

Reconceptualizing Mathematics Learning Media for Madrasah Ibtidaiyah: Evidence from a Qualitative Literature Review

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ABSTRAK

Penelitian ini bertujuan untuk merekonseptualisasi peran media pembelajaran matematika di Madrasah Ibtidaiyah melalui sintesis bukti dari studi literatur kualitatif. Berbeda dari kajian yang memposisikan media pembelajaran sekadar sebagai alat bantu instruksional, artikel ini memandang media pembelajaran sebagai mediator kognitif dan pedagogis yang menjembatani konsep matematika yang bersifat abstrak dengan karakteristik berpikir konkret siswa usia sekolah dasar. Metode penelitian yang digunakan adalah studi literatur kualitatif dengan sumber data berupa artikel jurnal bereputasi, prosiding ilmiah, dan referensi akademik yang relevan dalam sepuluh tahun terakhir. Data dianalisis melalui sintesis tematik untuk mengidentifikasi pola penggunaan media, keselarasan pedagogis, dan dampaknya terhadap pembelajaran matematika di jenjang pendidikan dasar. Hasil kajian menunjukkan bahwa media pembelajaran matematika berfungsi paling efektif ketika diintegrasikan secara progresif. Media konkret berperan dalam membangun pemahaman konseptual dasar melalui pengalaman langsung, media visual memfasilitasi transisi menuju representasi dan penalaran simbolik, sementara media audiovisual dan digital memperluas pembelajaran melalui keterlibatan, eksplorasi, dan umpan balik. Ketika diintegrasikan secara selaras dengan prinsip konstruktivisme dan pendekatan Realistic Mathematics Education, penggunaan media pembelajaran secara sistematis terbukti mendukung peningkatan pemahaman konsep, motivasi belajar, penurunan kecemasan matematika, serta peningkatan hasil belajar siswa. Secara teoretis, penelitian ini memberikan kontribusi berupa sintesis konseptual yang menjelaskan bagaimana dan mengapa berbagai jenis media pembelajaran mendukung pembelajaran matematika pada jenjang pendidikan dasar. Meskipun berfokus pada konteks

Madrasah Ibtidaiyah, kerangka konseptual yang dihasilkan bersifat transferabel dan dapat diterapkan pada konteks pembelajaran matematika sekolah dasar secara lebih luas.

ABSTRACT

This study reconceptualizes mathematics learning media in Madrasah Ibtidaiyah by synthesizing evidence from a qualitative literature review. Rather than positioning learning media merely as instructional aids, this article conceptualizes them as cognitive and pedagogical mediators that bridge abstract mathematical concepts with students' concrete operational thinking. A qualitative literature review was conducted using peer-reviewed journal articles, conference proceedings, and authoritative academic sources published over the last decade. The selected studies were analyzed through thematic synthesis to identify patterns of media use, pedagogical alignment, and learning outcomes in elementary mathematics education. The findings indicate that mathematics learning media function most effectively when integrated progressively. Concrete media establish foundational conceptual understanding through hands-on experiences, visual media facilitate the transition toward representational and symbolic reasoning, and audiovisual-digital media extend learning through engagement, exploration, and feedback. When aligned with constructivist principles and Realistic Mathematics Education, this integrated use of learning media consistently supports improved conceptual understanding, increased learning motivation, reduced mathematics anxiety, and enhanced learning achievement. This study contributes theoretically by offering a conceptual synthesis that explains how and why different types of learning media support mathematics learning at the elementary level. Although situated in the context of Madrasah Ibtidaiyah, the proposed framework is transferable to broader elementary mathematics education settings, providing a conceptual reference for researchers, educators, and curriculum designers seeking to integrate learning media systematically and meaningfully.

1. INTRODUCTION

Mathematics learning in *Madrasah Ibtidaiyah* (MI) presents distinctive pedagogical challenges that require careful instructional design. Students at the MI level, typically aged

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between 6 and 12 years, are situated within Piaget's concrete operational stage of cognitive development. At this stage, learners experience difficulty in processing abstract concepts without the support of concrete objects and visual representations. Consequently, mathematics, characterized by abstraction, hierarchy, and deductive reasoning, is often perceived as difficult by MI students. Previous studies have consistently emphasized that this cognitive mismatch necessitates the use of learning media to bridge abstract mathematical ideas with students' concrete ways of thinking (Juwantara, 2019; Wiryanto, 2020).

Learning media play a strategic role in addressing these challenges. Beyond functioning as instructional aids, learning media serve as cognitive mediators that facilitate students' construction of mathematical understanding. Well-designed media can attract students' attention, enhance motivation, and support the internalization of concepts through visual, manipulative, and interactive experiences (Nurseto, 2012; Tafonao, 2018). Empirical studies in elementary and MI contexts indicate that the use of concrete and visual media significantly improves conceptual understanding and learning outcomes in mathematics, particularly for topics such as arithmetic operations, fractions, and geometry (Saputro et al., 2021; Suryani et al., 2023).

In recent years, research on mathematics learning media has expanded beyond traditional, concrete tools to include audiovisual and digital media. Interactive videos, educational games, and dynamic software, such as GeoGebra, have been shown to enhance student engagement, exploratory learning, and conceptual visualization, particularly in geometry and problem-solving tasks (Batubara, 2018; Sati et al., 2024). Bibliometric and review studies further reveal a growing trend in integrating digital technologies into elementary mathematics instruction, reflecting broader developments in educational technology and digital pedagogy (Pulungan & Rakhmawati, 2022). However, much of this literature remains focused on measuring effectiveness rather than examining the pedagogical roles and conceptual functions of different media within a unified framework.

Within the Indonesian context, the Realistic Mathematics Education (RME) approach has frequently been combined with learning media to contextualize mathematical concepts using real-life situations and manipulatives. Studies report that media-assisted RME improves students' conceptual understanding and supports meaningful learning by connecting mathematics to students' lived experiences (Artika et al., 2019; Primasari et al., 2021). Despite these positive findings, existing studies tend to be fragmented, examining specific media types or isolated interventions without synthesizing how various forms of media, concrete, visual, audiovisual, and digital, collectively support mathematics learning in Madrasah Ibtidaiyah.

This fragmentation points to a critical research gap. While numerous studies confirm the effectiveness of learning media in mathematics instruction, there is a lack of comprehensive, qualitative syntheses that reconceptualize learning media as an integrated pedagogical system aligned with students' cognitive development and instructional contexts. Most existing reviews emphasize classification or outcome comparison, leaving the conceptual role of learning media as pedagogical bridges between abstraction and cognition, particularly within Islamic elementary education settings, underexplored.

Addressing this gap, the present study aims to reconceptualize mathematics learning media for Madrasah Ibtidaiyah through a qualitative literature review. Rather than merely cataloging media types, this study synthesizes findings from relevant literature to construct a conceptual understanding of how different forms of learning media function pedagogically and cognitively in MI mathematics learning. By identifying patterns of media use, pedagogical alignment, and learning outcomes, this study seeks to contribute theoretically to

elementary mathematics education and practically to the design of effective, context-sensitive mathematics instruction in Madrasah Ibtidaiyah.

2. METHOD

This study adopted a qualitative literature review approach to reconceptualize the role of mathematics learning media in Madrasah Ibtidaiyah. A qualitative design was selected because the primary objective of this study was not to measure effect sizes or establish causal relationships, but to synthesize existing scholarly evidence in order to construct conceptual insights regarding how learning media function pedagogically in elementary mathematics education. Through this approach, learning media were examined as cognitive and instructional mediators rather than as isolated teaching tools.

Relevant literature was collected from peer-reviewed academic sources, including nationally accredited journals, conference proceedings, and authoritative books in the fields of mathematics education and instructional media. The literature search was conducted using academic databases such as Google Scholar, Portal Garuda, and SINTA, employing keywords related to mathematics learning media, Madrasah Ibtidaiyah, elementary mathematics education, manipulative teaching aids, and digital learning media. To ensure the relevance and currency of the data, only publications from the last ten years (2014–2024) were considered.

The selection of literature followed a systematic process to enhance analytical rigor and transparency. Initially, publications were identified based on keyword relevance and screened by reviewing titles and abstracts to exclude studies that did not align with the research focus. The remaining studies were then examined in full text to assess their eligibility in terms of context, methodological clarity, and relevance to mathematics learning media at the elementary or Madrasah Ibtidaiyah level. Only studies that met these criteria were included for qualitative synthesis.

Data analysis was conducted through a thematic synthesis process guided by the interactive model of Miles and Huberman. Relevant information from each study was systematically reduced and coded to capture recurring themes related to types of learning media, pedagogical functions, instructional contexts, and reported learning outcomes. These themes were then organized and compared across studies to identify consistent patterns and conceptual relationships. Through this iterative process, conclusions were drawn and continuously verified by cross-checking findings across multiple sources to ensure conceptual consistency.

Throughout the analysis, learning media were interpreted as integral components of a pedagogical system that aligns mathematical abstraction with students' cognitive development. To enhance the trustworthiness of the findings, the study employed source triangulation by incorporating diverse types of publications and research designs, as well as analytical transparency through explicit documentation of the selection and analysis procedures.

3. RESULT AND DISCUSSION

a. Learning Media as Cognitive and Pedagogical Mediators

The synthesis of the reviewed literature demonstrates that mathematics learning media in Madrasah Ibtidaiyah function primarily as cognitive and pedagogical mediators, rather than as supplementary instructional tools. At the elementary level, particularly in Madrasah Ibtidaiyah contexts, instructional practices facilitate the understanding of abstract mathematical concepts through concrete representations and structured learning experiences,

thereby shaping students' understanding of mathematics. Learning media facilitate this mediation by enabling students to interact with mathematical ideas in ways that are consistent with their cognitive development (Juwantara, 2019; Wiryanto, 2020).

Several studies emphasize that learning media shape not only *what* students learn, but *also how* they learn. Media guide students' attention, support meaning-making processes, and scaffold the transition from informal reasoning to formal mathematical thinking. Nurseto (2012) and Tafonao (2018) argue that effective media enhance cognitive processing by reducing abstraction and supporting comprehension through multimodal representations. In this sense, learning media serve as instructional bridges that connect content, pedagogy, and learner cognition.

From a pedagogical standpoint, the mediating role of learning media aligns closely with constructivist learning theory, which views knowledge as actively constructed through interaction with learning environments. Studies in elementary mathematics education suggest that the use of learning media actively encourages students to explore, manipulate, and reflect on mathematical ideas, thereby fostering deeper conceptual understanding than passive reception (Nurrita, 2018; Saputro et al., 2021). This finding reconceptualizes learning media as integral elements of instructional design that influence the quality of learning interactions.

Overall, the literature supports a reconceptualization of mathematics learning media in MI as active mediators that structure cognitive engagement and pedagogical practice. This perspective moves beyond a utilitarian view of media as teaching aids and positions them as foundational components of effective mathematics instruction in Islamic elementary education.

b. Concrete and Visual Media in Supporting Conceptual Understanding

The reviewed studies consistently show that concrete and visual media dominate mathematics instruction in Madrasah Ibtidaiyah and play a critical role in supporting students' conceptual understanding. Concrete media, including manipulatives, physical models, and measurement tools, enable students to engage directly with mathematical concepts through hands-on activities. Such media are particularly effective for introducing foundational topics such as arithmetic operations, fractions, measurement, and basic geometry (Saputro et al., 2021; Suryani et al., 2023).

Concrete media allow students to experience mathematical relationships physically, which helps reduce cognitive load and minimize misconceptions. Research indicates that students who learn through manipulative-based instruction demonstrate stronger conceptual clarity and greater confidence compared to those taught through abstract explanations alone (Fitrah, 2020). This finding reinforces Piagetian perspectives that emphasize the importance of concrete experiences during the operational stage of cognitive development (Juwantara, 2019).

Visual media further extend the function of concrete tools by supporting the transition from physical manipulation to mental representation. Diagrams, charts, number lines, and symbolic illustrations help students reorganize concrete experiences into structured mental models. Studies show that visual representations enhance pattern recognition, relational reasoning, and symbolic interpretation in elementary mathematics learning (Wartini et al., 2024; Wardani & Putra, 2024).

Taken together, concrete and visual media form a coherent instructional sequence that supports gradual abstraction. The literature suggests that systematic integration of these media enables students to construct a stable conceptual foundation that prepares them for more advanced mathematical reasoning.

c. Audiovisual and Digital Media for Engagement and Exploratory Learning

In recent years, the literature documents a growing integration of audiovisual and digital media in mathematics learning at the Madrasah Ibtidaiyah level. Educational videos, animations, interactive applications, and digital platforms are reported to enhance student motivation, attention, and engagement, particularly in topics that are difficult to visualize through static representations (Batubara, 2018; Sati et al., 2024).

Audiovisual media support learning by combining visual and auditory channels, which helps students process complex information more effectively. Research indicates that animated explanations and interactive videos can clarify abstract relationships and improve students' understanding of mathematical procedures and concepts (Batubara, 2018). Digital media also facilitates exploratory learning by allowing students to manipulate variables, test hypotheses, and receive immediate feedback.

However, the findings consistently emphasize that the effectiveness of digital media depends on pedagogical integration rather than technological novelty. Studies caution that teachers who use digital tools without clear instructional objectives often limit their impact to increasing enjoyment rather than enhancing conceptual understanding (Khairunnisa & Ilmi, 2020; Pulungan & Rakhmawati, 2022). Digital media are most effective when they reinforce and extend understanding developed through concrete and visual learning experiences.

Thus, the literature positions audiovisual and digital media as powerful extensions of mathematics learning that support engagement and exploration when educators align them with learning goals and students' cognitive readiness.

d. Integrated Media Use and Its Implications for Mathematics Learning in Madrasah Ibtidaiyah

A key finding across the reviewed studies is that mathematics learning media are most effective when implemented as an integrated and progressive system rather than as isolated instructional elements. Teachers tend to introduce concepts using concrete media, reinforce understanding through visual representations, and extend learning using audiovisual or digital tools. This progression reflects an implicit instructional logic that aligns media use with students' cognitive development and learning needs (Pulungan & Rakhmawati, 2022).

Pedagogical approaches such as Realistic Mathematics Education (RME) further strengthen this integration by emphasizing contextual learning and meaningful problem situations. Studies show that media-assisted RME supports conceptual understanding by connecting mathematical ideas to students' real-life experiences (Artika et al., 2019; Primasari et al., 2021). In this framework, media are not add-ons but essential components that support meaningful and contextualized learning.

Despite these benefits, the literature also highlights challenges in media implementation, including limited resources, unequal access to technology, and insufficient teacher preparation. Several studies report that teachers require sustained professional development to design and integrate media effectively into mathematics instruction (Subarinah et al., 2023). Without adequate support, media use risks becoming superficial or inconsistent.

This conceptual map illustrates the reconceptualization of mathematics learning media in Madrasah Ibtidaiyah as an integrated pedagogical system. Learning media function as cognitive and pedagogical mediators that connect students' concrete operational thinking with abstract mathematical concepts through progressive integration of concrete, visual, and audiovisual-digital media, aligned with constructivist and Realistic Mathematics Education principles to enhance learning outcomes.

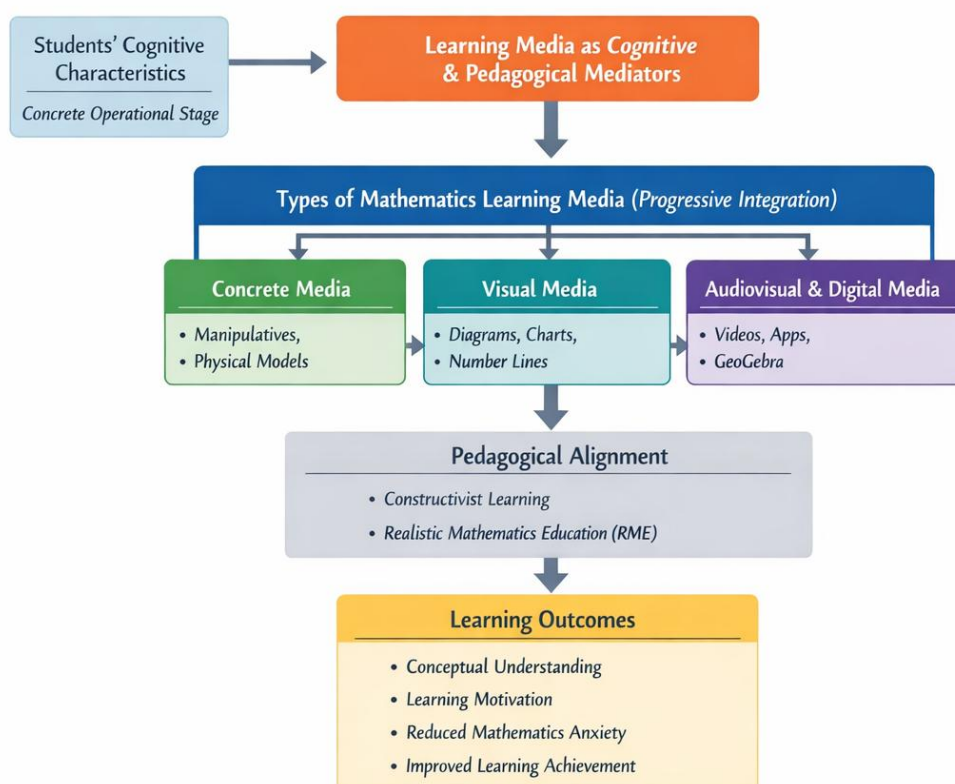


Figure 1. Conceptual Map of Reconceptual Mathematics Media in Madrasah Ibtidaiyah

Overall, the integrated use of learning media has important implications for mathematics education in Madrasah Ibtidaiyah. By reconceptualizing learning media as interconnected pedagogical mediators, this study highlights the importance of integrating media systematically, building teacher capacity, and providing institutional support to enhance conceptual understanding, motivation, and learning outcomes in elementary mathematics education.

e. Limitations

This study has several limitations that should be considered when interpreting the findings. First, as a qualitative literature review, the analysis relies entirely on previously published studies and does not involve direct empirical observation or primary data collection. Consequently, the findings represent conceptual insights derived from existing literature rather than empirical generalizations of classroom practices in Madrasah Ibtidaiyah.

Second, although this review synthesizes a wide range of studies on mathematics learning media, the majority of the analyzed literature originates from the Indonesian educational context. While this focus strengthens contextual relevance, it may limit the generalizability of the findings to elementary education systems with different curricular structures, technological infrastructures, and pedagogical traditions.

Third, this study does not examine the effectiveness of specific learning media through quantitative comparison or meta-analytic techniques. As a result, the review emphasizes conceptual patterns and pedagogical roles rather than effect sizes or measurable impacts of particular media types. Additionally, variations in methodological quality across the reviewed studies may influence the depth and consistency of the synthesized findings.

Finally, this review does not explicitly address issues related to cost-effectiveness, long-term sustainability, or large-scale implementation of learning media in Madrasah Ibtidaiyah. Future research that combines empirical investigation with economic and institutional analysis would provide a more comprehensive understanding of media integration in elementary mathematics education.

4. CONCLUSION

This qualitative literature review reconceptualizes mathematics learning media in Madrasah Ibtidaiyah as an integrated pedagogical system rather than a collection of isolated instructional tools. The findings demonstrate that learning media function as cognitive and pedagogical mediators that bridge abstract mathematical concepts with students' concrete operational thinking. Through progressive integration, concrete media establish foundational understanding, visual media facilitate the transition toward abstraction, and audiovisual–digital media extend learning through engagement and exploration. When aligned with constructivist principles and Realistic Mathematics Education, this integration supports meaningful mathematics learning that is responsive to students' cognitive development and instructional contexts.

The study contributes theoretically by offering a conceptual synthesis that clarifies how and why different types of learning media support mathematics learning in Madrasah Ibtidaiyah. Practically, the findings highlight the importance of deliberate media selection, pedagogical alignment, and teacher competence in implementing effective mathematics instruction. For teachers, curriculum designers, and policymakers, this reconceptualization underscores the need to move beyond sporadic media use toward systematic and integrated media design that enhances conceptual understanding, learning motivation, and overall learning outcomes in Islamic elementary education.

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