

A Systematic Review of Creative Teaching Approaches in Mathematics Education

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ABSTRACT

Creative teaching plays an important role in enhancing the teaching and learning of mathematics by fostering students' engagement, flexibility of thinking, and meaningful understanding. Teachers are encouraged to adopt creative teaching approaches to support students' interest and creative thinking in mathematics classrooms. However, despite the growing attention to creative teaching, the literature remains fragmented in terms of how creative teaching approaches in mathematics education are conceptualised and reported. Therefore, this study aims to conduct a systematic review of the existing literature to identify and synthesise the creative teaching approaches reported in mathematics education. This study employed a systematic literature review following established review procedures. Articles were retrieved from two leading academic databases, namely Scopus and Web of Science. A total of 40 empirical studies published within the selected time frame were included for analysis. The selected studies were analysed using thematic analysis to identify recurring patterns and similarities in the reported creative teaching approaches. The findings reveal that creative teaching approaches in mathematics education can be synthesised into five major themes: technology-enhanced and AI-supported teaching, student-centred and inquiry-oriented learning, problem-solving and conceptual understanding approaches, project-based and STEAM/STEM-oriented learning, and visual, manipulative, and context-based learning. Among these, technology-enhanced and student-centred approaches were the most frequently reported in the literature. Overall, this review provides a comprehensive synthesis of creative teaching approaches in mathematics education and highlights prevailing trends and gaps in the existing literature. The findings offer valuable insights for educators, researchers, and curriculum developers in understanding how creative teaching is currently enacted in mathematics classrooms and suggest directions for future research on creative pedagogy in mathematics education.

Keywords: Creative teaching; Mathematics education; Teaching approaches

INTRODUCTION

Mathematics education has long been perceived by students as abstract, rigid, and challenging, often leading to low engagement and negative attitudes towards learning. In response, educational researchers and practitioners have increasingly emphasised the need for creative teaching approaches that promote meaningful learning experiences and higher-order thinking skills. Creative teaching in mathematics is commonly associated with instructional practices that encourage flexibility, originality, problem exploration, and active student participation (Ersoy & Kara, 2026).

In recent years, the focus on creativity in education has been further strengthened by global educational agendas that stress innovation, adaptability, and 21st-century skills. Within mathematics education, creative teaching is viewed not merely as the use of novel activities, but as a pedagogical orientation that enables students to construct mathematical understanding through exploration, collaboration, and contextualised problem solving (Sasmita et al., 2025). This shift represents a fundamental reconceptualization of mathematics instruction, moving away from traditional reproductive approaches towards constructivist and student-centered models that prioritize meaningful engagement and deep conceptual development.

The urgency for innovative approaches is underscored by persistent challenges in mathematics education. International assessments such as PISA and TIMSS have consistently revealed inadequate mathematics literacy and achievement levels, particularly when students are required to apply mathematical thinking to real-world

problems (Krishnan et al., 2023). These findings have prompted educational systems worldwide to investigate creative pedagogies that not only improve academic performance but also foster the development of essential 21st-century competencies including critical thinking, creativity, collaboration, and adaptability.

Although numerous empirical studies have examined creative teaching approaches in mathematics education, the literature remains scattered across different educational contexts and methodological designs. Consequently, a comprehensive synthesis of recent research is needed to clarify dominant approaches and reported outcomes. This systematic literature review comprehensively synthesizes empirical research published between 2023 and 2025 to address the following research questions: What creative teaching approaches have been reported in the literature on mathematics education?

MATERIAL AND METHODS

This systematic review followed the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines developed by Page et al. (2021). The researchers used PRISMA to provide a clear and transparent reporting structure that allows readers to understand how the review was conducted and to assess the appropriateness of the methods applied. This approach enables readers to evaluate the trustworthiness of the review findings with greater confidence. In addition, the researchers used the PRISMA framework to organise the review process in a systematic manner. The framework guided the researchers in formulating clear research questions, establishing explicit inclusion and exclusion criteria, and managing a large body of literature within a defined time frame (Sierra Correa et al., 2015). In this review, the researchers applied PRISMA to ensure a rigorous and systematic search of literature related to creative teaching. The review process consisted of four main stages, namely identification, screening, eligibility, and inclusion, as illustrated in Figure 1.

Identification

The identification stage formed the initial phase of the systematic review process in accordance with the PRISMA guidelines. At this stage, the researchers derived three key terms from the research question, namely creative teaching, mathematics education and teaching approaches. To broaden the scope of the search, the researchers identified relevant synonyms and related terms. They consulted online thesaurus sources such as thesaurus.com, reviewed keywords used in previous studies, and considered input from subject experts. Through this process, the researchers selected appropriate terms and variations related to factor and creative teaching. They then applied search techniques including field code functions, phrase searching, wildcards, truncation, and Boolean operators to generate comprehensive combinations of search terms, as presented in Table 1.

The study used two major academic databases, Scopus and Web of Science, as the primary sources for literature identification. These databases provide extensive coverage of publication metadata and impact indicators and therefore support a wide range of research activities, including journal selection, literature retrieval, bibliometric analysis, and research evaluation across different levels (Pranckute, 2021). The search process identified a total of 736 potentially relevant articles, comprising 511 records from the Scopus database and 225 records from the Web of Science database.

Table 1: The search string

Database	Keywords used
Scopus	TITLE-ABS-KEY(("creative teaching" OR "creative pedagogy" OR "teaching creatively" OR "innovative teaching" OR "student-centered learning") AND (mathematics OR "mathematics education"))
Web of Sciences	TS=(("creative teaching" OR "creative pedagogy" OR "teaching creatively" OR "innovative teaching" OR "student-centered learning" AND (mathematics OR "mathematics education")))

Screening

The screening stage followed the identification of relevant articles. At this stage, the researchers screened studies

based on predefined inclusion and exclusion criteria, as outlined in Table 2. The screening process first removed journals categorised as systematic reviews, as well as book series, books, book chapters, and conference proceedings. The researchers then limited the review to articles published between 2023 and 2025, guided by the concept of research field maturity, which suggests that an adequate body of literature is required to support a representative review (Kraus et al., 2020). The researchers focused the review on empirical studies published in English. This process excluded articles that did not meet the inclusion criteria. From the remaining records, 24 duplicate articles were removed. As a result, 165 articles remained for further assessment in the subsequent stage.

Table 2: The selection criterion is searching

Criterion	Inclusion	Exclusion
Language	English	Non-English
Time line	2023 - 2025	< 2022
Literature type	Journal (Article)	Journals (systematics review), book, chapter in book conference and proceeding

Eligibility

The eligibility stage followed the screening process to ensure that all remaining articles met the established criteria. At this stage, the researchers manually examined the retrieved studies by reviewing their titles, abstracts, and where necessary, the full texts. This careful assessment allowed the researchers to confirm the relevance of each study to the focus of the review. During this stage, the researchers excluded 125 articles because they did not address factors influencing teachers creative teaching, did not focus on education, or appeared as sections within books. As a result of this eligibility assessment, 40 articles remained and were included for synthesis in the systematic literature review.

Included

The final set of articles included in this systematic review focused on teachers creative teaching. Table 3 presents an overview of the selected studies. In total, the researchers included 40 articles retrieved from the Scopus and Web of Science databases. The researchers selected these databases due to the quality and relevance of their indexed publications, particularly within the field of education. All included studies specifically addressed issues related to teachers creative teaching and aligned with the aims of this review.

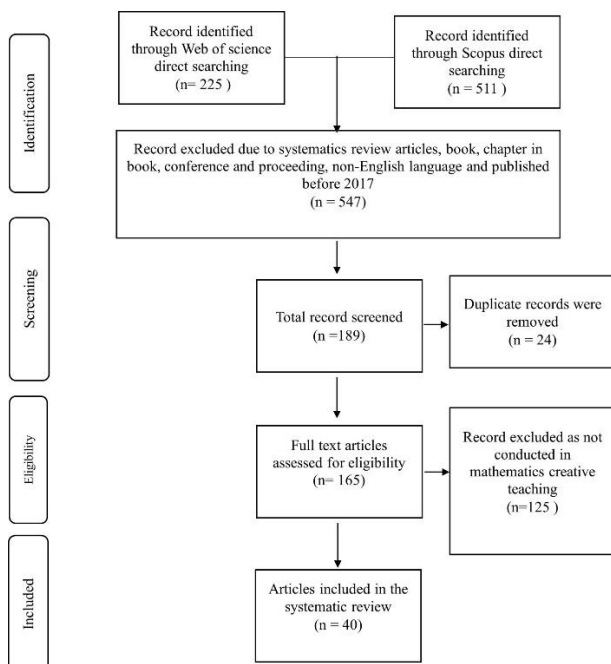


Figure 1. PRISMA systematic review adapted from Page et al. (2021)

RESULTS AND DISCUSSION

Background of the Selected Studies

This systematic review included a total of 40 studies, representing research conducted across multiple geographical contexts. The analysis shows that the selected studies covered Asia, the Middle East, Europe, and Africa, thereby highlighting the global relevance of creative teaching approaches in mathematics education. Indonesia contributed the highest number of studies ($n = 7$) (Kusumandari et al.; Alhusna et al.; Cahyono et al.; Marhaeni et al.; Abdullah et al.; Ardianto et al.; Johar et al.), followed by Malaysia ($n = 4$) (Nasran & Zakaria; Ahmad Fuad Khoo et al.; Abdullah et al.; Nasir et al.). Researchers also conducted notable numbers of studies in Saudi Arabia ($n = 3$) (AlAli & Al-Barakat; Alhazzani; AlAli et al.), Jordan ($n = 3$) (AlAli & Al-Barakat; AlAli et al.; Alkouri & Wardat), Rwanda ($n = 3$) (Habiyaemye et al.; Nungu et al.; Ukobizaba et al.), and Taiwan ($n = 3$) (Chang et al.; Chang et al.; Lee et al.). Several studies involved multiple countries, including those by Szilágyi et al., Cahyono et al., Abdullah et al., Fergusson-Patrick and Liebech-Lien, AlAli and Al-Barakat, and Dominguez. Figure 2 illustrates the geographical distribution of the selected studies.

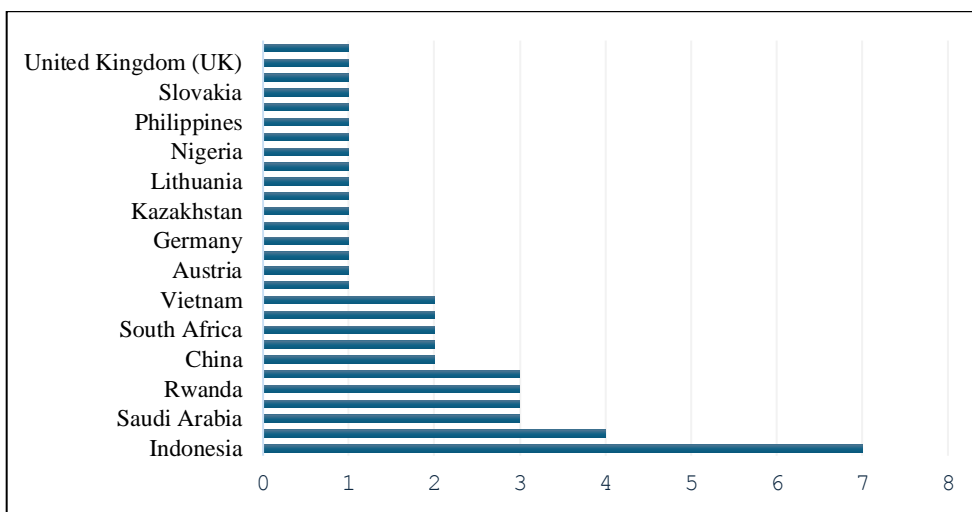


Figure 2: Countries in which the selected studies were conducted

Regarding the year of publication, the findings demonstrate a clear upward trend across the selected period. Researchers published 8 studies in 2023 (Hiwarekar; Nungu, Mukama & Nsabayezu; Johar et al.; Nasir et al.; Zhou, Deng & Leong; Lee et al.), followed by 14 studies in 2024 (Ardianto et al.; Hetmanenko; Liu et al.; Janardhanan & Charles; AlAli & Al-Barakat; Habiyaemye et al.; Alhazzani; Dominguez; AlAli et al.; Chang et al.). The publication output peaked in 2025, with 18 studies (Szilágyi et al.; Nasran & Zakaria; Kusumandari et al.; Alhusna et al.; Ion & Popescu; Cahyono et al.; Ahmad Fuad Khoo et al.; Marhaeni et al.; Sapparbaeva et al.; Elhilal; Fergusson-Patrick & Liebech-Lien; Alós Civico et al.; Danlami et al.; Xuan et al.; Abdullah et al.; Ncube & Luneta; Triet et al.; Gruber & Faßbender; Alkouri & Wardat; Ukobizaba et al.). This pattern reflects a growing research interest in creative and innovative teaching practices in mathematics education. Figure 3 presents the distribution of publication years.

With respect to the level of education, most studies focused on secondary school contexts ($n = 14$), followed by primary school settings ($n = 11$) and tertiary education ($n = 11$). A smaller group of studies examined learning across both primary and secondary levels ($n = 3$), while only one study addressed preschool education. These findings indicate that researchers predominantly investigate creative teaching in school-level mathematics education, particularly at the secondary level, while paying comparatively less attention to early childhood contexts.

In terms of research design, most studies adopted quantitative approaches ($n = 23$), including those by Szilágyi et al., Nasran and Zakaria, Alhusna et al., Ion and Popescu, Marhaeni et al., Sapparbaeva et al., Danlami et al., Xuan et al., Abdullah et al., Ardianto et al., Hetmanenko, Liu et al., Janardhanan and Charles, AlAli and Al-Barakat, Habiyaemye et al., Chang et al., Hiwarekar, Johar et al., Nasir et al., Zhou et al., Lee et al., Alkouri and Wardat, and Ukobizaba et al. Researchers next employed mixed-methods designs ($n = 8$) (Kusumandari et al.;

Ahmad Fuad Khoo et al.; Elhilal; Ncube & Luneta; Caningo; Nungu et al.), while a smaller number of studies used qualitative designs (n = 6) (Cahyono et al.; Fergusson-Patrick & Liebech-Lien; Alhazzani; Dominguez; Gruber & Faßbender). Overall, these patterns show that researchers strongly favour quantitative and mixed-methods approaches when examining creative teaching practices in mathematics education. Additional details of the selected studies, including geographical distribution, publication year, level of education, and research design, are summarised in Table 3.

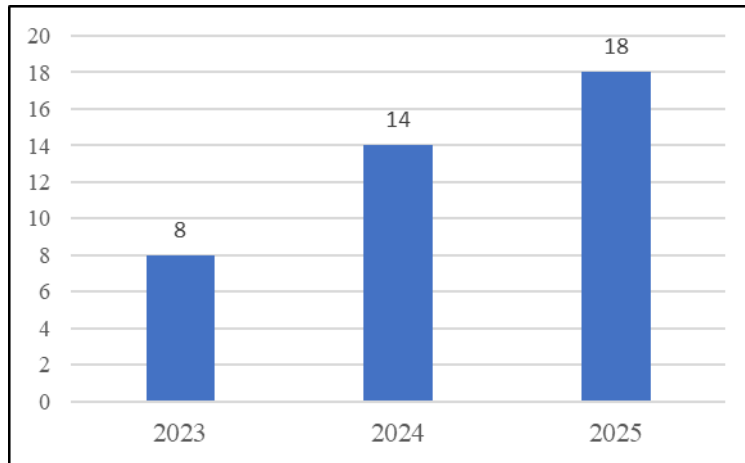


Figure 3. Year of publication

Table 3: Characteristics of the Selected Studies on Creative Teaching in Mathematics Education

No.	Author(s)	Main Study Design	Country	Level of Education	Creative Teaching Approaches
1	Szilágyi, Körei & Vaičiulytė, 2025	Quantitative	Hungary Lithuania	Tertiary	Educational robotics; STEAM-based learning; hands-on & visualization-based learning
2	Nasran Zakaria, 2025	Quantitative	Malaysia	Primary Secondary	Problem-solving-based teaching; 4C skills pedagogy; student-centred facilitative teaching
3	Kusumandari et al., 2025	Mix method	Indonesia	Primary school	Interactive digital learning media; multimedia-based learning; technology-enhanced constructivist approach
4	Alhusna et al., 2025	Quantitative	Indonesia	Tertiary	Inquiry-based learning; active learning; student-centred instructional materials
5	Ion & Popescu, 2025	Quantitative	Romania	Secondary school	Distance learning platform; interactive e-learning; virtual whiteboard & collaborative tools
6	Cahyono et al., 2025	Qualitative	Indonesia Austria UK	Tertiary	STEAM pedagogy; AI-supported creative tasks; arts-integrated mathematics learning
7	Ahmad Fuad Khoo et al., 2025	Mixed-methods	Malaysia	Primary	Manipulative-based learning; concrete-representational approach; innovative teaching model
8	Marhaeni et al., 2025	Quantitative	Indonesia Spain	primary & secondary secondary	Interactive math comics; visual storytelling; multimedia-supported learning

No.	Author(s)	Main Study Design	Country	Level of Education	Creative Teaching Approaches
9	Saparbayeva et al., 2025	Quantitative	Kazakhstan	Tertiary	Project-based learning (PjBL); active & applied mathematics learning
10	Elhilal, 2025	Mixed-methods	Kuwait	Tertiary	Flipped classroom; blended learning; active & student-centred learning
11	Ferguson-Patrick & Liebech-Lien, 2025	Qualitatif	Australia Norway	Primary school	Collaborative problem-solving (CPS); reflective practice; student-centred facilitation
12	Alós Cívico et al., 2025	Quantitative	Spain	Primary school	Open Number-Based Algorithm (ABN); flexible & conceptual calculation strategies
13	Danlami et al., 2025	Quantitative	Nigeria	Secondary school	Brainstorming learning strategy; idea-generation & active participation
14	Xuan et al., 2025	Quantitative	Vietnam	Secondary school	Generative AI-supported learning; personalised & student-centred instruction
15	Abdullah et al., 2025	Quantitative	Malaysia Indonesia	Secondary school	Ethnomathematics; culture-based & arts-integrated mathematics learning
16	Ncube & Luneta, 2025	Mixed-methods	South Africa	Secondary school	Concept-based instruction; conceptual understanding-focused teaching
17	Canonigo, 2024	Mixed-methods	Philippines	Secondary school	AI-supported collaborative learning; GeoGebra & ChatGPT integration
18	Triet et al., 2025	Quantitative	Vietnam	Primary school	GeoGebra-supported 5E model; inquiry-based & interactive learning
19	Ardianto et al., 2024	Quantitative	Indonesia	Primary school	Language-integrated mathematics teaching; reasoning-focused instruction; contextual word-problem pedagogy
20	Hetmanenko, 2024	Quantitative	Ukraine	Tertiary	Concept-based instruction; applied mathematics; problem-solving & analytical reasoning
21	Liu et al., 2024	Quantitative	China	Primary school	Schema-based teaching; visual-cognitive strategies; mental arithmetic instruction
22	Janardhanan & Charles, 2024	Quantitative	India	secondary school	Innovative teaching techniques; project-based learning; cooperative & technology-integrated learning
23	AlAli & Al-Barakat, 2024	Quantitative	Saudi Arabia Jordan	Primary school	Constructivist pedagogy; active learning; problem-solving and mathematical communication
24	Habiyaremye et al., 2024	Quantitative	Rwanda	Tertiary	Reflective pedagogy; TPACK-based instruction; technology-integrated mathematics teaching
25	Alhazzani, 2024	Qualitative	Saudi Arabia	Secondary School	Generative AI-supported teaching; AI-assisted lesson planning; creative pedagogy enhancement

No.	Author(s)	Main Study Design	Country	Level of Education	Creative Teaching Approaches
26	Dominguez, 2024	Qualitative	Mexico / Chile	Tertiary	Active learning dynamics; collaborative learning; model-eliciting activities & technology use
27	AlAli, Wardat, Saleh & Alshraifin, 2024	Quantitative	Saudi Arabia, UAE, Jordan	Secondary school	STEM-aligned pedagogy; problem-based and project-based learning; integrative STEM instruction
28	Hiwarekar, 2023	Quantitative	India	Tertiary	Flipped classroom; video-based learning; technology-enhanced active learning
29	Chang, Du, Kuo & Chang, 2024	Quantitative	Taiwan	Secondary school	Design Thinking-based STEAM PBL; project-based learning; creativity- and CT-oriented pedagogy
30	Nungu, Mukama & Nsabayezi, 2023	mixed methods	Rwanda	Tertiary	Online collaborative learning; multimedia-supported instruction; knowledge co-construction
31	Johar, Mailizar, Safitri, Zubainur & Suhartati, 2023	Quantitative	Indonesia	Secondary school	Mathematics comics; visual storytelling; contextual and media-based learning
32	Nasir, Talib, Latif, Hanid & Harmeni, 2023	Quantitative	Malaysia	Secondary school	STEM Productive Learning (STEMPL); inquiry- and activity-based learning; HOTS-oriented pedagogy
33	Zhou, Deng & Leong, 2023	Quantitative	China	Secondary school	Student-lecturing model; dialogic teaching; communication-based problem solving
34	Chang et al., 2024	Quantitative	Taiwan	Secondary school	Design thinking; project-based learning; creative problem-solving and interdisciplinary STEAM
37	Lee et al., 2023	Quantitative	Taiwan	Secondary school	Integration of mathematics with computational thinking; problem-solving and literacy-based instruction
38	Gruber & Faßbender, 2025	Qualitative	Germany	Tertiary	Gamification; digital escape games; game-based and constructivist learning
39	Alkouri & Wardat, 2025	Quantitative	Jordan	Preschool	Technology-enhanced curriculum; visual and interactive digital learning; structured digital integration
40	Ukobizaba et al., 2025	Quantitative	Rwanda	Primary & secondary	Project-based learning (PjBL); learner-centred pedagogy; collaborative and authentic learning

Developed Themes

This systematic review employed thematic analysis to synthesise findings from 40 selected studies, resulting in the identification of five major themes of creative teaching approaches in mathematics education. The analysis grouped the reported approaches based on shared characteristics and conceptual similarities across studies. To ensure analytical clarity and coherence, the themes were developed inductively from the reported teaching practices and pedagogical orientations identified in the reviewed literature. This process enabled the consolidation of diverse instructional approaches into broader thematic categories that reflect prevailing trends

in creative mathematics teaching. The resulting themes capture both pedagogical strategies and instructional designs that support creativity, engagement, and meaningful learning in mathematics classrooms.

Theme 1: Technology-Enhanced and AI-Supported Teaching

The review shows that technology-enhanced and AI-supported teaching emerges as the most dominant creative teaching approach in mathematics education. Many studies explicitly integrate artificial intelligence, digital platforms, multimedia resources, and educational software to support creative mathematical learning (Szilágyi, Körei, & Vaičiulytė, 2025; Kusumandari et al., 2025; Ion & Popescu, 2025; Cahyono et al., 2025). These studies demonstrate how teachers actively use AI-supported instruction, online collaborative environments, and digital tools such as GeoGebra to promote visualisation, interactivity, and personalised learning (Canonigo, 2024; Triet et al., 2025; Liu et al., 2024). Overall, the findings position technology not as a supplementary aid, but as a central pedagogical driver that enables creative engagement and flexible mathematical thinking (Gruber & Faßbender, 2025; Alkouri & Wardat, 2025). The distribution of technology-enhanced and AI-supported teaching subthemes across the selected studies is presented in Table 4.

Table 4: Subthemes of Technology-Enhanced and AI-Supported Teaching Across Selected Studies

Author(s)	AI-supported	Digital Media & Multimedia	E-learning Platforms	Educational Software (e.g., GeoGebra, Games)
Szilágyi et al. (2025)		✓		✓
Kusumandari et al. (2025)		✓		
Ion & Popescu (2025)		✓	✓	
Cahyono et al. (2025)	✓			
Elhilal (2025)			✓	
Xuan et al. (2025)	✓			
Canonigo (2024)	✓			✓
Triet et al. (2025)				✓
Liu et al. (2024)				✓
Habiyaremye et al. (2024)		✓		
Alhazzani (2024)	✓			
Hiwarekar (2023)			✓	
Nungu et al. (2023)		✓	✓	
Lee et al. (2023)				✓
Gruber & Faßbender (2025)				✓
Alkouri & Wardat (2025)		✓		

Theme 2: Student-Centred, Active and Inquiry-Oriented Learning

The synthesis further highlights student-centred, active, and inquiry-oriented learning as a key feature of creative teaching in mathematics. Across the reviewed studies, teachers adopt facilitative roles that encourage students to actively construct mathematical understanding through participation, discussion, and exploration (Nasran & Zakaria, 2025; Alhusna et al., 2025; Elhilal, 2025). Approaches such as collaborative problem-solving,

participatory activities, and dialogic teaching consistently support students’ engagement and creative thinking (Ferguson-Patrick & Liebech-Lien, 2025; Danlami et al., 2025; Zhou, Deng, & Leong, 2023). These findings reinforce the close alignment between creative teaching and constructivist pedagogy, where inquiry and interaction drive meaningful learning (Janardhanan & Charles, 2024; AlAli & Al-Barakat, 2024). The distribution of subthemes related to this theme across the selected studies is presented in Table 5.

Table 5: Subthemes of Student-Centred, Active and Inquiry-Oriented Learning Across Selected Studies

Author(s)	Student-Centred	Active Learning	Inquiry-Based	Collaborative / Dialogic
Nasran & Zakaria (2025)	✓	✓		
Alhusna et al. (2025)	✓	✓	✓	
Saparbayeva et al. (2025)	✓	✓		✓
Ferguson-Patrick & Liebech-Lien (2025)	✓			✓
Danlami et al. (2025)		✓		
Xuan et al. (2025)	✓			
Janardhanan & Charles (2024)	✓		✓	✓
AlAli & Al-Barakat (2024)	✓	✓		
Dominguez (2024)	✓	✓		✓
Hiwarekar (2023)	✓	✓		
Nungu et al. (2023)	✓			✓
Zhou et al. (2023)				✓
Ukobizaba et al. (2025)	✓			✓

Theme 3: Problem-Solving, Reasoning and Conceptual Understanding

Another prominent theme centres on problem-solving, reasoning, and conceptual understanding, reflecting the discipline-specific nature of creativity in mathematics. Several studies show that teachers emphasise conceptual clarity and mathematical reasoning to cultivate creative thinking (Ncube & Luneta, 2025; Hetmanenko, 2024). Through schema-based instruction, concept-focused teaching, and reasoning-oriented tasks, teachers help students analyse problems, justify solutions, and communicate mathematical ideas more effectively (Liu et al., 2024; Alós Cívico et al., 2025). Collectively, these studies indicate that creative teaching in mathematics prioritises deep understanding and cognitive flexibility rather than isolated innovative activities (Ardianto et al., 2024; Lee et al., 2023). The distribution of subthemes related to this theme across the selected studies is presented in Table 6

Table 6: Subthemes of Problem-Solving, Reasoning and Conceptual Understanding Across Selected Studies

Author(s)	Problem-Solving	Reasoning	Conceptual Understanding	Mathematical Communication
Nasran & Zakaria (2025)	✓	✓		
Ferguson-Patrick & Liebech-Lien (2025)	✓			
Alós Cívico et al. (2025)			✓	

Ncube & Luneta (2025)			✓	
Hetmanenko (2024)	✓	✓		
Liu et al. (2024)			✓	
Ardianto et al. (2024)	✓	✓		✓
Zhou et al. (2023)	✓			✓
Lee et al. (2023)	✓	✓		
Nasir et al. (2023)	✓			

Theme 4: Project-Based, STEAM/STEM and Design-Oriented Learning

The findings also identify project-based, STEAM/STEM, and design-oriented learning as important creative teaching approaches. Teachers use project-based learning and interdisciplinary integration to situate mathematics within authentic and meaningful problem contexts (Saparbayeva et al., 2025; Janardhanan & Charles, 2024; Ukobizaba et al., 2025). Studies further show that STEAM and STEM pedagogies strengthen creative mathematical thinking by connecting mathematics with science, technology, engineering, and the arts (Szilágyi, Körei, & Vaičiulytė, 2025; Cahyono et al., 2025; Nasir et al., 2023). In addition, design thinking approaches encourage iterative exploration and refinement, allowing students to develop creative and practical solutions to mathematical challenges (Chang, Du, Kuo, & Chang, 2024; Chang et al., 2024). The distribution of subthemes related to this theme across the selected studies is presented in Table 7

Table 7. Subthemes of Project-Based, STEAM/STEM and Design-Oriented Learning Across Selected Studies

Author(s)	Project-Based Learning	STEAM/STEM	Design Thinking	Interdisciplinary
Szilágyi et al. (2025)		✓		✓
Cahyono et al. (2025)		✓		✓
Saparbayeva et al. (2025)	✓			
Janardhanan & Charles (2024)	✓		✓	
AlAli et al. (2024)	✓	✓		✓
Chang, Du, Kuo & Chang (2024)	✓	✓	✓	✓
Chang et al. (2024)	✓	✓		✓
Nasir et al. (2023)	✓	✓		
Ukobizaba et al. (2025)	✓			✓

Theme 5: Visual, Manipulative, Contextual and Culture-Based Learning

The final theme highlights visual, manipulative, contextual, and culture-based learning as creative approaches that anchor mathematical ideas in concrete and meaningful experiences. Several studies report that teachers use visual representations, manipulatives, mathematical comics, and storytelling to make abstract concepts more accessible and engaging (Marhaeni et al., 2025; Johar et al., 2023; Ahmad Fuad Khoo et al., 2025). Other studies emphasise culture- and context-based approaches, such as ethnomathematics, which connect mathematical learning to students’ cultural backgrounds and everyday experiences (Abdullah et al., 2025; Ardianto et al., 2024). Although fewer studies report this theme compared to technology-driven approaches, the findings underscore its value in supporting inclusive, relatable, and human-centred mathematics teaching. The distribution of subthemes related to this theme across the selected studies is presented in Table 8.

Table 8: Subthemes of Visual, Manipulative, Contextual and Culture-Based Learning Across Selected Studies

Author(s)	Visualisation	Manipulatives	Contextual Learning	Culture-Based
Ahmad Fuad Khoo et al. (2025)		✓		
Marhaeni et al. (2025)	✓		✓	
Abdullah et al. (2025)				✓
Johar et al. (2023)	✓		✓	
Alós Cívico et al. (2025)		✓		
Liu et al. (2024)	✓			
Ardianto et al. (2024)			✓	✓

DISCUSSION

The findings of this systematic review indicate that creative teaching plays an important role in enhancing the teaching and learning of mathematics. Across the reviewed studies, creativity is consistently associated with more engaging, meaningful, and effective instructional practices (Nasran & Zakaria, 2025; Alhusna et al., 2025; Ferguson-Patrick & Liebeck-Lien, 2025). The increasing attention given to creative teaching in recent literature suggests that mathematics education is gradually shifting towards approaches that emphasise flexibility, innovation, and active student engagement, particularly in response to global educational changes. The analysis further shows that creative teaching in mathematics is most commonly realised through technology-enhanced and student-centred approaches. Many studies highlight how the integration of digital tools, artificial intelligence, and interactive learning environments supports creative mathematical learning by enabling visualisation, exploration, and personalised instruction (Szilágyi, Körei, & Vaičiulytė, 2025; Kusumandari et al., 2025; Cahyono et al., 2025; Canonigo, 2024). This trend reflects the growing role of technology in contemporary classrooms and suggests that creativity in teaching is increasingly linked to teachers' ability to design meaningful learning experiences using technological resources (Gruber & Faßbender, 2025; Alkouri & Wardat, 2025).

In addition, the literature emphasises the importance of student-centred, inquiry-based, and problem-solving-oriented approaches in fostering creativity in mathematics learning. These approaches encourage students to actively participate in learning, explore multiple solution strategies, and engage in reasoning and discussion (Saparbayeva et al., 2025; Danlami et al., 2025; Zhou, Deng, & Leong, 2023). This finding aligns with perspectives on creative pedagogy, which view creativity as emerging through exploration, flexibility, and the generation of multiple ideas rather than through fixed instructional procedures (Beghetto & Kaufman, 2014; Runco, 2014). The findings also suggest that creative teaching in mathematics aligns with domain-specific views of creativity that emphasise conceptual understanding, reasoning, and flexible thinking. Several studies indicate that creative teaching focuses on how students make sense of mathematical ideas, justify solutions, and communicate reasoning, rather than on surface-level novelty (Ncube & Luneta, 2025; Hetmanenko, 2024; Liu et al., 2024). This supports the view that creativity in mathematics is closely tied to higher-order thinking and meaningful conceptual engagement (Torrance, 1974).

Although technology-driven and student-centred approaches dominate the literature, the review also identifies visual, manipulative, contextual, and culture-based approaches as important, though less frequently reported. Studies on manipulatives, mathematical comics, and ethnomathematics highlight how grounding mathematics learning in concrete and culturally meaningful contexts can support students' understanding and engagement (Marhaeni et al., 2025; Abdullah et al., 2025; Johar et al., 2023). The relatively limited emphasis on these approaches suggests a potential gap in the literature and highlights the need for future research on culturally responsive creative teaching in mathematics education.

Overall, this review shows that creative teaching in mathematics education is a multifaceted construct influenced by pedagogical design, learner engagement, and contextual factors. While recent studies place strong emphasis on technological innovation and active learning, future research should continue to explore how creative teaching can be sustained through balanced approaches that integrate conceptual depth, cultural relevance, and supportive learning environments. Taken together, these findings provide a synthesised answer to the research question by

demonstrating that creative teaching approaches reported in mathematics education predominantly encompass technology-supported, student-centred, problem-solving-oriented, and contextually grounded pedagogical practices.

CONCLUSION

This systematic literature review analysed 40 empirical studies published between 2023 and 2025 that examined creative teaching approaches in mathematics education. The distribution of publication years shows a clear increase in research output over the selected period, with the highest number of studies published in 2025. This trend indicates that creative teaching in mathematics has received growing attention from researchers, reflecting its increasing importance in addressing contemporary educational challenges.

Based on the findings, creative teaching in mathematics is not shaped by a single factor or approach. Instead, the reviewed studies demonstrate a wide range of teaching approaches and contextual elements, including problem-based learning, inquiry-based instruction, STEM and STEAM integration, technology-enhanced learning, and collaborative learning strategies. These approaches collectively emphasise active student engagement, higher-order thinking, and meaningful learning experiences. The findings suggest that the implementation of creative teaching depends on the interaction between instructional strategies, teacher competencies, and educational contexts. The review also reveals that most studies focused on primary and secondary education, while fewer studies examined preschool and tertiary contexts. In addition, the dominance of quantitative and mixed-methods research designs indicates a strong emphasis on measuring the effectiveness of creative teaching approaches, whereas fewer studies explored teachers' lived experiences and classroom practices in depth. As a result, the existing literature provides strong empirical evidence on outcomes but offers more limited insight into the processes underlying creative teaching in mathematics classrooms.

Overall, this review contributes to the literature by offering a recent and systematic synthesis of research on creative teaching in mathematics education. The findings highlight the need for a more comprehensive understanding of how creative teaching can be effectively implemented and sustained across different educational levels and contexts. Despite the contributions of this review, several limitations should be acknowledged. First, this review included only studies published between 2023 and 2025, which may limit the generalisability of the findings to earlier research. Second, the review focused on studies retrieved from selected databases, which may have resulted in the exclusion of relevant studies indexed elsewhere. Third, the predominance of quantitative and mixed-methods designs in the reviewed studies may have restricted deeper insights into teachers' lived experiences and classroom practices related to creative teaching in mathematics.

RECOMMENDATION

This systematic review provides valuable insights into factors associated with creative teaching in mathematics education. The findings offer important implications for educators, researchers, and policy-makers, particularly in understanding how creative teaching can be supported and strengthened in classroom practice. Therefore, future research should undertake more extensive and systematic investigations to further examine the impact of the identified approaches and contextual factors on creative teaching implementation. Future studies could explore whether these factors function as direct influences, moderators, or mediators of creative teaching among mathematics teachers. In addition, research may be extended by utilising broader and more comprehensive databases, as well as employing diverse methodological approaches to enhance the robustness of findings. More in-depth research is also required, as several aspects of creative teaching remain underexplored, particularly in relation to teachers' experiences across different educational levels and contexts. It is expected that this review will serve as a reference point and stimulate further research aimed at advancing knowledge on creative teaching in mathematics education, especially within the Malaysian context and the wider field of mathematics education.

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