas III SDN Bandung 1," *Jurnal Ilmiah Penelitian Mahasiswa* 3, no. 3 (2025): 91–99.
[11] P N Bambang, "Peningkatan Kemampuan Membaca Permulaan Melalui Penggunaan Papan Flanel Pelangi Pada Murid Tunagrahita Ringan Kelas II Di SLB Negeri 1 Barru" (2024).
[12] I N Suarta and A K Jaelani, "Penerapan Media Papan Flanel Untuk Meningkatkan Kemampuan Membaca Permulaan Anak Kelompok A TK Negeri Pembina Ampenan," *Pendas: Jurnal Ilmiah Pendidikan Dasar* 9, no. 4 (2024): 208–17.

(scaffolding) that transforms abstract numbers into visual objects that can be sensed, in harmony with the student's brain's developmental stage.[13]

This analysis is also in line with Jerome Bruner's Learning Theory, which postulates that the child's learning process ideally moves through three stages: enactive (activity-based/real objects), iconic (image-based/visual-based), and symbolic (number-based/language-based).[14] Conventional learning often fails because it directly presents number symbols (symbolic stage) without grounding them in manipulative experience (enactive stage). Learning media facilitate these enactive and iconic stages, allowing students to construct an understanding of the concept of meaningful learning before moving on to procedural problems.[15]

The effectiveness of this visual-concrete media-based approach has been empirically proven.[16] Found that Smart Board media proved to be valid and effective in mathematics learning. In line with that, FuuuuuuuuuuuuuuuuuuuuuuClick or tap here to enter text. Also recorded a significant increase in learning outcomes using similar board media. Based on the synthesis of Piaget and Bruner's theories and the empirical data, the researcher offers a solution in the form of the application of "Rainbow Board Media. This media is not just a visual aid; it is designed to represent the place values of numbers (hundreds, tens, units) using color coding (red, yellow, green). This approach explicitly accommodates the student's iconic need to facilitate understanding of the concepts of addition and subtraction, which can be challenging to grasp when explained verbally only.[17]

MI Darussalam presents a real context regarding the challenges of basic education, where the need to transform passive learning into active student involvement is seen as urgent. Based on the background of these problems and the potential solutions offered, this study aims to analyze in depth the "Application of Rainbow Board Media Learning in Grade II Students of MI Darussalam in Improving the Ability of Addition and Subtraction

[13] G Brown and C Desforges, *Piaget's Theory* (Routledge, 2013).
[14] J Bruner, "The Narrative Construction of Reality," *Critical Inquiry* 18, no. 1 (1991): 1–21.
[15] J S Bruner, *Jerome S. Bruner*, 1980.
[16] Saviola and Dewi, "Media Pabergiban Berbantuan Problem Based Learning Dalam Meningkatkan Keaktifan Siswa Kelas IV Materi Segi Banyak."
[17] A Ridho, A Alfiansyah, and R Rohaili, "Integrating Gamification and SEL to Strengthen Elementary Students' Character in Indonesia," *Molang: Journal Islamic Education* 3, no. 2 (2025): 1–15.

Operations. The primary focus is in how this learning media innovation can foster a dynamic classroom atmosphere and optimally develop students' thinking skills. Thus, this research not only seeks to improve academic learning outcomes but also makes a practical contribution to the development of fun and effective mathematics learning strategies at the elementary school level.

Method

This study uses a Classroom Action Research approach with a cycle design, drawing on the Kemmis and McTaggart models.[18] This approach was chosen to explore and synthesize the direct impact of the "Rainbow Board" media intervention on students' computational operation abilities. The design of this study allows researchers to map learning progress and identify effective teaching patterns through continuous improvement mechanisms. The research subjects included 17 grade II students from MI Darussalam, Manding District (11 male and six female students) in the odd semesters. The research procedure is carried out in two cycles, each consisting of four interrelated stages: planning, acting, observing, and reflecting.[19]

The primary data source consists of student learning outcome test scores (pre-cycle, cycle I, and cycle II), student activity observation sheets, and learning documentation. Data collection techniques include participant observation to monitor students' direct involvement in media use, as well as written tests designed to measure cognitive aspects ranging from knowledge (C1) to application (C3). This instrument is used to ensure the validity of data related to increasing understanding of the concept of addition and subtraction.

Data analysis used a comparative descriptive approach, namely by comparing the average grade point average and the percentage of classical learning completeness between cycles. This analysis aims to systematically compile data to draw valid conclusions about the effectiveness of the media. The indicators of research success are determined based on the school's Minimum Completeness Criteria (KKM) of 75. This study was deemed successful if at least 80% of the total students (13 students) achieved the completeness score, indicating

[18] Herawati Susilo, Husnul Chotimah, and Yuyun Dwita Sari, *Penelitian Tindakan Kelas* (Media Nusa Creative (MNC Publishing), 2022).
[19] M R Pahleviannur et al., *Penelitian Tindakan Kelas* (Pradina Pustaka, 2022).

a significant increase in cognitive learning outcomes and student active participation in learning.

Results and Discussion

This section outlines the empirical findings from two cycles of classroom action research, focusing on changes in learning activities and students' cognitive learning outcomes, in addition to subtraction operations in class II at MI Darussalam. The discussion focused on the observed improvement pattern, not on claims of absolute effectiveness.

1. Pre-Cycle Conditions: Cognitive Gaps and Low Student Activity

   The initial observations indicate a significant gap between learning expectations and classroom conditions. Of the 17 students, only 2 showed active involvement in mathematics learning, while most were passive. This condition correlates with low cognitive learning outcomes.

   Pre-cycle data showed that only two students (2%) met the Minimum Completeness Criteria (KKM), while the other 15 students (88%) did not complete. The class's average grade was 59, which is still far below the standard for completeness. These findings do not point solely to students' weaknesses, but rather indicate that the dominant learning approaches are verbal and abstract in nature and have not fully corresponded to the cognitive development characteristics of early primary school students.[20]

2. The Dynamics of Improving Learning Outcomes Between Cycles

   The implementation of actions in Cycle I through Rainbow Board media began to show positive changes, although it had not yet reached the set success indicators (80% classical completeness). The number of active students increased to 8, while the number of students who achieved learning completeness increased to 10 (58.8%), and the average class score increased to 71.

   However, the reflection results show that teachers' use of media is not optimal, and the variety of practice questions remains limited. As a result, some students still have

[20] Anwar, "Pelaksanaan Pembelajaran Matematika Di Sekolah Dasar."

difficulty in understanding the concept of counting operations in its entirety. These findings are the basis for improving strategies in the next cycle.

In Cycle II, improvements were made by increasing students' direct involvement in using the Rainbow Board and enriching the range of interactive exercises. This change was followed by a more participatory classroom atmosphere. The number of active students increased to 16 (94.1%), while learning completeness reached 15 students (88.2%) with an average class score of 91. Although this achievement exceeded the indicators of research success, the results were interpreted as an indication of an increase in the suitability of learning strategies to the needs of students, rather than as absolute evidence of effectiveness.

To clarify the development of learning outcomes at each stage, Table 1 summarizes the data is presented in Table 1.

Table 1. Summary of Student Activities and Learning Outcomes in Each Cycle

Research Stages	Number of Active Students	Percentage of Activity	Number of Students Completed	Completion Percentage	Average Score
Pre-Cycle	2	11,8%	2	11,8%	59
Cycle I	8	47,1%	10	58,8%	71
Cycle II	16	94,1%	15	88,2%	91

3. The Role of Rainbow Board Media in Supporting Elementary Students' Understanding of Basic Arithmetic Concepts

The improvement in student learning outcomes from the pre-cycle stage to cycle II shows that the use of Rainbow Board media plays a significant role in strengthening students' conceptual understanding of basic calculation operations. These findings provide empirical evidence consistent with Piaget's theory of cognitive development, which asserts that children aged 7–8 years are in the concrete operational stage, a phase in which logical thinking skills develop only when students interact directly with real objects. The Rainbow Board media, through a combination of color and physical manipulation, serves as a cognitive

scaffolding that bridges the transition from concrete experience to symbolic understanding.[21] Thus, this media not only simplifies the calculation process but also strengthens the process of internalizing number concepts through meaningful learning experiences.

Pedagogically, the novelty of the Rainbow Board does not lie solely in its form as a concrete tool, but in its multimodal and gradual instructional design. This approach is in line with Bruner's theory of learning, which states that effective learning occurs through three sequential representations: enactive (direct action), iconic (visual), and symbolic (abstraction).[22] The Rainbow Board in this study accommodates these three stages: students first manipulate real objects (enactive), then understand color patterns as representations of place values (iconic), and finally generalize concepts into the form of numbers and mathematical symbols (symbolic). Thus, the Rainbow Board can be categorized as a conceptual transition medium, which helps students move from intuitive understanding to structured mathematical thinking.

The results of this study also reinforce previous findings that emphasized the effectiveness of concrete and visual media in basic mathematics learning. Rahayu proves that rainbow boards improve fractional operability through a visual approach that displays place values.[23] Furthermore, Fadila et al. found that the use of interactive board media significantly increased the activeness and learning outcomes of Pancasila learning in elementary school.[24] Saviola and Dewi's research also shows that integrating visual media in the Problem-Based Learning model fosters active participation and deeper understanding of concepts in geometry materials.[25] Aminah and Pratiwi's findings,[26] and Suarta and Jaelani's, show that visual-based concrete media contribute significantly to increasing interest in learning and

[21] Brown and Desforges, *Piaget's Theory*.
[22] Jerome Seymour Bruner, *Toward a Theory of Instruction* (Harvard university press, 1974).
[23] Y Rahayu, "Pengembangan Alat Peraga Papan Pelangi Pada Operasi Hitung Pecahan Di Sekolah Dasar," *Jurnal Didaktika Pendidikan Dasar* 2, no. 2 (2018): 299–318.
[24] P N Fadila et al., "Upaya Meningkatkan Hasil Belajar Peserta Didik Melalui Media Papan Tempel Pada Mata Pelajaran Pendidikan Pancasila Kelas IVA SDN 005 Palembang," *Indonesian Research Journal on Education* 4, no. 4 (2024): 2881–86.
[25] Saviola and Dewi, "Media Pabergiban Berbantuan Problem Based Learning Dalam Meningkatkan Keaktifan Siswa Kelas IV Materi Segi Banyak."
[26] Aminah and Pratiwi, "Penerapan Media Papan Pintar Untuk Meningkatkan Keaktifan Siswa Dalam Materi Simbol Dan Penerapan Pancasila Di Kelas III SDN Bandung 1."

understanding concepts in elementary school-age children.[27] The consistency between the findings of this study and various previous studies confirms that manipulative-visual media play a central role in building bridges between concrete experiences and symbolic representations of students.

Learning through the Rainbow Board supports the view that learners actively build knowledge through interaction with the learning environment.[28] The process of manipulating colors and shapes allows students to build personal meanings for the mathematical concepts they learn. This is in line with Anggraini's findings.[29] and Ismatullah[30] This shows that using active learning strategies and manipulative media can increase students' engagement and critical thinking skills in basic mathematics. The improvement in learning outcomes in this study not only reflects procedural success but also profound conceptual development, namely the shift from passive learning to active and reflective participation.

This research has several methodological limitations that need to be considered. First, the relatively small sample size (17 students from one madrasah) limits the generalizability of this study's results to a broader educational context. Second, the research focuses only on addition and subtraction, so the effectiveness of the Rainbow Board relative to other mathematical materials, such as multiplication, division, or fractions, cannot be determined. Third, the absence of a control group limits the ability to isolate the influence of media as the sole factor in improving learning outcomes, given that other variables, such as the intensity of teacher guidance and the frequency of practice, also play a role. Therefore, advanced research is recommended to use a quasi-experimental or mixed-methods design with a larger sample, a broader range of materials, and a comparative approach across learning media. This approach will enable stronger validation of the Rainbow Board's effectiveness as a visual-concrete-based mathematics learning medium at the primary education level.

[27] Suarta and Jaelani, "Penerapan Media Papan Flanel Untuk Meningkatkan Kemampuan Membaca Permulaan Anak Kelompok A TK Negeri Pembina Ampenan."
[28] Jean Piaget, "Childhood Cognitive Development: The Essential Readings," *Essential Readings in Developmental Psychology. Malden, MA: Blackwell*, 2000, 33–47.
[29] Anggraini, "Analisis Persiapan Guru Dalam Pembelajaran Matematika Di Sekolah Dasar."
[30] Ismatullah, "Penerapan Metode Pembelajaran Resitasi Dalam Pembelajaran Matematika Dasar."

Conclusion

Based on an in-depth analysis of the research data of this class action, it can be concluded that the application of the "Rainbow Board" media has been empirically proven to be able to improve the ability of addition and subtraction operations in grade II students of MI Darussalam. In the initial condition, learning dominated by lecture methods results in low levels of participation and completeness. However, after implementing the Rainbow Board media, there was a significant transformation in both process and results. This is evidenced by the increase in the grade point average from 59 in the pre-cycle to 71 in Cycle I, and reached a peak of 91 in Cycle II. In addition, classical learning completeness reached 88.2% (15 students completed), exceeding the target for the success indicators. Thus, the Rainbow Board media is recommended as an effective solution to overcome the difficulties of learning mathematics at the elementary school level, especially in instilling the concept of basic calculation operations.

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