

Weaving Character Through Mathematics: A Systematic Review of Character Education in Mathematics Education

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Abstract

Character education has become a fundamental pillar of twenty-first-century education, as it plays a crucial role in developing students who are not only academically competent but also possess moral integrity, responsibility, and strong social skills. Mathematics, as a discipline that emphasizes logical reasoning, systematic thinking, and problem-solving, offers considerable potential as a medium for fostering students' character development. However, research on the integration of character education into mathematics instruction remains fragmented, with no comprehensive synthesis of instructional models, character values promoted, implementation challenges, and future research directions. Therefore, this study aims to synthesize the existing evidence on the integration of character education in mathematics education through a Systematic Literature Review (SLR) following the PRISMA 2020 guidelines. Data were collected from Google Scholar, covering publications from 2015 to 2026, using predefined inclusion and exclusion criteria. A total of six studies met all eligibility criteria and were analyzed thematically. The findings indicate that the integration of character education is most frequently implemented through Problem-Based Learning (PBL), Project-Based Learning (PjBL), Generative Learning, and Blended Learning. The most commonly developed character values include responsibility, discipline, honesty, collaboration, creativity, and critical thinking. Furthermore, contextual approaches such as ethnomathematics have been shown to strengthen students' social, cultural, and religious character. Nevertheless, the implementation of character education continues to face several challenges, including limited teacher competence, the lack of standardized instruments for assessing character development, and insufficient institutional policy support. This review provides a comprehensive overview of current research on the integration of character education in mathematics education and offers valuable implications for curriculum development, instructional practices, and future research.

Keywords

character education, mathematics learning, systematic literature review, prisma 2020, etnomatematika

Introduction

Character education has become one of the primary goals of educational systems worldwide, as it extends beyond the development of academic competence to encompass the cultivation of students' personality, moral values, and social

responsibility (Joko, [2025](#)). Rapid technological advancement, globalization, and ongoing social transformation have intensified the demand for education systems to prepare graduates who are not only capable of critical thinking but also demonstrate integrity, ethical awareness, collaboration skills, and concern for their communities and the broader environment (Purwanto et al., [2023](#)). Consequently, character education has become an integral component of the teaching and learning process across all subject areas.

In the Indonesian educational context, strengthening character education has become a national priority, as reflected in various educational policies (Musawwamah & Taufiqurrahman, [2019](#)). The implementation of character education is not confined to specific subjects but is integrated across the entire teaching and learning process, including mathematics education (Syamsuddin et al., [2020](#)). This integration aims to provide students with meaningful learning experiences that not only enhance their cognitive development but also foster positive attitudes, values, and behaviors that can be applied in their daily lives (Fauzan & Anshari, [2024](#)).

Mathematics has traditionally been perceived as a subject primarily concerned with computational skills and logical problem-solving. However, mathematics instruction provides abundant opportunities for students to develop a wide range of character values, including honesty in the problem-solving process, responsibility for completing assigned tasks, discipline in following mathematical procedures, collaboration through group discussions, and perseverance when addressing complex problems (Musthofa et al., [2025](#)). Student-centered instructional approaches, such as Problem-Based Learning (PBL), Project-Based Learning (PjBL), and contextual approaches grounded in ethnomathematics, further create meaningful opportunities for fostering these character values (Aditya, [2023](#)).

A growing body of research has reported that integrating character education into mathematics instruction yields positive outcomes for both students' academic achievement and character development. For example, Mahfudy et al. ([2019](#)) found that character-based mathematics instruction effectively fosters responsibility, discipline, religious values, and collaboration among students. Other studies have further demonstrated that Project-Based Learning (PjBL), Generative Learning, and ethnomathematics-based approaches promote creativity, critical thinking, and social responsibility (Rahman & Ramli, [2024](#)). In addition, advances in educational technology

have stimulated the development of innovative instructional practices that integrate character education through digital learning environments and project-based learning activities (Rahayu, [2019](#)).

Despite these promising findings, research on the integration of character education into mathematics education remains subject to several limitations. Most existing studies have focused on the implementation of specific instructional models within limited educational contexts, involved relatively small samples, or examined only one or two dimensions of character development (Aditya, [2023](#)). Furthermore, few studies have systematically synthesized the existing evidence regarding research trends, the instructional models most frequently employed, the character values most commonly promoted, implementation challenges, and future research directions (Mahfudy et al., [2019](#)). Consequently, a comprehensive understanding of the research landscape on the integration of character education in mathematics education is still lacking.

Previous systematic literature reviews have primarily examined character education from a broader educational perspective or focused on the development of mathematical thinking skills. In contrast, systematic reviews that specifically map the integration of character education into mathematics education remain scarce (Agusantia et al., [2022](#)). This gap highlights the need for a more comprehensive synthesis of the existing evidence to identify prevailing instructional models, the character values most frequently promoted, implementation challenges, and directions for future research.

Building upon this research gap, the present study conducts a Systematic Literature Review (SLR) of research on the integration of character education into mathematics education following the PRISMA 2020 guidelines. Specifically, the review seeks not only to identify publication trends and the characteristics of the existing literature but also to synthesize the instructional models employed, the character values promoted, the challenges associated with implementation, and promising directions for future research.

The primary contribution of this study lies in its thematic synthesis, which provides a comprehensive overview of the development of character education integration in mathematics education over the past decade. By consolidating the existing evidence, this review offers a clearer understanding of prevailing instructional models, the character values most frequently promoted, implementation challenges, and emerging research directions. The findings are expected to serve as a valuable reference for researchers,

educators, curriculum developers, and policymakers in designing mathematics education strategies that not only enhance students' academic achievement but also foster the character competencies required for twenty-first-century learning.

Methodology

Research Design

This study employed a Systematic Literature Review (SLR) to identify, evaluate, and synthesize research on the integration of character education into mathematics education (Ridwan et al., [2021](#)). The SLR approach was selected because it enables the systematic, transparent, and reproducible synthesis of scientific evidence (Cabrera & Cabrera, [2023](#)). The review process followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines, which comprise four main phases: Identification, Screening, Eligibility, and Inclusion.

Through this approach, the review not only identifies research trends but also synthesizes the instructional models employed, the character values promoted, the challenges associated with implementation, and promising directions for future research (Syaharuddin et al., [2026](#)).

Data Sources

The literature was retrieved from the Google Scholar database because it provides broad coverage of scholarly publications in the fields of education and mathematics education (Rohman, [2025](#)). The literature search was conducted on 15 January 2026, covering publications published between 2015 and 2026. The literature selection criteria are presented in Table 1.

Table 1. Inclusion and Exclusion Criteria

Kriteria	Deskripsi
Database	Google Scholar,
Tahun publikasi	2015-2026
Bahasa	Indonesia dan inggris
Jenis publikasi	Artikel jurnal peer -reviewed
Fokus penelitian	Integrasi pendidikan karakter dalam pembelajaran matematika
Full text	tersedia
Kriteria eksklusi	Artikel prosiding, opini, editorial, skripsi, tesis, disertasi, serta artikel yang tidak membahas pendidikan karakter dalam pembelajaran matematika

Search Strategy

The literature search was performed using a combination of keywords and Boolean operators to retrieve relevant studies. The search string used in this review was as follows: ("character education") AND ("mathematics learning") The keywords were carefully selected to align with the objectives of the review, ensuring that all retrieved studies were relevant to the integration of character education into mathematics education.

Literature Selection Process

Article selection was conducted in accordance with the PRISMA 2020 guidelines. During the Identification phase, a total of 200 records were retrieved from Google Scholar. After the removal of nine duplicate records, the remaining studies underwent an initial screening process. Subsequently, 112 records were excluded because they did not match the predefined keywords or the scope of the review. An additional 59 records were removed because they were conference proceedings, non-peer-reviewed publications, or unavailable in full-text format.

The Screening phase resulted in 20 records that were considered potentially eligible for further assessment. During the Eligibility phase, the full texts of all remaining studies were thoroughly reviewed. Following the full-text assessment, 18 studies met the predefined eligibility criteria and were retained for further evaluation. These studies were subsequently assessed based on their topical relevance, publication quality, and alignment with the objectives of the review.

During the Eligibility phase, full-text articles were excluded for the following reasons:

- Seven studies were excluded because their topics were not relevant to the objectives of the review.
- One study was excluded because it was not published in a peer-reviewed journal.
- Four studies were excluded because they did not provide sufficient data for the review.

Consequently, six studies satisfied all the predefined inclusion criteria and were included in the final qualitative analysis of this review.

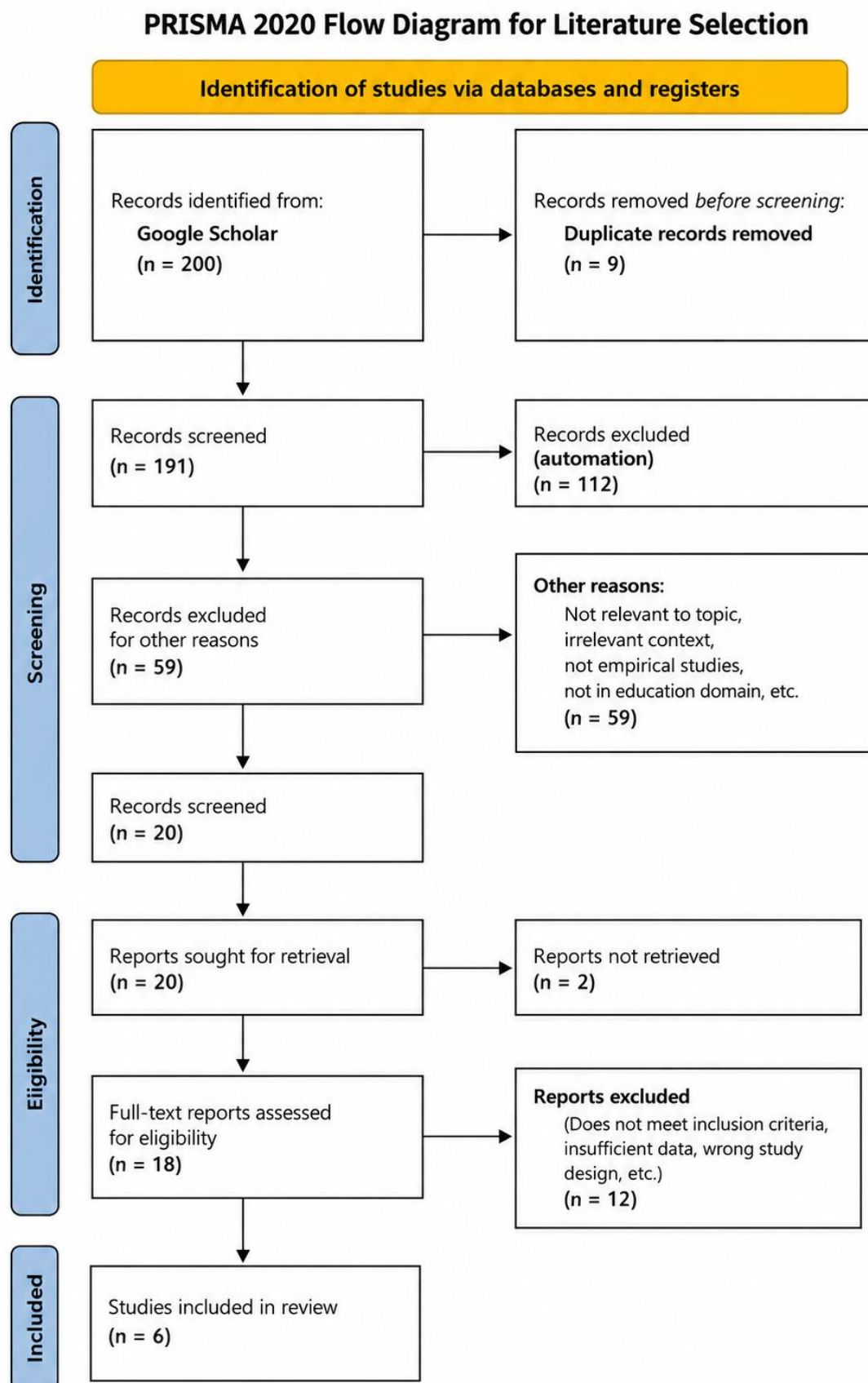


Figure 1. PRISMA 2020 Flow Diagram for Literature Selection

Data Extraction

Data from each included study were extracted using a standardized data extraction form developed in accordance with the objectives of the review. The extracted information included the authors, year of publication, country where the study was conducted, research design, study participants, instructional model, character values targeted, and the main findings. The data extraction process was carried out systematically to ensure that all included studies were analyzed using a consistent set of criteria.

Quality Assessment

The methodological quality of the included studies was evaluated using a set of predefined quality assessment criteria. The assessment considered five key indicators: (1) relevance to the review topic, (2) clarity of the research objectives, (3) transparency and appropriateness of the research methodology, (4) consistency between the findings and the stated research objectives, and (5) contribution to advancing character education in mathematics education. Only studies that satisfied all of these quality assessment criteria were included in the final synthesis.

Data Analysis

Data were analyzed using thematic analysis to identify, organize, and interpret recurring patterns across the included studies. Each study was read thoroughly before being systematically coded through three sequential stages: (1) open coding, in which meaningful concepts and initial categories were identified from the extracted data; (2) axial coding, where related codes were grouped into broader categories by examining their relationships; and (3) selective coding, in which the core themes were refined and integrated to develop a comprehensive synthesis of the findings. This analytical procedure enabled the identification of recurring themes concerning instructional models, character values, implementation challenges, and future research directions related to the integration of character education in mathematics education.

Following the coding process, the findings were synthesized and organized into several overarching themes to facilitate a comprehensive interpretation of the evidence. The final thematic structure comprised six major themes: (1) characteristics of the included studies, (2) publication trends, (3) research methods, (4) instructional models, (5) character values, (6) implementation challenges, and (7) future research directions.

This analytical approach enabled the development of a more comprehensive synthesis than merely describing the findings of individual studies, thereby facilitating the identification of cross-study patterns and overarching themes (Thomas & Harden, [2008](#)). The synthesized findings were subsequently presented through summary tables and a narrative synthesis to provide a clear and systematic interpretation of the research landscape concerning the integration of character education in mathematics education.

Result

Characteristics of Included Studies

Based on the selection process conducted in accordance with the PRISMA 2020 guidelines, six studies met all the predefined inclusion criteria and were included in the final qualitative synthesis. These studies were published between 2018 and 2026 and represented diverse contexts within mathematics education. Qualitative research was the most frequently employed methodological approach, while the remaining studies adopted quantitative, mixed-methods, and systematic review designs.

All included studies examined the integration of character education into mathematics education through various student-centered instructional models. Across the reviewed studies, the most frequently emphasized character values included responsibility, discipline, honesty, collaboration, critical thinking, creativity, religiosity, and communication. These findings indicate that the integration of character education in mathematics extends beyond the development of cognitive competencies by also fostering a broad range of personal and social attributes that are essential for twenty-first-century learning.

Table 2. Characteristics of Included Studies

Author	Year	Country	Research Design	Participant	Learning Model	Character Values	Main Findings
Fisher & Kusumah	2018	Indonesia	Quantitative	Preservice mathematics teachers	Blended Learning	Creativity, Hard Work, Communication	Blended learning improved students' character development.
Mahfudy et al.	2019	Indonesia	Literature Review	Literature	Character-based Mathematic Learning	Responsibility, Discipline, Honesty, Religious Values	Character values can be effectively integrated into mathematics learning.

Rahayu	2019	Indonesia	Experimental	High school students	Generative Learning	Hard Work, Critical Thinking	Generative learning improved both learning outcomes and character.
Rahayu et al.	2025	Indonesia	Qualitative	Elementary students	Character-based Learning	Responsibility, Discipline, Collaboration	Character integration enhanced students' participation and attitudes.
Musthofa et al.	2025	Indonesia	Systematic Literature Review	Literature	Ethnomathematics	Creativity, Curiosity, Responsibility	Ethnomathematics effectively supports character education in mathematics.
Nanda et al.	2026	Indonesia	Systematic Literature Review	Literature	Ethnomathematics	Critical Thinking, Creativity, Cultural Awareness	Ethnomathematics strengthens students' conceptual understanding and cultural character.

Publication Trends

The distribution of publications indicates a growing research interest in the integration of character education into mathematics education over recent years (Andiani, [2026](#)). During the 2018–2019 period, studies primarily focused on the development of character-based instructional models and conceptual discussions of character education in mathematics (Fisher, [2018](#)). In contrast, research published between 2024 and 2026 demonstrates a clear shift toward more systematic approaches, including systematic literature reviews, the integration of educational technologies, and the use of ethnomathematics as a pedagogical approach for fostering character development (Nanda et al., [2026](#)). This progression suggests that the field has evolved from establishing conceptual and instructional foundations toward exploring evidence-based syntheses and innovative instructional strategies for integrating character education into mathematics education.

This shift in research trends suggests that character education is no longer regarded as a supplementary component of mathematics education but rather as an integral element of the instructional process that supports the development of twenty-first-century

competencies (Rafiqoh, [2020](#)). This evolving perspective reflects an increasing recognition that mathematics education can simultaneously promote students' cognitive development and foster essential character attributes required for lifelong learning and active participation in society.

Research Methods

The analysis revealed considerable methodological diversity among the included studies. Qualitative research was the predominant approach, particularly in studies aimed at exploring the implementation of character education in mathematics education (Fauzan & Anshari, [2024](#)). These studies primarily employed literature reviews, classroom observations, interviews, and document analysis to gain an in-depth understanding of how character education was integrated into mathematics instruction (Qurotul, [2025](#)).

Quantitative approaches were employed to examine the effects of instructional models on students' character development and learning outcomes, primarily through experimental and quasi-experimental research designs (Tuanany & Triwiyanto, [2024](#)). These studies generated empirical evidence regarding the effectiveness of character-oriented instructional interventions by comparing learning outcomes and character-related indicators across different instructional conditions.

In addition, several studies adopted mixed-methods approaches to provide a more comprehensive understanding of students' character development by integrating quantitative evidence with qualitative insights (Mustaqim, [2016](#)). This methodological combination enabled researchers to examine not only the measurable outcomes of character-oriented instructional interventions but also the processes through which character values were developed within mathematics education.

The methodological diversity identified across the included studies indicates that research on the integration of character education in mathematics education has evolved not only in terms of instructional implementation but also in terms of research design and methodological rigor. This diversity reflects an increasing effort to investigate character education from multiple methodological perspectives, thereby providing a more comprehensive understanding of its implementation and educational impact.

Learning Models for Character Education

The analysis of the six included studies revealed several instructional models that were commonly employed to integrate character education into mathematics education.

Problem Based Learning (PBL)

Problem-Based Learning (PBL) emerged as one of the most frequently implemented instructional models for integrating character education into mathematics education. By engaging students in collaborative problem-solving activities based on authentic real-world situations, PBL provides meaningful opportunities to cultivate responsibility, communication, collaboration, and critical thinking skills (Rahman & Ramli, [2024](#)). These findings suggest that PBL supports not only students' mathematical understanding but also the development of essential character attributes through active participation and shared responsibility in the learning process.

Project Based Learning (PjBL)

Project-Based Learning (PjBL) was also identified as an effective instructional model for integrating character education into mathematics education. By engaging students in the completion of extended projects over a sustained period, PjBL fosters discipline, creativity, independence, and decision-making skills (Asidiqi, [2024](#)). The project-based nature of this approach encourages students to take ownership of their learning while developing both mathematical competencies and character attributes through authentic and collaborative learning experiences.

Generative Learning

Generative Learning was identified as another instructional model that supports the integration of character education into mathematics education. This approach encourages students to actively construct mathematical concepts by building on their prior knowledge through exploration, thereby fostering curiosity, perseverance, and reflective thinking (Fauzan & Anshari, [2024](#)). By emphasizing learners' active engagement in knowledge construction, Generative Learning promotes both conceptual understanding and the development of positive character attributes that are essential for meaningful mathematics learning.

Blended Learning

Blended Learning also emerged as an instructional approach that facilitates the integration of character education into mathematics education. By combining face-to-face instruction with digital learning technologies, this approach provides students with opportunities to engage in self-directed learning while fostering greater responsibility for their own learning process (Taulabi et al., [2002](#)). The flexibility afforded by Blended Learning enables students to develop learning autonomy and self-regulation, thereby reinforcing character values that support lifelong learning.

Ethnomathematics

The ethnomathematics approach was also identified as an effective strategy for integrating character education into mathematics education. By connecting mathematical concepts with local cultural practices and contexts, this approach enhances students' conceptual understanding while fostering character values such as nationalism, religiosity, tolerance, and appreciation for cultural diversity (Nanda et al., [2026](#)). These findings suggest that ethnomathematics not only promotes meaningful mathematics learning but also reinforces students' cultural identity and social awareness through contextually relevant learning experiences.

Character Values Developed

The synthesized findings revealed that the most frequently developed character values across the included studies were:

Table 3. Characteristics of Included Studies

Character Value	Frequency
Responsibility	6
Discipline	5
Critical Thinking	5
Creativity	5
Collaboration	4
Honesty	3
Curiosity	3
Cultural Awareness	2
Religious Values	2

Responsibility emerged as the most prominent character value across the included studies, as nearly all instructional approaches positioned students at the center of the learning process. This student-centered orientation requires learners to take

responsibility for both their learning processes and learning outcomes, thereby reinforcing accountability and active engagement throughout mathematics instruction.

Implementation Challenges

Despite the generally positive findings reported across the included studies, the implementation of character education in mathematics education continues to face several important challenges. First, teachers' competencies in integrating character values into mathematics instruction remain inconsistent, resulting in variations in the quality and effectiveness of classroom implementation (Musthofa et al., [2025](#)). Second, the absence of standardized instruments for assessing character development limits the objectivity and consistency of evaluating character education outcomes (Sihab et al., [2026](#)). Third, insufficient institutional support, including school-level initiatives and educational policies, hinders the sustainable implementation of character education within mathematics classrooms (Syahra et al., [2025](#)). Finally, most existing studies have been conducted on a relatively small scale, thereby limiting the generalizability of their findings across broader educational contexts (Rahayu et al., [2025](#)).

These challenges highlight the need for stronger teacher professional development, more robust character assessment frameworks, greater institutional commitment, and large-scale empirical studies to strengthen the implementation and evidence base of character education in mathematics education.

Research Gaps

The synthesis of the six included studies revealed several important research gaps that warrant further investigation. First, most studies focused on assessing only one or two character values, providing a limited understanding of students' holistic character development. Second, longitudinal research examining the sustained development of students' character over time remains scarce, restricting insights into the long-term effectiveness of character education interventions. Third, empirical studies investigating the integration of Artificial Intelligence (AI), digital learning, and character education within mathematics education are still limited, despite the increasing adoption of educational technologies in contemporary classrooms. Finally, systematic literature reviews addressing the integration of character education into mathematics education remain scarce, highlighting the need for more comprehensive evidence syntheses that

encompass broader databases, diverse educational contexts, and a wider range of instructional approaches.

Discussion

The findings of this Systematic Literature Review indicate that the integration of character education into mathematics education makes a meaningful contribution to the development of both students' cognitive and affective competencies (Mahfudy et al., [2019](#)). These findings reinforce the view that mathematics education extends beyond the acquisition of conceptual knowledge and procedural skills, serving as a meaningful context for character development through problem-solving, collaboration, communication, and reflective learning activities (Witraguna et al, [2026](#)). Such learning experiences enable students to develop not only mathematical proficiency but also essential character values that support their academic, personal, and social development.

Effectiveness of Instructional Models in Fostering Character Development

The synthesis findings indicate that Problem-Based Learning (PBL) is the instructional model most consistently associated with the development of character values in mathematics education (Aditya, [2023](#)). This finding can be attributed to the student-centered nature of PBL, which engages learners in authentic real-world problems that must be addressed through both independent inquiry and collaborative problem-solving (Irawan, [2024](#)). Throughout this process, students develop responsibility for their learning tasks, respect for others' perspectives, effective communication skills, and the ability to make well-reasoned decisions. Consequently, PBL creates meaningful learning experiences that simultaneously promote mathematical understanding and character development.

These findings are consistent with constructivist learning theory, which posits that knowledge is actively constructed through meaningful learning experiences (Utami, [2026](#)). When students actively engage in solving authentic problems, they not only develop a deeper understanding of mathematical concepts but also cultivate character values such as discipline, collaboration, and critical thinking. This process enables cognitive and character development to occur simultaneously, as students construct knowledge through interaction, reflection, and shared learning experiences.

In addition to Problem-Based Learning (PBL), Project-Based Learning (PjBL) also demonstrated strong potential for fostering character development in mathematics education. Unlike PBL, which primarily emphasizes problem-solving, PjBL focuses on the design and completion of meaningful projects or tangible products (Triana et al., [2026](#)). This process requires students to manage their time effectively, collaborate with peers, assume responsibility for project outcomes, and demonstrate creativity throughout the learning process. Consequently, PjBL provides authentic learning experiences that integrate mathematical knowledge with the development of essential character values and twenty-first-century competencies, making it a highly relevant instructional model for contemporary mathematics education (Rahayu et al., [2025](#)).

The Role of Ethnomathematics in Character Education

The synthesis findings further indicate that the ethnomathematics approach offers a distinctive contribution to character education compared with other instructional approaches. Integrating local cultural knowledge and practices into mathematics instruction not only enhances students' conceptual understanding but also strengthens cultural identity, nationalism, tolerance, and appreciation for cultural diversity (Musthofa et al., [2025](#)).

This contribution can be explained by the contextual nature of ethnomathematics, which enables students to learn mathematical concepts through authentic situations that are closely connected to their cultural and everyday experiences. As a result, learning becomes more meaningful, allowing students to recognize mathematics as an integral part of the social and cultural practices of their communities rather than as an abstract body of knowledge (Nanda et al., [2026](#)).

Furthermore, these findings are consistent with the current direction of educational policy in Indonesia, which emphasizes the preservation of local cultural heritage alongside the development of students' character through the Pancasila Student Profile framework (Nanda et al., [2026](#)). Consequently, ethnomathematics represents not only an effective pedagogical approach for improving mathematical learning but also a strategic means of promoting culturally responsive character education.

Why Responsibility Emerged as the Most Prominent Character Value

One of the most significant findings of this review is the prominence of responsibility as the character value most consistently reported across the included studies. This pattern suggests that the majority of instructional models implemented in mathematics education adopt a student-centered approach, positioning learners as active participants in the learning process rather than passive recipients of knowledge. As a result, students are encouraged to take ownership of their learning, assume responsibility for completing academic tasks, and actively engage in collaborative and reflective learning activities.

Through collaborative discussions, project-based activities, presentations, and problem-solving tasks, students are encouraged to take responsibility for their own learning processes and outcomes (Mahfudy et al., [2019](#)). Such learning experiences require learners to demonstrate accountability, actively participate in group activities, and make informed decisions throughout the learning process. Responsibility also appears to serve as the foundation for the development of other character values, including discipline, collaboration, and academic integrity (Rahayu et al., [2025](#)). In this regard, responsibility may be regarded as a core character value that supports and reinforces the development of other positive character attributes within mathematics education.

Challenges in Implementing Character Education in Mathematics Education

Although the synthesized studies consistently reported positive outcomes, the implementation of character education in mathematics education continues to face several important challenges. These challenges suggest that translating character education into classroom practice remains a complex process that requires coordinated pedagogical, institutional, and assessment-related support.

First, many teachers still lack the pedagogical competence required to design instructional materials and learning activities that explicitly integrate character education objectives. Consequently, character values are often embedded implicitly within classroom practices without being supported by well-defined instructional strategies or systematic assessment procedures (Joko, [2025](#)). This limits teachers' ability to intentionally foster and monitor students' character development throughout the learning process.

Second, the reviewed studies highlight the limited availability of valid and reliable instruments for assessing students' character development. Character assessment continues to rely primarily on classroom observations, making evaluation outcomes highly dependent on teachers' subjective judgments and potentially reducing the consistency and credibility of assessment results (Sihab, [2026](#)).

Third, institutional support plays a crucial role in the successful implementation of character education. Effective implementation requires consistent school policies, a school culture that reinforces character values, and sustained collaboration among teachers, parents, and the wider community to ensure that character development extends beyond classroom instruction (Rohyana, [2024](#)). These findings indicate that character education should be viewed not solely as a classroom responsibility but as a whole-school effort supported by multiple educational stakeholders.

Theoretical and Practical Implications

The findings of this review have several important implications for both theory and educational practice. From a theoretical perspective, this review enriches the literature on the integration of character education in mathematics education by synthesizing evidence on instructional models, character values, and implementation challenges reported across the included studies. The synthesis provides a comprehensive understanding of how different pedagogical approaches contribute to character development and identifies key areas that require further investigation, thereby offering a foundation for future research in this field.

From a practical perspective, the findings suggest that mathematics teachers may adopt student-centered instructional approaches, such as Problem-Based Learning (PBL), Project-Based Learning (PjBL), and ethnomathematics, as effective strategies for simultaneously promoting students' mathematical learning and character development (Agusdianita, [2023](#)). These approaches create meaningful learning experiences that encourage responsibility, collaboration, critical thinking, and respect for cultural diversity.

For curriculum developers and educational policymakers, the findings provide evidence to support the systematic integration of character education into curriculum design, instructional materials, and assessment frameworks. Developing explicit character

indicators alongside academic learning objectives may facilitate more consistent implementation and evaluation of character education within mathematics classrooms.

Study Limitations

This review has several limitations that should be acknowledged when interpreting its findings. First, although this review included studies indexed in Google Scholar, Scopus, and SINTA, it is possible that relevant studies available in other databases, such as Web of Science, ERIC, and Dimensions, were not identified. Consequently, the evidence synthesized in this review may not fully represent the entire body of literature on character education in mathematics education.

Second, the number of studies that met the inclusion criteria was relatively limited. While these studies provide valuable insights into current research trends, the findings should be interpreted with caution and may not fully capture the diversity of research conducted across different educational contexts and countries.

Third, this review employed a thematic synthesis approach rather than a quantitative meta-analysis. As a result, it was not possible to estimate the magnitude of the effects of individual instructional models on character development or to statistically compare their effectiveness across studies.

These limitations also suggest directions for future research. Subsequent reviews could expand the range of databases searched, include a larger and more internationally diverse body of literature, and employ meta-analytic techniques where sufficient empirical evidence is available to provide more robust estimates of the effectiveness of instructional approaches in fostering character development.

Future Research

Future research should broaden the scope of literature searches by incorporating a wider range of international databases to ensure a more comprehensive representation of research on character education in mathematics education. Expanding the evidence base across diverse educational contexts would also strengthen the generalizability of future review findings.

In addition, future studies should focus on developing and validating robust instruments for assessing students' character development, enabling more reliable and consistent

evaluation across educational settings. Where sufficient empirical evidence is available, future reviews are also encouraged to employ meta-analytic techniques to quantify the effect sizes of different instructional approaches and compare their relative effectiveness in fostering character development.

Furthermore, given the rapid advancement of educational technologies, future research should explore the integration of digital technologies, artificial intelligence (AI), and adaptive learning systems into character education within mathematics education (Noorbaiti et al., [2025](#)). Investigating how these technologies can support both students' cognitive development and character formation may provide valuable insights for designing innovative and culturally responsive mathematics learning environments.

Conclusion

This study aimed to synthesize research on the integration of character education into mathematics education through a Systematic Literature Review (SLR) following the PRISMA 2020 guidelines. Based on the analysis of six studies that met the inclusion criteria, the findings suggest that mathematics education has considerable potential to foster students' character development when instructional activities are designed using student-centered learning approaches.

The review identified several instructional approaches that are commonly used to integrate character education into mathematics education, including Problem-Based Learning (PBL), Project-Based Learning (PjBL), Generative Learning, Blended Learning, and ethnomathematics. Beyond enhancing students' mathematical understanding, these approaches contribute to the development of a wide range of character values, including responsibility, discipline, honesty, collaboration, creativity, curiosity, critical thinking, and appreciation for local culture.

Among these character values, responsibility emerged as the most consistently emphasized across the reviewed studies. This finding indicates that mathematics learning environments that actively engage students in problem-solving, collaborative discussions, project work, and reflective learning encourage students to take ownership of both their learning processes and academic responsibilities, thereby fostering responsibility as a foundational character value.

Despite these positive findings, several challenges continue to hinder the effective implementation of character education in mathematics education. These include

teachers' limited pedagogical competence in explicitly integrating character values into instructional practices, the lack of standardized and validated instruments for assessing character development, and insufficient institutional support through consistent educational policies and school cultures that reinforce character education.

This review contributes to the literature by providing a comprehensive synthesis of research on the integration of character education in mathematics education, encompassing research characteristics, instructional approaches, character values, implementation challenges, and future research priorities. The findings offer valuable insights for teachers, researchers, curriculum developers, and educational policymakers seeking to design mathematics learning environments that promote not only academic achievement but also students' holistic character development in response to the demands of twenty-first-century education.

Future research should broaden the scope of literature searches by incorporating additional international databases, such as Web of Science, ERIC, and Dimensions, to provide a more comprehensive synthesis of the available evidence. Furthermore, future studies should prioritize the development and validation of reliable character assessment instruments and employ meta-analytic approaches to quantify and compare the effectiveness of different instructional models in fostering students' character development.

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