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Mathematical Comics in Mathematics Education: A Systematic Literature Review

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Abstract

Mathematical comics represent a didactic resource that enhances the teaching and learning of mathematical concepts by promoting meaningful learning experiences. This study presents a systematic literature review on the use of mathematical comics in mathematics education between 2015 and 2024. The review was conducted following PRISMA guidelines and adopted a qualitative approach to analyze research trends and characteristics. Four academic databases were consulted using search equations in English and Spanish that combined terms related to comics and mathematics. The inclusion criteria delimited the corpus to peer-reviewed articles, conference proceedings, and book chapters published during the specified period. After the identification, screening, and eligibility phases, 49 studies were selected for analysis. The results indicate that mathematical comics have become a topic of growing research interest. Furthermore, they show that they function as versatile pedagogical tools, providing significant value as a comprehensive resource for the teaching and learning of mathematics. However, their application in educational practice remains limited. This highlights the need for further research on their impact, as their potential has not yet been fully developed across diverse educational contexts.

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Introduction

In a constantly changing world, mathematics education faces the challenge of preparing individuals to meet the demands of everyday life. This entails prioritizing and ensuring that students acquire appropriate mathematical training gradually and systematically (Veitia et al., 2021), enabling them to develop the ability to solve problems and make informed decisions. In this context, the teaching of mathematics plays a key role, as it provides essential tools for daily life and professional development.

However, despite the importance of solid mathematical training, traditional methodologies still prevail in classrooms, relegating students to the role of passive recipients. These approaches, characterized by the excessive use of technical jargon and decontextualized abstract concepts, limit students' active participation in the construction of knowledge (Saenz, 2023). As a result, a disconnect arises that not only hinders the understanding of content but also contributes to a lack of motivation and poor performance in the subject. In this context, the role of the teacher becomes crucial—not only as a facilitator of learning, but also as an innovator and designer of didactic tools that respond to the specific needs of the classroom and promote meaningful learning (Chu & Toh, 2020; Darmayanti et al., 2022; Sánchez-Barbero & Cáceres, 2023). For this purpose, the incorporation of innovative didactic tools is essential, as they foster understanding and allow students to establish meaningful connections between theory and practice.

One of these tools is the comic, which stands out for its ability to facilitate the interpretation of complex situations (Urbina et al., 2021) and stimulates students' creativity and higher-order thinking skills (Toh et al., 2019). Moreover, comics can present recognizable or familiar scenarios that allow students to explore and apply mathematical concepts in contexts that are close to their everyday reality. In this way, they help contextualize learning and create an environment in which mathematical understanding becomes relevant for students (Çilingir, 2024; Nugraha & Samsudin, 2024).

In this regard, several studies have demonstrated the effectiveness of comics with mathematical content in teaching specific mathematical concepts, highlighting how they can serve as cognitive bridges and generate measurable improvements in student participation and understanding. Specifically, they can provide meaningful contexts, increase motivation, facilitate problem-solving, strengthen mathematical communication, foster critical thinking, improve comprehension and logical-mathematical reasoning, and integrate cultural aspects.

Although the effectiveness of comics as a didactic tool has been demonstrated, much remains to be explored regarding their potential in classroom teaching (Toh, 2024). To delve deeper into this aspect, it is essential to identify the key factors and elements considered in previous research. In this regard, four systematic reviews analyzing the role of comics in education have been identified.

The first reviews, conducted by Grande de Prado (2022) and Fitriyanti and Kristanto (2023), offer a general overview of the use of comics in education. In contrast, the other two reviews, carried out by Chu and Toh (2020) and Cher and Toh (2022), focus specifically on mathematics education and pursue different objectives. For

example, Chu and Toh (2020) analyzed the use of comics in primary mathematics teaching and proposed guidelines for their design and implementation. Similarly, Cher and Toh (2022) reviewed the literature on the use of comics in education and developed the PATH-CoHANa framework, which outlines a set of principles for designing comics with mathematical content.

Despite these contributions, none of the existing reviews offers a detailed and up-to-date analysis of the role that comics have played in mathematics education. For this reason, the present research aims to conduct a systematic review of the literature published between 2015 and September 2024 on the use of comics in mathematics education. Specifically, it seeks to analyze the trends and key characteristics of studies in this field based on the following questions:

1. What has been the annual frequency of publications on the use of comics in mathematics education between 2015 and 2024?
2. What is the geographical distribution of research related to the use of comics with mathematical content in mathematics education?
3. For which populations have comics with mathematical content been designed, and what types of comics are most commonly used in the field of mathematics education?
4. What mathematical concepts are addressed through the use of comics with mathematical content?
5. What roles have comics with mathematical content played in mathematics education?

Methodology

This research was conducted following a qualitative approach through a systematic literature review aimed at analyzing trends and characteristics of studies on the use of comics in mathematics education. To enhance the transparency, reproducibility, and methodological rigor of the study, this systematic review was reported in accordance with the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) (Page et al., 2020).

Systematic Literature Review Process

The search, selection, and analysis of documents were structured into three stages: identification, screening, and inclusion. These stages are described below and illustrated in the flow diagram presented in Figure 1.

Study Identification Process

During the identification stage, an exhaustive search of academic literature was performed across four databases recognized for their relevance in the fields of education and mathematics education: Google Scholar, ERIC, ScienceDirect, and Taylor & Francis. These databases were selected for their extensive coverage of scientific journals, conference proceedings, and book chapters specializing in education and mathematics didactics.

The search included publications from 2015 through September 2024. Search strings were constructed by

integrating terms in both English and Spanish using Boolean operators to broaden the retrieval of relevant studies. The following general search equation was used: (historietas OR cartoons OR cómic OR comic OR manga) AND (matemáticas OR mathematics OR math).

Furthermore, the search was limited to publications in English and Spanish. This decision was based on methodological and accessibility considerations, as these two languages account for a substantial portion of international scientific output in mathematics education. It also ensured a rigorous systematic analysis within a clearly defined linguistic scope. This language limitation is explicitly acknowledged as a delimitation of the study; no claim is made regarding exhaustive global coverage of the topic.

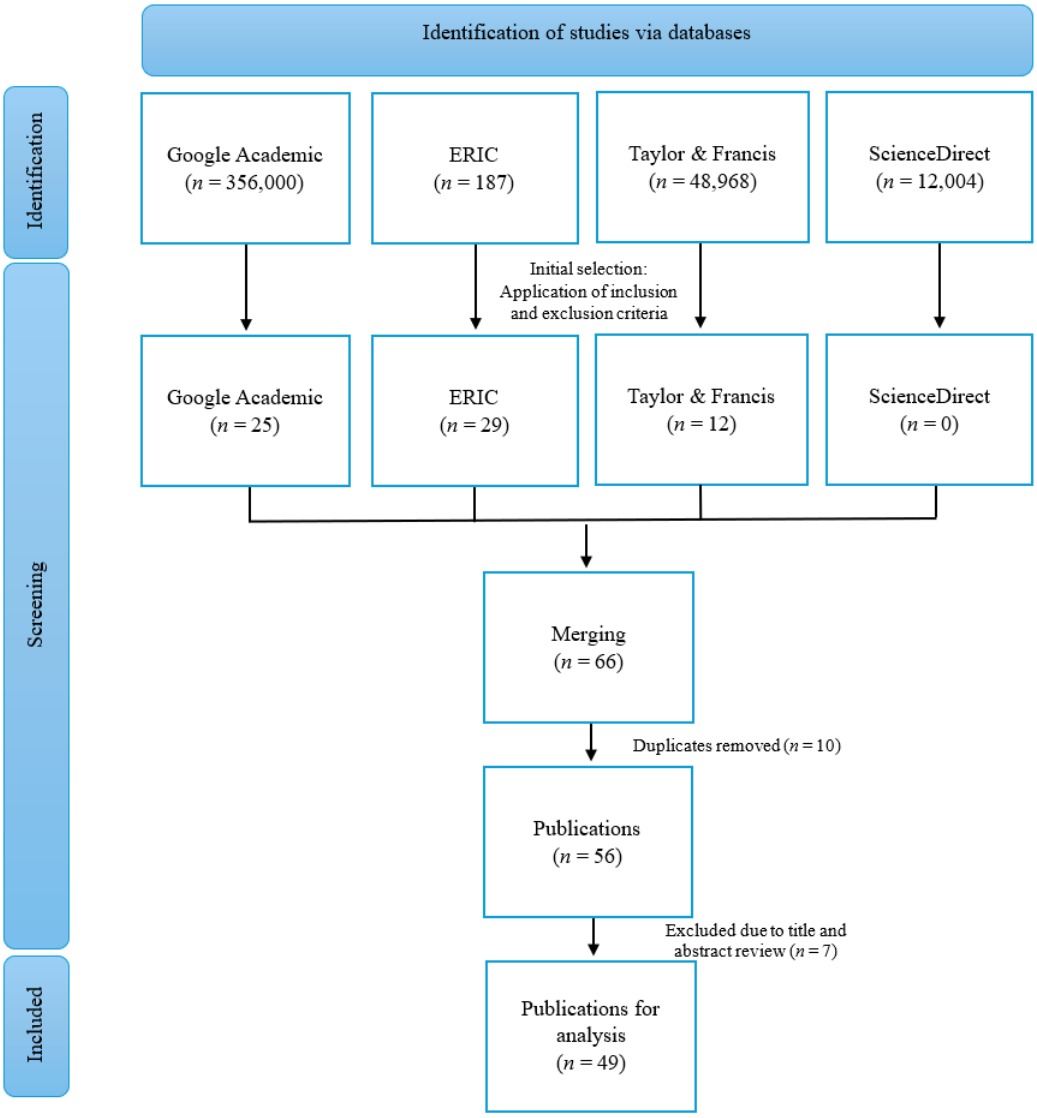

Figure 1. Flow Chart Illustrating the Process of Literature Selection

Screening Process

The screening stage involved the initial refinement of retrieved records. First, the predefined inclusion and exclusion criteria were applied systematically. The inclusion criteria were:

a) Research articles, conference proceedings, or book chapters with full text available.

b) Studies published between 2015 and September 2024, written in English or Spanish.

c) Research situated in the field of mathematics education whose title or abstract included terms related to comics, cartoons, or visual narrative formats used for teaching or learning of mathematics.

Studies failing to meet these criteria were excluded, as were those utilizing visual resources without an explicit educational purpose in mathematics or belonging to unrelated disciplinary fields. Subsequently, duplicates identified across the different databases were removed. Finally, a review of titles and abstracts was conducted to exclude studies unrelated to mathematics education or that did not explicitly address the use of comics, cartoons, or narrative visual resources for educational purposes.

Inclusion Process

Following this process, a final corpus of 49 studies was established. All included studies met the inclusion criteria and underwent detailed analysis. For this purpose, Microsoft Excel (Microsoft 360, version 2412) was used as the primary data analysis tool, generating tables, pivot tables, and charts. This approach allowed for the systematic organization of the information, facilitating its interpretation and the identification of key findings.

Findings

This section presents the main findings derived from the analysis of the selected publications, organized according to the previously defined categories. The results cover aspects such as the annual frequency of publications, their geographical distribution, characteristics of the study populations, types of comics used, mathematical concepts addressed, and pedagogical roles played by the comics. The study aims to provide a comprehensive overview of trends in research on the use of comics in mathematics education between 2015 and 2024.

Year of Publication

Figure 2 shows the results of the annual distribution of publications between 2015 and 2024. The year 2020 stands out with the highest number of publications (20.4%), followed by 2021 and 2022, each with nine publications (18.4%). Nearly 70% (69.4%) of the total analyzed studies (n = 49) were concentrated between 2020 and 2023.

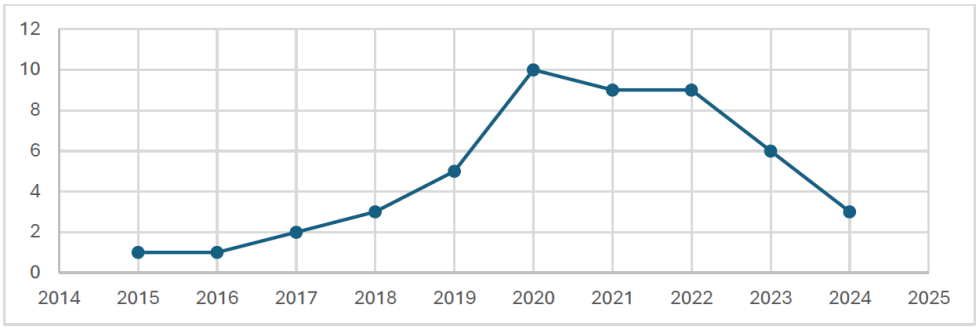

Figure 2. Annual Publications in the Period 2015-2024

Geographical Distribution

The geographical distribution of the studies included in this systematic review is presented in Figure 3. In total, the studies were distributed across four continents —Africa, the Americas, Asia, and Europe— covering 14 countries. Africa is represented solely by South Africa (7.1% of studies). In the Americas (21%), contributions come from Brazil, Ecuador, and the United States. Asia accounts for the largest share (42.9%), with studies from Brunei, the Philippines, Indonesia, Singapore, Taiwan, and Turkey. Europe represents 35.7% of the corpus, with studies from Germany, Cyprus, Spain, the Czech Republic, and Turkey.

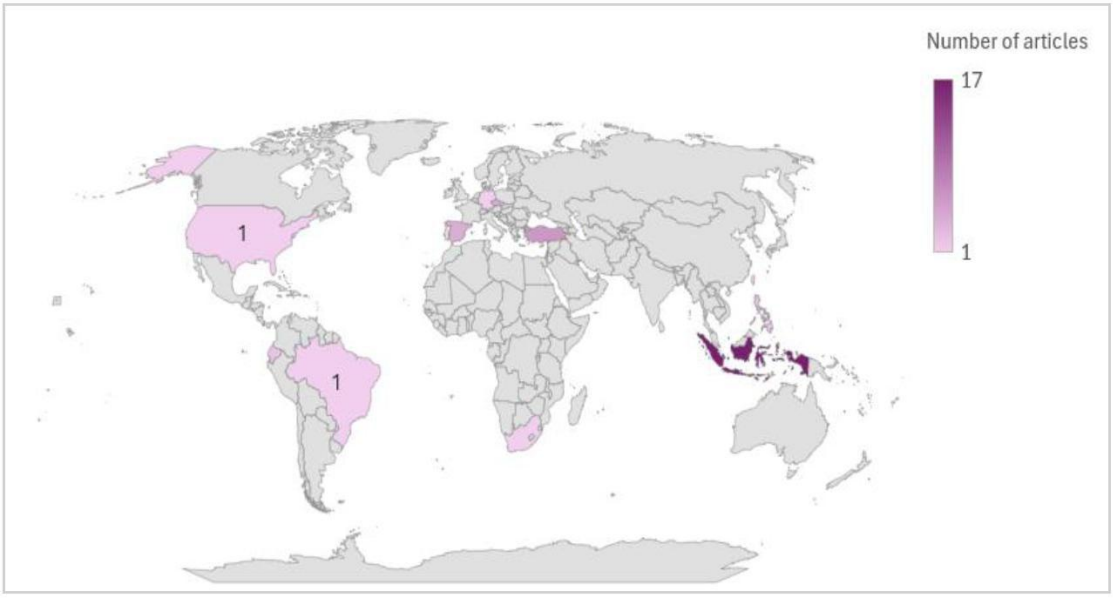

Figure 3. Geographic Distribution

Indonesia, marked with the darkest shade on the map, stands out with the highest number of publications, comprising more than one-third of the total (34.7%, n = 17). It is followed by Singapore and Turkey, each contributing 12.2% (n = 6). Spain and the Czech Republic rank third, each with 8.2% (n = 4). The remaining countries are represented by one or two publications each.

Target Population and Types of Comics with Mathematical Content

The analyzed studies reveal that in two-thirds of the cases (66.6%, n = 38), comics with mathematical content are designed for students in basic education (kindergarten, primary school, and junior high school levels). To a lesser extent, studies targeting university students were identified (19.3%, n = 11), followed by those focused on high school students and teachers (7%, n = 4). It is important to note that some mathematical comics are intended for use with multiple populations.

Regarding the types of comics used, several categories were identified, including animated cartoons, animated concept cartoons, cartoon vignettes, comics, concept cartoons, digital concept cartoons, eComics, and manga. It is worth mentioning that in more than half of the studies (61.2%, n = 30), comics with mathematical content were

the most commonly used, whereas concept cartoons appeared as the second most frequent type (18.3%, n = 9). The remaining formats were represented to a much lesser extent, with no more than three studies each.

Figure 4 shows the relationship between the types of comics with mathematical content and the target population. Junior high school students represent the population for which the largest variety of comic types has been used. Comics have been used with all populations except in studies involving teachers.

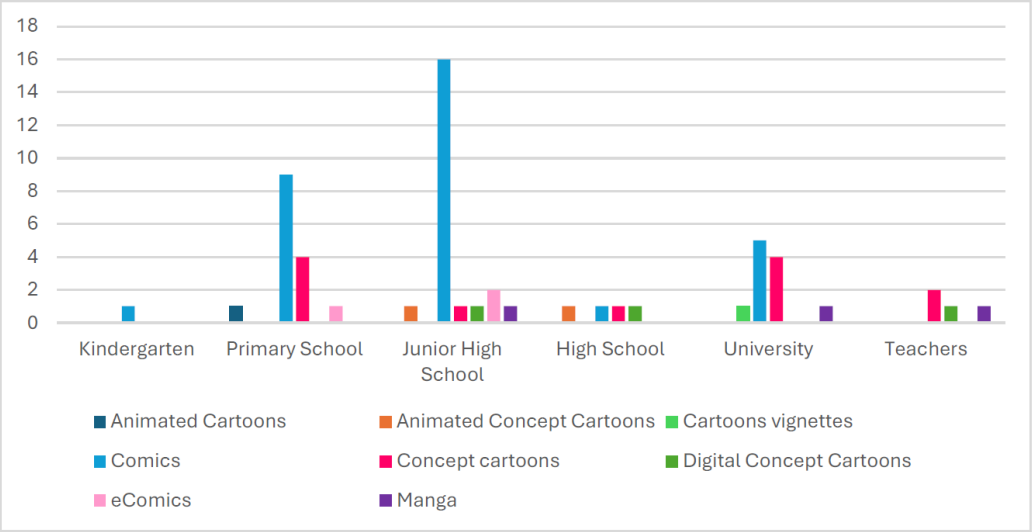

Figure 4. Types of Comics with Mathematical Content and the Target Population

Mathematical Concepts

The analysis of the reviewed studies indicates that arithmetic is the area most frequently addressed in comics with mathematical content, accounting for 32% of the studies (n = 17). The contents explored include fractions, basic operations, order of operations, the number line, percentages, and other topics. In second place is the area of plane geometry (17%, n = 9), which includes concepts such as measurement, areas of geometric figures, perspective, and symmetry. Similarly, 17% of the studies address multiple mathematical concepts in an integrated manner (n = 9).

Another trend observed in the studies is the design of comics with mathematical content centered on problem-solving related to daily life (15%, n = 8), or on more specific mathematical concepts such as functions, linear equations, systems of equations, and applications in physics, though these appear with lower frequency (19%, n = 10). It is worth noting that some studies cover more than one mathematical topic.

Role of Comics with Mathematical Content in Mathematics Education

The analysis identified seven roles that comics with mathematical content play in mathematics education, highlighting their versatility as a didactic tool. The identified roles, according to the intended use of the comic in the classroom, were as follows: a tool for learning, understood as a resource primarily aimed at supporting

students' individual or collective learning processes and the construction of mathematical understanding; a teaching-learning tool, referring to its use as a mediating resource that supports the interaction between teaching actions and student learning processes within instructional settings; a teaching tool, related to its function as a resource that assists teachers in planning, presenting, or explaining mathematical content during instruction; a knowledge and/or skills assessment tool, refers to the student assessment process; a cognitive development tool, resource connected to the development of critical thinking and logical-mathematical reasoning; and finally, a sociocultural tool, pertaining to the promotion of interculturality (see Table 1). It should be noted that, in some studies, comics were perceived as fulfilling multiple roles, highlighting their adaptability to different contexts.

Among these roles, three were most prominently highlighted in the studies. First, they functioned as a learning tool (41.5%, n = 22), and second, as a teaching–learning tool (26.4%, n = 14). Lastly, their role as a teaching tool (15%, n = 8). These results demonstrate that comics with mathematical content not only facilitate the transmission of concepts but also promote comprehensive teaching and learning processes, positioning themselves as a key strategy for fostering cognitive and cultural development in mathematics education.

Table 1. Roles of Comic Strips in Mathematics Education

Role performed by comics	Research
Learning tool	Darmayanti et al. (2022), De Pereira and Ferreira (2020), Gokkurt-Ozdemir et al. (2022), Hidayah and Fathimatuzzahra (2019), Lestari and Ekawati (2019), Mamolo (2019), Nugraha and Samsudin (2024), Nurdin et al. (2020), Pardimin and Widodo (2017), Pericleous (2022), Prihanto and Yunianta (2018), Rose et al. (2021), Safitri et al. (2021), Samková (2019a, 2020, 2021), Setiyani (2019), Tandayamo et al. (2023), Toh et al. (2023), Trimurtini et al. (2021), Urbina et al. (2021) and Webb (2015).
Teaching-learning tool	Ari and Demir (2023, Azamain et al. (2020), Clair (2018), De Torres et al. (2022), Fahreza et al. (2022), Huang and Tzu-Ying (2020), Musa (2020), Nurfitriyanti and Suhendri (2020), Önal and Çilingir (2022), Putra et al. (2021), Saenz (2023), Sanchez-Barbero et al. (2020), Tay et al. (2024) and Toh et al. (2017).
Knowledge and/or skills assessment tool	Çilingir (2024), Günbas (2020) and Samková (2019a, 2020, 2021, 2022).
Teaching tool	Ahmadi et al. (2021), Bulut et al. (2021), Cher and Toh (2022), Chu and Toh (2020), Friesen and Knox (2022), González and Fernández de Simón Romero (2018), Sánchez-Barbero and Cáceres (2023) and Toh et al. (2016).
Cognitive development tool	Johar et al. (2023) and Lestari et al. (2021).
Sociocultural tool	Urbina et al. (2021).

Discussion

The findings of this systematic review indicate that publications on the use of comics with mathematical content in mathematics education increased during the period 2015–2020, reaching their peak in 2020. This trend likely reflects a growing interest in integrating innovative methodologies, modern strategies, and didactic tools in mathematics classrooms, tools that transform the traditional teaching-learning model, promote active construction of mathematical knowledge, and facilitate meaningful learning (Johar et al., 2023; Saenz, 2023; Sánchez-Barbero & Cáceres, 2023; Tandayamo et al., 2023).

Another important finding is the limited accessibility of the comics created in the reviewed studies. Just over one-third of the investigations provide access to the comics they designed, which represents a barrier to their implementation in other educational contexts and in future research. The lack of availability hinders dissemination and limits the possibility of replicating or adapting these tools to diverse educational realities, which is essential for strengthening their effectiveness and expanding their impact.

Regarding geographical distribution of the studies, the results show a greater concentration of research in Southeast Asian countries, particularly in Indonesia. This pattern should be interpreted as a direct consequence of the methodological decisions guiding the literature search and selection process. Specifically, the analyzed corpus consists exclusively of studies published in English and Spanish and indexed in the selected databases, which conditions the visibility of certain investigations. Therefore, the prominent representation of Southeast Asian countries should not be taken as an absolute indicator of higher academic productivity in this field, but rather as a reflection of the literature retrieved under the defined criteria. It is probable that relevant studies from other Asian contexts—such as Japan, South Korea, mainland China, Taiwan, or Hong Kong—were not included due to language barriers, as a significant portion of academic work in these regions is published in local languages. This constitutes a recognized limitation of the present review and highlights the value of future studies incorporating multilingual searches to achieve a more comprehensive global perspective.

The concentration of studies in certain regions is also related to the educational levels at which the use of comics with mathematical content has been prioritized. The results indicate that research predominantly focuses on basic education, which is consistent with pedagogical approaches that recognize the potential of visual narrative resources to foster conceptual understanding, motivation, and engagement in the early stages of mathematics learning.

In contrast, the presence of studies focused on upper secondary and higher education is significantly lower. This trend is often linked to the perception that comics are suitable resources for younger students. However, this review suggests that this perception should not be assumed to be an inherent limitation of the resource, but rather an underexplored line of research.

On the other hand, the decline in publications since 2020 should not be interpreted in isolation as a loss of interest in mathematical comics. It is possible that, in recent years, these resources have been integrated into broader

pedagogical proposals related to the use of digital technologies, multimodal learning environments, or innovative approaches that are not always explicitly identified under the category of "comics." This highlights the need for future systematic reviews to employ broader search strategies with greater terminological sensitivity.

This need to broaden the scope of research on mathematical comics beyond basic education also has methodological implications for how these resources are identified and analyzed in the literature. In particular, it requires careful attention to the terminology used to describe visual narrative resources in educational research, as well as to the conceptual assumptions underlying their classification. In this respect, the way in which terms such as vignettes and comics are used during the literature search and subsequent analysis is especially relevant for understanding the scope and limitations of the reviewed studies.

In the bibliographic search process, both the terms cartoons and comics were deliberately included, even though they do not constitute equivalent conceptual categories. While cartoon usually refers to a single visual representation, frequently of a humorous or illustrative nature, comic implies a structured narrative sequence composed of panels that combine text and image to construct a story. Nevertheless, in the educational literature, both terms are often used interchangeably to refer to visual resources employed for didactic purposes, which justified their joint inclusion in the search equation. The conceptual differentiation between these formats is carried out subsequently, during the analysis and classification of the types of comics identified in the reviewed studies.

Throughout the analyzed studies, it is observed that the term mathematical comic does not have a formally established or consensual definition in the literature. In most of the reviewed works, authors assume a shared understanding of the concept of comic, without making explicit the criteria by which such a resource acquires a mathematical character. This absence of an operational definition constitutes a relevant conceptual gap, particularly when the aim is to classify, compare, or analyze different types of visual narrative resources used in mathematics teaching. In this study, the term mathematical comic is not employed as a prior or prescriptive category, but rather as an analytical construction derived from the systematic analysis of the resources reported in the included studies. From this analysis, common characteristics are identified that allow a resource to be considered a mathematical comic: a) the intentional use of a structured visual narrative, b) the explicit integration of mathematical content into said narrative, and c) a didactic purpose oriented toward the learning, teaching, or assessment of mathematical concepts. This operational delimitation provides a reference framework that justifies the classification presented in Table 2. The different formats presented in Table 2 do not always incorporate the term “mathematical” in their original designation. However, within the context of the analyzed studies, all these resources were explicitly designed or used with a mathematical purpose, whether to introduce, develop, discuss, or evaluate content specific to the discipline.

In this regard, the classification adopted in this study is not based on the denomination of the format itself, but rather on the educational use assigned to it within the mathematics classroom. Therefore, all formats included in Table 2 are considered comics with mathematical content insofar as they fulfill a didactic function related to the learning or teaching of mathematics, regardless of their artistic, technological, or cultural origin.

Table 2. Types of Comics with Mathematical Content

Type	Definition
Animated mathematical cartoons	Animations designed in meaningful and motivating contexts for solving mathematical problems (Günbas, 2020). Useful for conveying messages through everyday images and symbols, while exaggerating messages and using humor (Dalacosta et al., 2009).
Animated mathematical concept cartoons	These are animations of mathematical concept cartoons that depict everyday situations in which mathematical ideas are explicitly integrated to spark curiosity, provoke debate, and stimulate mathematical reasoning (Keogh et al., 1998; Long & Marson, 2003).
Mathematical cartoon vignettes	Illustrated vignettes, in which mathematical ideas are explicitly represented through brief visual narratives, often using humor or critique to highlight mathematical situations or concepts, but in a smaller format than a comic strip. They consist of one or a few panels with a concise message.
Mathematical comics	Stories are told through sequences of panels in which mathematical content is explicitly integrated into the narrative, with text and images working together to develop mathematical ideas within a coherent storyline whith humor.
Mathematical concept cartoons	Static images that present a mathematical conceptual situation, integrating mathematical ideas into everyday contexts. They feature a blank speech bubble to indicate that additional ideas may not yet be included in the dialogue, and the captions often include mathematical common misconceptions so they can be recognized and directly addressed in the lesson (Naylor & Keogh, 2013).
Digital mathematical concept cartoons	Digital versions of mathematical concept cartoons, specifically designed to stimulate critical thinking through the explicit representation and discussion of mathematical ideas using interactive or digital platforms.
Mathematical eComics	Digital-format mathematical comics in which mathematical content is explicitly embedded in the narrative structure, with the possibility of including animations, sound, or interactivity to support mathematical understanding.
Mathematical manga	Comics originating from Japan that adopt a characteristic manga style, in which mathematical content is explicitly integrated into extended and complex narrative structures.

For the analysis of the role played by comics with mathematical content in mathematics education, different categories were identified based on the way in which the studies themselves describe their use in the classroom. In this work, a learning tool is understood as a resource primarily employed to support student learning, fostering the comprehension of concepts, the development of skills, or the resolution of mathematical problems. The term teaching-learning tool is used to refer to resources that explicitly mediate the interaction between teacher instruction and student learning, actively integrating into the didactic process. In turn, teaching tool refers to those cases in which the comic is employed as direct support for teaching practice, whether to introduce content, generate discussion, or plan instructional activities.

These categories should not be understood as mutually exclusive, since in several studies a single resource fulfills multiple functions, which highlights the versatility of comics with mathematical content as a didactic tool.

Once the types of comics and the characteristics that define the essence of each were analyzed and based on the contributions of Chu and Toh (2020), González and Fernández de Simón (2017), Toh et al. (2016), and Urbina et al. (2021), the authors of this research adopt the term "Mathoon" to refer to the mathematical comic. This term derives from the combination of the English words mathematics and cartoon and is used to designate a sequence of panels that articulate images and text to construct a narrative in which mathematical concepts are situated in ways that are contextually and culturally relevant for students.

This definition helps us understand how mathematical comics entertainment tools are not simply, serving a well-defined educational purpose through the integration of visual and textual elements that support the understanding of mathematical concepts. Moreover, by embedding the concepts within specific contexts, these comics allow students to assimilate them in a more meaningful way, closely connected to their own realities. This culturally contextualized approach is essential for the effectiveness of comics as pedagogical tools, as it makes learning more accessible and relevant for diverse student populations.

While the results show a greater concentration of studies focused on arithmetic, plane geometry, and problem-solving, this does not imply that mathematical comics are limited exclusively to these areas. Some works included in the review address content such as functions, linear equations, statistical reasoning, or mathematical applications in interdisciplinary contexts; however, these appear less frequently, which may be explained by the predominance of research conducted at the basic education level, where such content is more recurrent in the curriculum. Nevertheless, if appropriate implementation strategies are developed, mathematical comics could facilitate the teaching of more complex mathematical concepts, since their visual and narrative nature introduces new forms of reading and writing that are not commonly used in traditional classroom settings (De Pereira & Ferreira, 2020). This reinforces the relevance of developing future research that explores how mathematical comics can contribute to the teaching of more complex mathematical concepts.

Regarding the pedagogical role of mathematical comics, the results show that they are used in a versatile manner, addressing various educational needs—from learning and assessment to cognitive and sociocultural development. Their role as learning, teaching-learning, and teaching tools stand out, as it demonstrates their potential to facilitate or enhance the understanding and application of mathematical concepts in meaningful contexts for students (see Table 1). Furthermore, their use as an assessment tool —for both knowledge and skills— demonstrates that their utility extends beyond merely presenting content. This finding is consistent with the reports of Naylor and Keogh (1999) and Toh (2009).

Conclusions

This review shows that, by the midpoint of the 2015–2024 period, publications on the use of mathematical comics in mathematics education experienced growth, reflecting a growing interest in adopting innovative methodologies

that transform traditional teaching and facilitate more meaningful learning. However, from 2020 onwards, a decline in such publications was observed, highlighting the need to encourage the use of mathematical comics in educational practice and to continue investigating their impact. This stagnation in academic output underscores the need for new initiatives that foster the implementation of comics across various educational settings.

Geographically, publications are concentrated in Asia, while regions such as Oceania show no research on the topic, representing a clear opportunity for future investigations. This situation suggests that the use of mathematical comics has not yet reached its full global potential and could benefit from wider dissemination across different regions.

Most of the research has focused on students in basic education. However, there is a significant need to explore their application at more advanced educational levels, where they could serve as valuable tools for developing critical thinking skills and for teaching more abstract concepts.

An important finding is the absence of a formally established definition for the term "mathematical comic." This conceptual gap suggests that the concept remains flexible and could benefit from greater theoretical clarity for its use and development in future studies. Nonetheless, despite the lack of consensus on its definition, several types of mathematical comics have been identified, each with specific characteristics that enable adaptation to different contexts and educational needs. This could contribute to transforming mathematics teaching into a more dynamic process—one that aligns more closely with students' cultural and cognitive realities—thus enriching the educational experience and facilitating the meaningful learning of mathematical concepts.

Limitations of Study

This study has some limitations inherent to the nature of a systematic review, particularly in the stages of data collection, analysis, and presentation. One of the main limitations lies in the selection of literature. Although recognized academic databases such as Google Scholar, ERIC, ScienceDirect, and Taylor & Francis were consulted, it is possible that some relevant studies were not included. This may be due to their unavailability on the selected platforms or limitations in the search terms used. Consequently, the results of this review offer a partial view of the use of mathematical comics, which may limit the generalizability of the findings.

Another significant limitation concerns the lack of a formally established definition for the concept of mathematical comic. This theoretical gap results in a flexible and sometimes ambiguous use of the term in the analyzed studies, making it difficult to compare and synthesize findings across research employing different approaches, formats, and objectives. Although this review proposes an operational delimitation of the concept based on the common characteristics observed, the need to continue deepening its theoretical clarification is acknowledged.

Furthermore, the review lacks information on the long-term impact of mathematical comics on student learning and motivation. The included studies do not provide sufficient evidence to evaluate how these didactic tools

influence educational processes over time or whether the observed effects are replicable in diverse contexts. This underscores the need for longitudinal studies examining the effectiveness of mathematical comics across different educational levels and diverse sociocultural contexts.

Recognizing these limitations is essential for contextualizing the findings of this review and identifying key areas where future research can contribute to the development of knowledge about the use of mathematical comics as didactic tools in mathematics education.

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