

TRENDS IN THE USE OF INTERACTIVE MEDIA FOR MATHEMATICS LEARNING IN ELEMENTARY SCHOOLS: A LITERATURE REVIEW (2015–2025)

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Abstract

Mathematics learning at the elementary level plays a crucial role in developing students' logical, systematic, and critical thinking skills, yet it is still widely perceived as abstract and difficult, indicating the need for pedagogical innovation through digital technology integration. This study aims to systematically analyze trends in the use of interactive media in elementary school mathematics learning from 2015 to 2025, focusing on media types, pedagogical implementation strategies, and learning outcomes. Employing a Systematic Literature Review (SLR) method following the PRISMA 2020 guidelines, literature was collected from Crossref, Google Scholar, and Scopus databases, yielding 1,243 articles, of which 28 studies met the inclusion criteria for analysis. The findings reveal three dominant trends: pedagogical trends marked by a shift toward student-centered learning models such as Problem-Based Learning and Digital Game-Based Learning; technological trends characterized by the increasing use of interactive multimedia, educational games, Augmented Reality, and interactive digital worksheets (E-LKPD); and cognitive trends reflected in a stronger focus on students' motivation, engagement, and higher-order thinking skills. This review also identifies a key research gap in the limited longitudinal and context-sensitive evaluation of interactive media effectiveness in elementary mathematics learning. The scientific contribution of this study lies in its integrative synthesis of a decade-long development of interactive media by systematically linking media types, instructional models, and learning outcomes, offering a more comprehensive analytical perspective than previous short-term or media-specific reviews.

Keywords: Elementary school; Interactive media; Mathematic

Abstrak

Pembelajaran matematika pada tingkat sekolah dasar memainkan peran krusial dalam mengembangkan keterampilan berpikir logis, sistematis, dan kritis siswa, namun masih sering dianggap abstrak dan sulit, menunjukkan perlunya inovasi pedagogis melalui integrasi teknologi digital. Studi ini bertujuan untuk menganalisis secara sistematis tren penggunaan media interaktif dalam pembelajaran matematika di sekolah dasar dari tahun 2015 hingga 2025, dengan fokus pada jenis media, strategi implementasi pedagogis, dan hasil belajar. Menggunakan metode Systematic Literature Review (SLR) sesuai dengan pedoman PRISMA 2020, literatur dikumpulkan dari basis data Crossref, Google Scholar, dan Scopus, menghasilkan 1.243 artikel, di mana 28 studi memenuhi kriteria inklusi untuk analisis. Temuan menunjukkan tiga tren dominan: tren pedagogis yang ditandai dengan pergeseran menuju model pembelajaran berpusat pada siswa seperti Pembelajaran Berbasis Masalah dan Pembelajaran Berbasis Permainan Digital; tren teknologi yang ditandai dengan penggunaan yang semakin meningkat dari multimedia interaktif, permainan edukatif, Realitas Augmentasi, dan lembar kerja digital interaktif (E-LKPD); serta tren kognitif yang tercermin dalam fokus yang lebih kuat pada motivasi siswa, keterlibatan, dan keterampilan berpikir tingkat tinggi. Tinjauan ini juga mengidentifikasi celah penelitian utama dalam evaluasi longitudinal dan kontekstual yang terbatas mengenai efektivitas media interaktif dalam pembelajaran matematika dasar. Kontribusi ilmiah studi ini terletak pada sintesis integratifnya terhadap perkembangan media interaktif selama satu dekade dengan secara sistematis menghubungkan jenis media, model instruksional, dan hasil belajar, menawarkan perspektif analitis yang lebih komprehensif daripada tinjauan jangka pendek atau spesifik media sebelumnya.

Kata Kunci: Matematika; Media Interaktif; Sekolah Dasar

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Introduction

Mathematics at the elementary school level plays a crucial role in developing students' logical, systematic, and analytical thinking skills that support everyday problem solving and adaptation to their environment (Hermawan et al., 2025; Amelia & Manurung, 2020). As a foundational subject, mathematics learning is expected to foster conceptual understanding and reasoning abilities through meaningful learning experiences rather than procedural memorization alone (Muslimin et al., 2022). At this level, mathematics is not merely content to be mastered but a formative experience that shapes students' attitudes toward thinking, reasoning, and learning itself (Azahra et al., 2025).

Mathematics is closely related to daily life, ranging from simple numerical activities to more complex reasoning tasks (Rambe & Afri, 2020). International perspectives emphasize that meaningful mathematics learning emerges from active, collaborative, and well-structured instructional experiences that support conceptual understanding (Koskinen & Pitkanien, 2022). Learning environments that encourage inquiry, reflection, and interaction enable students to actively construct mathematical knowledge rather than passively receive information (Darling et al., 2022). Consequently, elementary mathematics instruction should prioritize learning designs that are concrete, contextual, and engaging in order to support students' cognitive development (Hidayati et al., 2023).

Despite its importance, mathematics remains one of the subjects most frequently perceived by students as difficult and intimidating. The 2022 PISA results indicate that although Indonesia's ranking in mathematical literacy improved compared to 2018, the overall score declined, reflecting persistent challenges in students' mathematical understanding (Kemdikbudristek, 2023). This condition aligns with findings that students often view mathematics as abstract, symbol-heavy, and disconnected from real-life contexts, leading to confusion, anxiety, and low engagement (Hasiru et al., 2021; Rahmah et al., 2024). These negative perceptions are particularly evident among elementary students who experience learning difficulties, further hindering their participation and achievement in mathematics learning (Muin et al., 2022).

Low mathematics achievement has also been associated with instructional practices that emphasize teacher-centered approaches and procedural learning. Such practices may reinforce the belief that mathematics is only accessible to high-achieving students, causing others to disengage and develop negative learning attitudes (Yulianto et al., 2022). Mathematics anxiety and low motivation are common consequences of these experiences (Khaidir & Suhaili, 2023). Although digital technology offers considerable potential to address these challenges by supporting more engaging and student-centered learning, its integration into elementary mathematics classrooms remains limited due to reliance on conventional teaching methods and underutilization of digital learning media (Wulandari et al., 2024).

In the digital era, technology plays an increasingly important role in supporting teachers in designing and delivering effective learning experiences (Kaamilah et al., 2023). Learning approaches that rely solely on verbal explanations and static materials are no longer sufficient, as students need opportunities to explore concepts independently and interactively (Sevilla et al., 2023). Technology integration has been shown to enhance learning effectiveness and create more interactive learning environments that support student engagement (Ati & Fatimah, 2024). Interactive learning media, which combine elements such as text, images, animations,

audio, and simulations, enable students to actively participate in learning and facilitate deeper understanding of abstract mathematical concepts (Marifah & Amaliyah, 2022; Adam, 2023).

A growing body of research has documented the positive impact of interactive media on elementary mathematics learning. Studies report improvements in students' understanding, motivation, and engagement when interactive digital tools are incorporated into instruction. Moreover, the integration of interactive media with innovative learning models, such as Problem-Based Learning (PBL) and Digital Game-Based Learning (DGBL), has shown promise in promoting active learning and problem-solving skills. However, these findings are often derived from individual studies that focus on specific media types or short-term implementations, limiting broader conclusions about patterns and trends in media use.

Although numerous studies and systematic literature reviews have examined interactive media in mathematics education, several limitations remain. Existing reviews tend to focus on particular technologies or narrow timeframes, providing fragmented insights into media effectiveness. Few studies examine the evolution of interactive media use over an extended period or analyze how media are integrated with instructional models such as PBL and DGBL. In addition, prior reviews often emphasize general learning outcomes without sufficiently synthesizing evidence related to cognitive engagement and problem-solving processes in elementary mathematics learning. Consequently, there is a lack of comprehensive, longitudinal, and integrative reviews that map trends, implementation strategies, and learning impacts of interactive media in elementary mathematics education.

This study addresses these gaps by conducting a systematic literature review of interactive media use in elementary mathematics learning from 2015 to 2025. This ten-year period captures significant shifts in educational practices, including increased digitalization and the growing emphasis on student-centered learning approaches in primary education. By reviewing studies across a full decade, this research provides a more comprehensive understanding of how interactive media have been developed, implemented, and evaluated in elementary mathematics classrooms.

The unique contribution of this review lies in its integrative and longitudinal perspective. Unlike previous systematic reviews that focused on single media types or short-term interventions, this study synthesizes evidence across diverse forms of interactive media and examines their instructional integration, particularly in relation to innovative learning models such as PBL and DGBL. By analyzing reported learning impacts and engagement patterns, this review offers a more holistic view of how interactive media support meaningful mathematics learning at the elementary level.

Accordingly, this study aims to analyze trends in the use of interactive media in elementary mathematics learning from 2015 to 2025, focusing on media types, implementation strategies, and reported effectiveness in supporting learning outcomes and student engagement. The findings are expected to contribute to a clearer understanding of the evolving role of interactive media in elementary mathematics education and to inform the development of more effective and engaging instructional practices.

Research Methods

This study employed a Systematic Literature Review (SLR) to systematically identify, evaluate, and synthesize empirical evidence on the use of interactive media in elementary mathematics learning. The SLR approach was selected because it enables comprehensive mapping of research developments, identification of gaps, and evidence-based synthesis of existing studies. The review process followed the Preferred Reporting Items for Systematic

Reviews and Meta-Analyses (PRISMA) guidelines, which include four main stages: identification, screening, eligibility assessment, and inclusion. The process of searching and selecting scientific articles at each stage as shown in Figure 1.

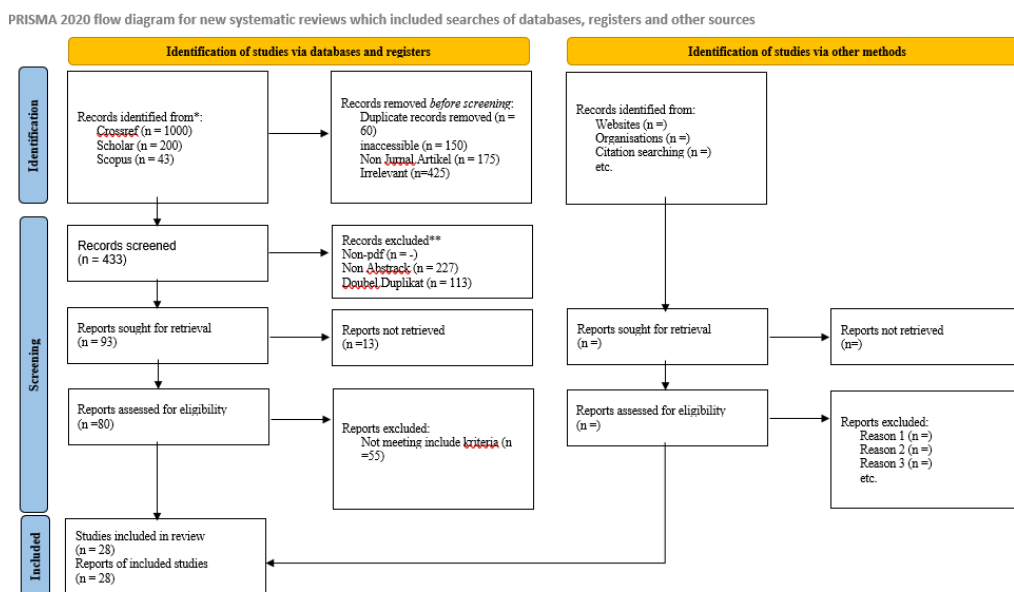


Figure 1. Literature Search Results Using the PRISMA 2020 Guidelines

The literature search was conducted using three databases: Scopus, Google Scholar, and Crossref. A structured search string was applied using Boolean operators to ensure relevance and consistency, namely (“interactive media” OR “digital media” OR “educational media”) AND (“mathematics learning” OR “mathematics education”) AND (“elementary school” OR “primary school”). The search was limited to articles published between 2015 and 2025 and written in English or Indonesian. Supporting tools, including Publish or Perish and VOSviewer, were used to assist article retrieval and bibliometric analysis. VOSviewer was employed to visualize keyword co-occurrence and identify dominant research themes related to interactive media in elementary mathematics learning.

The initial search yielded 1,243 articles from the three databases. During the identification stage, 60 duplicate articles, 150 inaccessible articles, 425 non-relevant studies, and 175 non-journal publications were excluded, resulting in 433 articles for screening. Further screening excluded 227 articles without abstracts and 113 articles with duplicate or overlapping content, leaving 93 articles for full-text eligibility assessment. Based on predefined inclusion and exclusion criteria, including relevance to the research focus, document completeness, and publication quality, 28 articles were ultimately included in the final review.

To reduce selection bias, the screening and selection process was conducted collaboratively by two reviewers who independently examined titles, abstracts, and full texts. Any disagreements were resolved through discussion and consensus. Furthermore, a quality assessment was conducted to strengthen methodological rigor and minimize the risk of bias. An adapted rubric based on the Critical Appraisal Skills Programme (CASP) framework was used to evaluate each article’s clarity of research objectives, methodological appropriateness, rigor of data collection and analysis, validity of findings, and relevance to elementary mathematics learning. Only articles meeting the minimum quality criteria were included in the synthesis.

Data extraction was carried out using a structured form to record key information, including publication year, authorship, research design, data collection methods, learning

models applied, types of interactive media used, key findings, study limitations, and contributions to elementary mathematics learning. The extracted data were analyzed descriptively and thematically to identify trends, patterns, and remaining research gaps in the use of interactive media in elementary mathematics education.

Results and Discussion

Based on the data obtained, there were 28 articles relevant to the keywords used. The researchers then reviewed articles relevant to interactive media in mathematics learning in elementary schools. The data from these articles are documented as shown in Table 1.

Table 1. Research Results Related to Interactive Media in Mathematics Learning

Source	Author, Year, Journal	Findings
Crossref	Cecep Kurniawan, Elga Ayudhia, Adrias, Fadila Suciana (2025), CaXra: Jurnal Pendidikan Sekolah Dasar, Vol. 05, No. 01, Juni 2025	The study developed Wordwall-based interactive media using the ADDIE model for fourth-grade flat shape material, which was validated by experts and proven effective in improving students' conceptual understanding.
Crossref	Neha, La La Ili, Iman Ashari (2023), Jurnal Ilmiah Pembelajaran Sekolah Dasar, Vol. 5, No. 2, Agustus 2023	The study developed PowerPoint-based interactive media for sixth-grade spatial geometry using the ADDIE model, and validation results showed it was highly suitable for use.
Crossref	Dea Puspita, Tarpan Suparman, Andes Safarandas Asmara (2024), DIDAKTIKA: Jurnal Pendidikan Sekolah Dasar, Vol. 7, No. 1, 2024	The study found that Powtoon-based interactive media significantly improved fourth graders' mathematics learning outcomes on area and volume material.
Crossref	Cintya Amelia, Albert Supriyanto Manurung (2022), Edukatif: Jurnal Ilmu Pendidikan, Vol. 4, No. 3, 2022	The study showed that Powtoon audiovisual media significantly increased third graders' motivation in mathematics learning.
Crossref	Indah Nanindia Restiani, Ida Putriani, Desy Anindia (2022), Autentik: Jurnal Pengembangan Pendidikan, Vol. 6, No. 2, 2022	The study developed SEPARO interactive media using Kodular for fourth-grade fraction material, and expert validation confirmed it was highly suitable for use.
Crossref	Sinta Oliviana, M. Yusuf Setia Wardana, Ari Widyaningrum (2024), Wawasan Pendidikan, Vol. 4 No. 1, Februari 2024	The study developed the Android-based "SIPINTAR" interactive learning media for fourth-grade flat shape material, which was rated highly valid (84–94%) and well received by teachers and students.
Crossref	Salsa Phira Putri Kinanti, Masniladevi (2024), e-JIPSD (Jurnal Ilmiah Pendidikan Sekolah Dasar), Vol. 12 No. 1, 2024	The study developed Articulate Storyline 3 multimedia with a PBL model for decimal multiplication and division, receiving a "highly valid" score (91.75%) and high practicality.
Crossref	Annisa Aulia Rahmah, Dinda Vidyana Dwi Putri, Ayya Maulida, Ahmad Suriansyah, Celia Cinantya (2024), MARAS: Jurnal Penelitian Multidisiplin, Vol. 2 No. 4, Desember 2024	The research found that animated audiovisual media significantly improved first graders' conceptual understanding and learning motivation in mathematics.
Crossref	Ibnu Muthi, Hanna Latifah (2024), Jurnal Ilmiah Global Education, Vol. 5 No. 3, 2024	The review concluded that interactive media—including apps, simulations, and Quizizz—

Source	Author, Year, Journal	Findings
		effectively improved elementary students' interest and mathematical understanding.
Crossref	Sopia, N. (2022), JPMI – Jurnal Pembelajaran Matematika Inovatif, Vol. 5, No. 1	The use of Microsoft PowerPoint-based interactive media successfully increased second graders' interest in learning mathematics from 52.91% to 97.98%.
Crossref	Yulianto, A., Sisworo, & Hidayanto, E. (2022), Mosharafa: Jurnal Pendidikan Matematika, Vol. 11, No. 3	PBL-based learning videos increase student motivation and learning outcomes
Crossref	Pamungkas, Z. S., dkk. (2021), Social Pedagogy: Journal of Social Science Education, Vol. 2, No. 2	Developing gamified Wordwall media to increase student learning motivation by up to 84.83%
Crossref	Thohir, M. A., dkk. (2024), DE Journal, Vol. 5 No. 2	The SISPERMA multimedia developed with Adobe Animate, Photoshop, and Illustrator successfully increased fifth graders' learning interest.
Crossref	Hendratmoko, Y., dkk. (2024), Alwatzikhoebillah, Vol. 10 No. 2	Using the Quizizz app with the Lesson feature for mathematics learning; increasing interest in learning (calculated t-value 8.768 > table t-value 2.011)
Crossref	Amatullah, D. C., & Sutrisno, J. (2022), Lentera: Jurnal Ilmiah Kependidikan, Vol. 15, No. 1	Developing computer-based interactive media (ADDIE model), resulting in 95% classical mastery
Crossref	Hasibuan, F., & Napitupulu, S. (2021), Education Achievement: Journal of Science and Research, Vol. 2, No. 3	Developing Powtoon-based animated videos for square and rectangle perimeter material; student response rate of 90.42%
Crossref	Rohman, A., dkk. (2023), Papanda Journal of Mathematics and Sciences Research, Vol. 2, No. 2	Using Android-based learning media; increasing students' interest in learning (N-Gain 0.467)
Crossref	Supratman & Rahayu, D. S. (2022), Arus Jurnal Psikologi dan Pendidikan, Vol. 1, No. 3	Audiovisual media (educational videos) increase student participation and understanding in mathematics
Crossref	Paseleng, M. C., & Arfiyani, R. (2015), Scholaria, Vol. 5, No. 2	Interactive multimedia with animations and educational games increases learning motivation (83% vs. 47%)
Scholar	Dian Aprianty, Somakim, Ketang Wiyono (2021), Sekolah Dasar: Kajian Teori dan Praktik Pendidikan, Vol. 30 No.1	The study developed animation- and simulation-based interactive multimedia using the Alessi & Trollip model for fourth-grade rectangular and triangular material.
Scholar	Azarial Ubaidi, Rifa Nabila, Muhammad Ar Raffi, Arita Marini (2023), Jurnal Pendidikan Dasar dan Sosial Humaniora (JPDSH), Vol. 2 No. 8	The media includes text, images, videos, exercises, and interactive games, and has been proven effective for online and offline use in supporting interactive mathematics learning.
Scholar	Diana Nur Septiyawati Putri, Fitriah Islamiah, Tyara Andini, Arita Marini (2022), Jurnal Pendidikan Dasar dan Sosial Humaniora (JPDSH), Vol. 2 No. 2	Interactive learning media such as PowerPoint, videos, and online quizzes significantly improved elementary students' motivation and learning outcomes.

Source	Author, Year, Journal	Findings
Scholar	Anisa Rahmadanti, La Ode Amril, Irwan Efendi (2024), Jurnal Pengajaran Sekolah Dasar, Vol. 3 No. 1	The experimental study showed that using Wordwall in fourth-grade math lessons effectively increased student motivation and improved learning outcomes.
Scholar	Annisa Fitri Auliya, Eneng Fitriasaki, Mutia Nurunnisa, Arita Marini (2023), Jurnal Pendidikan Dasar dan Sosial Humaniora (JPDSH)	A review of 10 studies concluded that technology-based interactive media effectively enhances elementary students' learning outcomes, motivation, interest, and participation.
Scholar	Hayu Ika Anggraini, Nurhayati, Shirly Rizki Kusumaningrum (2021), Jurnal Pendidikan Indonesia (Japendi)	HOTS-based DGBL using computer and Android games effectively enhances elementary students' numeracy, reasoning, critical thinking, and motivation.
Scopus	Rani Puspita Dhaniawaty, Sri Supatmi, Mia Fitriawati (2023), Journal of Advanced Research in Applied Sciences and Engineering Technology, Vol. 32, Issue 2	The study developed an Android-based math game featuring "Banru," which effectively increased elementary students' motivation and independent learning.
Scopus	F. H. Firmansyah, I. P. Sari, F. C. Permana, D. Rinjani (2021), Journal of Physics: Conference Series (IOP Publishing) Vol. 1987	AR-based interactive multimedia with 3D simulations integrated into Google Classroom effectively improved fifth graders' spatial geometry understanding.
Scopus	Sri Utaminingsih et al. (2024), Management of Mathematics Learning Based on Interactive Digital Worksheets to Improve Students' Critical Thinking Ability	The critical-thinking-based interactive E-LKPD for fourth-grade fractions was validated as effective and well-received, improving learning outcomes and critical thinking skills.

Data on Tabel 1 show that the development of interactive learning media at the elementary school level not only reflects technological advances but also indicates a shift in the pedagogical paradigm towards more constructivist and student-centered learning. The diversity of platforms, ranging from Wordwall, interactive PowerPoint, Articulate Storyline, Powtoon, Kodular, to Android applications, confirms that the selection of media is not merely following digital trends, but rather a pedagogical strategy to transform abstract mathematical concepts into concrete and meaningful learning experiences.

Empirical evidence from various studies shows that media interactivity not only increases motivation, participation, and learning outcomes, but also functions as a cognitive mechanism that strengthens students' reasoning and critical thinking. These findings confirm that media design, especially in the DGBL and interactive E-LKPD models, encourages independent and adaptive learning that is in line with the needs of 21st-century learners.

Trends in the Use of Interactive Media in Elementary School Mathematics Learning Based on Publication Year and Media Used

The use of interactive media in elementary mathematics learning has gained increasing attention for its role in enhancing teaching effectiveness. This study used a bibliometric and Systematic Literature Review (SLR) approach on 28 articles from 2015–2025. Using VOSviewer, keyword relationships were mapped, and trend analysis traced research distribution

and development over time. The results of the bibliometric visualization are presented in **Figure 2**.

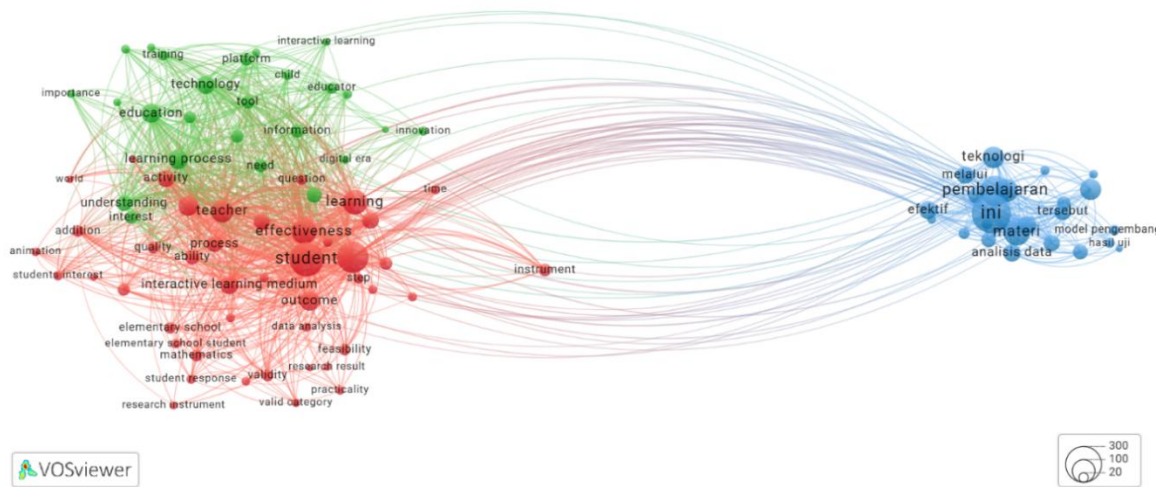


Figure 2. Network visualization for the keywords interactive media, mathematics, and elementary school

The visualization reveals three main research clusters on interactive media in elementary mathematics learning. The red cluster focuses on student-centered aspects like effectiveness, engagement, and outcomes. The green cluster highlights teachers’ roles and technology integration, showing a shift from information delivery to facilitation. The blue cluster emphasizes local contexts, media development, and effectiveness in specific math topics. The strong interconnections among clusters indicate a growing integration between technological and pedagogical aspects in current research.

An analysis of 28 selected articles shows that research on interactive media in elementary school mathematics learning has increased significantly over the past decade, particularly in the period 2021–2024. This increase not only reflects the acceleration of digitalization in the wake of the COVID-19 pandemic, but is also a logical consequence of the implementation of the Merdeka Curriculum, which emphasizes differentiated learning, technology integration, and independent learning. Details of the distribution of the year of publication of the research are presented in **Figure 3**.

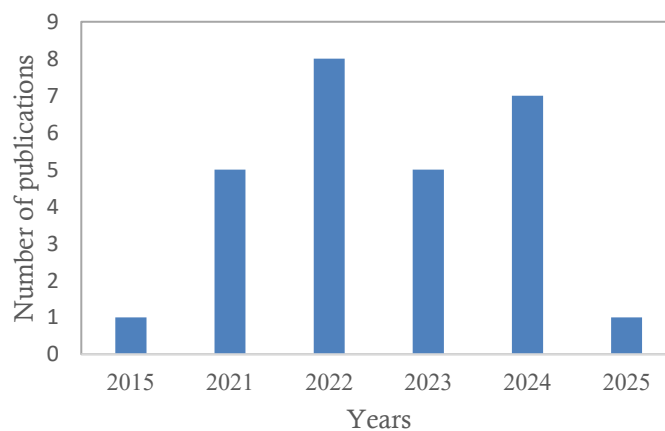


Figure 3. Interactive Media Bar Chart (2015-2025)

The trend of research publications on interactive learning media in elementary school mathematics education shows a fluctuating pattern throughout 2015–2025. The peak in publications in 2022 was influenced by teachers' need to overcome learning loss after the pandemic and the push for the implementation of the Merdeka Curriculum, which emphasizes differentiated learning and technology integration. During this period, interactive media evolved from simple forms such as videos and PowerPoint presentations to more sophisticated technologies such as Augmented Reality, Android-based educational games, and interactive E-LKPD. This change marks a shift in the role of technology from a mere tool to a more mature and adaptive digital learning environment.

Conversely, the lowest number of publications in 2015 and 2025 indicates two distinct phases: the initial stage of interactive media innovation development and the consolidation phase when research focused more on evaluating and applying the results of previous developments. Fluctuations between years also indicate disparities in infrastructure readiness and digital literacy among teachers in various regions, so that publication trends not only reflect technological innovation but also illustrate systemic challenges in the equitable access and implementation of digital-based learning in Indonesia. Figure 4 shows the percentage of interactive media use in mathematics learning in elementary schools.

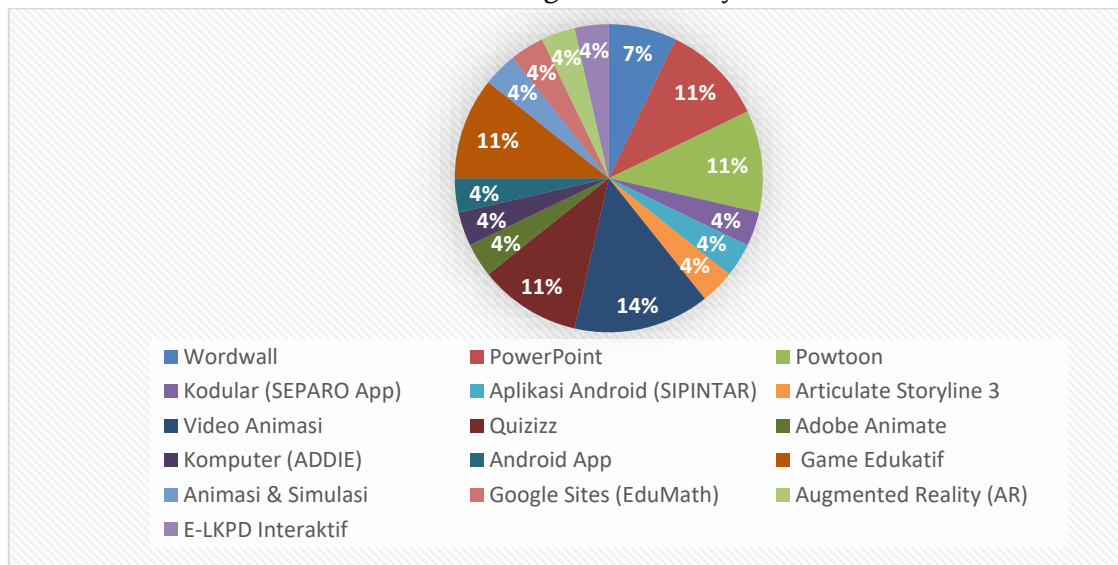


Figure 4. Interactive Media Circle Diagram

The results of the study show that all types of interactive media have a positive impact on mathematics learning, but their effectiveness depends on the characteristics of the media, instructional design, and the type of mathematical skills targeted. Simple media such as videos, interactive PPTs, and Powtoon are effective in improving basic concept understanding in accordance with the dual coding principle (Mayer, 2024), but are insufficient for developing higher-order thinking skills due to the lack of exploration space. In contrast, advanced interactive media such as E-LKPD and AR demonstrated stronger effects on higher-order thinking skills due to their capacity to support exploration, reasoning, and reflective learning. Conversely, gamified media such as Quizizz, Wordwall, and Android applications provide a significant increase in motivation of even more than 80% through elements of challenge, autonomy, and competency feedback as described in Self-Determination Theory.

The observed learning improvements were not merely associated with the presence of technology, but were primarily driven by specific pedagogical mechanisms embedded in the

media design. Interactive features such as immediate feedback, problem-based tasks, and digital manipulation of mathematical objects enabled students to actively construct knowledge, thereby supporting causal links between media use and cognitive development.

Based on the synthesis of 28 studies, simple interactive media accounted for 36% of the reviewed articles, followed by gamification-based media (32%), interactive digital worksheets (E-LKPD) (18%), and advanced technologies such as Augmented Reality (14%). However, high motivation does not always correlate with cognitive improvement if the game mechanics are not designed in line with explicit learning objectives, so instructional design remains the main determinant of gamification effectiveness. High-tech media such as interactive E-LKPD, digital simulations, and Augmented Reality (AR) have the greatest potential in developing HOTS, especially spatial reasoning, logical thinking, and problem solving, in accordance with the principle of embodied cognition which emphasizes learning through the manipulation of virtual objects.

Interactive Media Orientation towards Learning Models

The results of the analysis show a strong tendency to use the ADDIE model in media development research. Although systematic and easily adaptable, the dominance of ADDIE causes bias in studies that focus only on product validity rather than the long-term impact on student learning processes. Product-oriented research often ignores pedagogical variables such as social interaction, mathematical misconceptions, and scaffolding strategies. This can be seen in **Table 2**.

Table 2. Integrated Learning Models on Interactive Media

Model Pembelajaran	Penulis
Model ADDIE	Cecep Kurniawan et al. (2025), Neha et al. (2023) dan Amatullah & Sutrisno (2022)
Model Problem Based Learning	Salsa Phira Putri Kinanti et al. (2024) dan Yulianto et al. (2022)
Model Digital Game Based Learning	Hayu Ika Anggraini et al. (2021) dan Rani Puspita Dhaniawaty et al. (2023)

The ADDIE model is the most dominant development model used in the development of interactive mathematics learning media in elementary schools. This model was chosen because of its systematic and flexible nature, covering all stages of research and development, thus meeting the requirements of validity, practicality, and effectiveness of educational products. However, the focus of ADDIE use in 57% of studies tends to emphasize product validity rather than long-term pedagogical impact, so there needs to be an expansion of the approach that not only produces usable media but also media that truly has an impact on improving the quality of learning.

The integration of media with the Problem-Based Learning (PBL) model was found to be more effective in improving reasoning and problem-solving skills, in line with constructivist theory, which emphasizes student exploration and investigation. A total of 21% of studies showed that PBL-based media had a stronger cognitive impact than media that only displayed attractive visuals or animations without a clear instructional flow. Meanwhile, Digital Game-Based Learning (DGBL) has the greatest influence on student motivation; however, cognitive improvement is highly dependent on the quality of game design. DGBL with good game mechanics can improve numeracy and critical thinking, while poor design only results in

enjoyment without learning transfer. A more integrated overview of the relationship between interactive media types, instructional models, and dominant learning outcomes is presented in **Table 3**.

Table 3. Summary Matrix of Interactive Media, Learning Models, and Learning Outcomes

Media Type	Learning Model	Dominant Outcome	No. of Studies	Key Notes
Vidio/PPT	ADDIE	Conceptual understanding	10	Effective for basic concepts
Gamification	DGBL	Motivation & engagement	9	Requires alignment with objectives
E-LKPD	PBL	HOTS & reasoning	5	Strong cognitive impact
AR / Simulation	Constructivist	Spatial reasoning	4	High cognitive load
Mixed media	PBL–DGBL	Engagement & problem solving	3	Most balanced outcomes

The matrix highlights consistent patterns across the reviewed studies, showing how specific combinations of media and learning models are associated with particular learning outcomes in elementary mathematics learning. Media with attractive visuals but without strong instructional design risks becoming mere entertainment, while the integration of media with PBL and DGBL can have a different impact on cognitive and affective aspects. Thus, choosing the right learning model is key to ensuring that media can support the objectives of the Merdeka Curriculum, particularly in developing reasoning, analysis, and problem-solving skills as essential competencies in mathematics learning.

The Implications of Interactive Media on Mathematics Learning

The synthesis of the research shows that interactive media has strong potential in developing higher-order thinking skills (HOTS) in elementary school students, especially when designed based on problem contexts, allowing manipulation of digital objects, and providing interactive feedback that encourages reflection. However, only a small portion of studies explicitly measure HOTS, necessitating further research that systematically integrates indicators of critical thinking, creativity, and problem-solving in accordance with the requirements of the Merdeka Curriculum.

In the context of implementing the Merdeka Curriculum, interactive media has been proven to support differentiated learning, digital formative assessment, and context-based projects, while also strengthening digital literacy, numeracy, and the dimensions of the Pancasila Student Profile, especially creativity and mutual cooperation. Therefore, interactive media not only functions as a visual aid, but also as a strategic pedagogical instrument to deepen conceptual understanding, increase student participation, and actualize the principles of Merdeka Belajar in a more meaningful way.

Research findings indicate that media interactivity through 3D representations, simulations, and manipulative activities consistently improves students' conceptual understanding, motivation, and learning outcomes. This effectiveness is in line with the principles of the Cognitive Theory of Multimedia Learning (Mayer, 2024), Self-Determination

Theory, and the embodied cognition approach, which emphasizes the role of integrating text, visuals, and meaningful learning experiences in constructing knowledge. However, only 18% of studies explicitly measure higher-order thinking skills (HOTS), even though the Merdeka Curriculum requires the development of critical thinking, creativity, reflection, and problem-solving skills. This indicates the need for further research that emphasizes the stimulation of mathematical reasoning and the representation of complex concepts.

The effectiveness of interactive media is greatly influenced by the suitability of the instructional design and learning model used, for example, PBL, which is effective in stimulating HOTS, and DGBL, which is strong in increasing motivation. Optimal implementation also requires teacher training in technology-based instructional design and adequate digital infrastructure support so that inclusive learning can be achieved.

Despite the positive findings, the generalizability of this review remains limited. Most included studies were conducted in Indonesian elementary school contexts with relatively small sample sizes and short intervention durations. Variations in digital infrastructure, teacher readiness, and research design also restrict the extent to which these findings can be generalized to broader educational settings.

Research Gap in the Use of Interactive Media in Elementary School Mathematics Learning

A review of various studies shows that there is a conceptual and methodological gap in the development of interactive media for elementary school mathematics learning. Most studies only focus on motivation and learning outcomes without deeply integrating higher order thinking skills (HOTS), even though critical thinking, creativity, and problem-solving skills are essential competencies for the 21st century. This limitation indicates that existing interactive media have not been fully designed to stimulate reflective and analytical thinking processes in students.

Although most studies report positive results, their methodological quality remains limited. Many studies use small samples, short-term interventions, and do not assess retention or transfer of skills. In fact, 46% of studies do not use control groups, thereby increasing the potential for bias. The focus of the material also tends to be limited to arithmetic, fractions, and geometry, so areas such as early algebra and higher-level numeracy have not been explored much. The variation in results between studies can largely be explained by differences in experimental design and school readiness.

The findings show that the effectiveness of interactive media is greatly influenced by the school ecosystem, where limited devices, unequal internet access, low digital literacy among teachers, and a conventional learning culture are the main obstacles to its implementation. Time constraints also reduce the opportunities for applying constructivist models such as PBL, which require in-depth exploration. Therefore, the success of media depends not only on technological sophistication but also on the pedagogical and institutional readiness of schools.

These conditions emphasize the need to develop interactive media that not only increase motivation but also stimulate critical thinking skills through contextual problem-solving activities. Materials such as fractions have strategic potential to strengthen students' conceptual reasoning and problem representation, so that the development of HOTS-based media can contribute theoretically and practically to improving mathematical literacy and knowledge construction through problem-based and discovery learning approaches.

Overall, the research synthesis shows that interactive media has a positive impact on motivation, conceptual understanding, and HOTS development, especially when supported by strong instructional design and a ready school ecosystem. This study also has limitations

because it only uses articles from 2015–2025 from three databases, so the potential for selection bias cannot be avoided. Nevertheless, these findings emphasize the importance of integrating interactive media in line with the Merdeka Curriculum to strengthen independent, collaborative, and meaningful learning, while also serving as a basis for developing media that is more adaptive to the needs of the 21st century and the characteristics of elementary school students.

Conclusion

A systematic review of the 2015–2025 period shows that interactive media has a positive impact on motivation, conceptual understanding, and higher-order thinking skills (HOTS) in elementary school mathematics learning. Simple media is effective for basic concepts, gamification-based media increases engagement, and technologies such as interactive E-LKPD and AR support the development of mathematical reasoning. Their effectiveness is greatly influenced by pedagogical design and learning models such as PBL and DGBL. However, their implementation is still limited by infrastructure readiness, teacher digital literacy, and uneven school support. Overall, interactive media play a strategic role in supporting the Merdeka Curriculum and 21st-century learning needs, so they need to be developed in an adaptive and contextual manner.

References

- Adam, Syamsir. 2023. Eksplorasi Efektivitas Metode Pembelajaran Interaktif Dalam Meningkatkan Minat Dan Prestasi Belajar Matematika Pada Siswa SMK 7 Makassar. *Jurnal Pendidikan dan Ilmu Bahasa* Vol. 1(3), 198-203 DOI: <https://doi.org/10.59059/perspektif.772>
- Amelia, Cintya dan Manurung Albert, S. 2022. Pengaruh Media Pembelajaran Audiovisual Powtoon terhadap Motivasi Belajar Siswa pada Pelajaran Matematika di Sekolah Dasar. *Jurnal Ilmu Pendidikan*, 4(3) Tahun 2022, 4346 – 4355. <https://edukatif.org/index.php/edukatif/index>
- Ati, A.F Suryaning dan AzZahra, Fatimah R. 2024. Pengembangan Multimedia Interaktif Berbasis Macromedia Flash Pada Mata Pelajaran Ipa Kelas V Sekolah Dasar. *Jurnal Pendidikan Dasar*. 4, (1), 39-47.
- Azahra, A., Fathurohman, M., & Jaenudin, J. (2025). Penggunaan Media Interaktif Wordwall Untuk Meningkatkan Minat Belajar Matematika Siswa Smp Kelas Vii C Di Smp Negeri 2 Menes. *Wilangan: Jurnal Inovasi Dan Riset Pendidikan Matematika*, 6(1), 21. <https://doi.org/10.62870/wjirpm.v6i1.30995>
- Bulu, V. R. (2023). *Pengaruh strategi pembelajaran berdiferensiasi terhadap hasil belajar matematika mahasiswa*. 2(2022), 70–75.
- Chiu, T. K. F., Jong, M. S. Y., & Mok, I. A. C. (2021). Does learner-centered gamification improve student engagement in mathematics? *Computers & Education*, 168, 104206. <https://doi.org/10.1016/j.compedu.2021.104206>
- Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2022). Educating teachers to enact the science of learning and development. *Educational Researcher*, 51(4), 305–316. <https://doi.org/10.3102/0013189X211073703>

- Deci, E. L., & Ryan, R. M. (2022). *Self-determination theory: Basic psychological needs in motivation, development, and wellness* (2nd ed.). New York: Guilford Press.
- Hasiru, D., Badu, S. Q., & Uno, H. B. (2021). Media-Media Pembelajaran Efektif dalam Membantu Pembelajaran Matematika Jarak Jauh. *Jambura Journal of Mathematics Education*, 2(2), 59–69. <https://doi.org/10.34312/jmathedu.v2i2.10587>
- Hermawan, R., Trisnawaty, W., & Tisngati, U. (2025). Pemahaman Konsep Matematika melalui Model Pembelajaran Berdiferensiasi pada Kelas 5 Sekolah Dasar. *Scholarly Journal of Elementary School*, 5(1), 34–45. <https://doi.org/10.21137/sjes.2025.5.1.4>
- Kaamilah, Sayyidah. Herlina Usman, Yofita Sari.2023. Development of Inquiry-Based Interactive Digital Teaching Materials in Class V Elementary School Science Subjects. *Jurnal Pendidikan Sekolah Dasar* Volume 6, Nomor 2, 71–76. <https://journal.uny.ac.id/index.php/didaktika>
- Khaidir, C., & Suhaili, N. (2023). Pengaruh Bimbingan Konseling dalam Upaya Mengatasi Rendahnya Motivasi Belajar Matematika Siswa SMP. *Journal on Education*, 6(1), 2244–2253. <https://doi.org/10.31004/joe.v6i1.3226>
- Koskinen, R., & Pitkänemi, H. (2022). Meaningful Learning in Mathematics: A Research Synthesis of Teaching Approaches. *International Electronic Journal of Mathematics Education*, 17(2), em0679. <https://doi.org/10.29333/iejme/11715>
- Marifah, Siti dan Amaliyah N.2022. Pengembangan Media Pembelajaran Interaktif Berbasis Google Slide pada Mata Pelajaran IPS Sekolah Dasar. *Jurnal Basicedu*.6 (4) ,7563 – 7572. <https://jbasic.org/index.php/basicedu>
- Mayer, R. E. (2024). *Multimedia learning: Principles for integrating words and pictures effectively* (4th ed.). Cambridge University Press. <https://doi.org/10.1017/9781009206043>
- Muin, A., Firdaus, F., & Shari, A. M. (2022). Efektivitas Media Aplikasi Ruangguru terhadap Hasil Belajar Matematika Siswa Kelas V SDN 146 Bengo Kecamatan Bengo Kabupaten Bone. *JPPSD: Jurnal Pendidikan Dan Pembelajaran Sekolah Dasar*, 2(3), 285. <https://doi.org/10.26858/pjppsd.v2i3.36018>
- Muslimin, M., Hirza, B., Nery, R. S., Yuliani, R. E., Heru, H., Supriadi, A., Desvitasari, T., & Khairani, N. (2022). Peningkatan Hasil Belajar Matematika Siswa Melalui Pembelajaran Berdiferensiasi dalam Mewujudkan Merdeka Belajar. *Jurnal Pendidikan Matematika RAFA*, 8(2), 22–32. <https://doi.org/10.19109/jpmrafa.v8i2.14770>
- Prasetyo, A., & Fadillah, R. (2023). Integrasi model Problem-Based Learning dan Digital Game-Based Learning untuk meningkatkan keterampilan berpikir kritis siswa sekolah dasar. *Jurnal Teknologi Pendidikan Dasar*, 8(4), 234–248. <https://doi.org/10.21009/jtpd.v8i4.6127>
- Rahmah, A. A., Putri, D. V. D., Maulida, A., Suriansyah, A., & Cinantya, C. (2024). Media Pembelajaran Berbasis Audiovisual pada Mata Pelajaran Matematika di Sekolah Dasar. *MARAS: Jurnal Penelitian Multidisiplin*, 2(4), 2111–2119. <https://doi.org/10.60126/maras.v2i4.563>

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- Rambe, Arjuna Y.F. dan Afri, Lisa D., Analisis Kemampuan Pemecahan Masalah Matematis Siswa Dalam Menyelesaikan Soal Materi Barisan Dan Deret.2020. Jurnal Pendidikan dan Matematika.09(2),175-187. <http://jurnal.uinsu.ac.id/index.php/axiom>
- Sevilla, C. W., Halidjah, S., Ghasya, D. A. V., Suparjan, S., & Pranata, R. (2023). Pengembangan Bahan Ajar Interaktif IPA Materi Sistem Peredaran Kelas V Sekolah Dasar. *Fondatia*, 7(1), 178–190. <https://doi.org/10.36088/fondatia.v7i1.3101>
- Wulandari, M., Salsabila, N. H., & Ramadhani, A. (2025). Analisis efektivitas penggunaan teknologi digital dalam pembelajaran matematika. *Jurnal Media Akademik (JMA)*, 3(1), 1–11. <https://doi.org/10.62281/v3i1.1445>