Systematic Literature Review: Character Education Approach to Improve Students' Creative Thinking Skills in Mathematics Learning

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Abstract

This study aims to explore the character education approach in improving students' creative thinking skills in mathematics learning through a systematic literature review (SLR). The method used follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) stage, starting with the identification of 500 articles published in Indonesian scientific journals between 2010 and May 2025. After a screening and inclusion process, 50 relevant articles were selected for in-depth analysis. These articles are grouped based on research approaches, educational context, learning outcomes, theories used, types of interventions, and evaluations and assessments applied. The results of the study show that integrating character education into mathematics instruction significantly enhances students' creative thinking skills. Approaches used in the intervention include character development, collaborative learning, and project-based learning. Character education, with an emphasis on moral and ethical values, has been shown to strengthen students' creativity in solving math problems. These findings underscore the need to develop learning models that effectively combine character education theory with creativity. In addition, it is recommended to conduct further research exploring the relationship between character education and increased creative thinking, particularly in the context of mathematics learning, future research should focus on developing instructional tasks that foster creative thinking within the framework of character education. Longitudinal studies are recommended to assess the lasting impact of such interventions. Additionally, there is a need for more holistic evaluation methods that capture not only academic achievement but also the integrated development of students' character and creativity. This study contributes to the advancement of innovative and effective educational practices by highlighting the central role of creative thinking in mathematics education.

Keywords

Character Education, Creative Thinking, Educational Interventions, Holistic Evaluation, Mathematics Learning, Systematic Literature Review.

Introduction

Education is one of the main pillars in the development of quality human resources (Arifudin et al., 2024; A. Manurung & Marini, 2023b; Starko, 2021; Sukmawati et al., 2023). In

education, the ability to think creatively is one of the most important competencies for students to possess (Aditya, A. Y., 2023; Firdaus, 2023; Fitrofa & Peni, 2024; Kampylis, Panagiotis; Berki, 2014). This ability not only contributes to academic achievement, but also prepares students to face challenges in the real world that are increasingly complex and dynamic (Aditya, 2024; Fitriani & Yahfizham, 2024; Mcfadzean, 1998; Rahmawati et al., 2023). In mathematics learning, creative thinking skills are indispensable for solving problems, developing strategies, and finding innovative solutions.

Mathematics, as a foundational subject, plays a critical role in education (Avcı & Durak, 2023; Faizah et al., 2023; Juwita et al., 2024; Setiadi et al., 2024). In addition to being a tool to understand scientific and technological concepts, mathematics also trains students to think logically, analytically, and systematically (Aditya, A. Y., 2023; Nasution, 2018; Rahman et al., 2023; Suherman & Vidákovich, 2022). However, many students have difficulty in developing their creative thinking skills, especially in math subjects. This can be due to the conventional approach to learning, where the focus is on mastering concepts and procedures without leaving room for exploration and creativity Monotonous, rote-based instruction in mathematics often inhibits students from engaging in divergent thinking.

Student character, which includes values, attitudes, and behaviors, plays an important role in the learning process (Anggie Yudistira Aditya, 2024; Niar, 2023; Niswah, 2024). Students who have good character, such as curiosity, courage to take risks, and perseverance, tend to be better able to develop creative thinking skills (Ayyubi & Rohmatulloh, 2023; Manurung, 2023). Character education can help students to build a positive attitude towards learning, encourage them to innovate, and dare to try new approaches to solving mathematical problems (Nugraha, 2023). By integrating character education in math learning, it is hoped that students can be more motivated, risk-taking, and more open to new ideas, all of which are important elements of creative thinking.

Although numerous studies have explored character education (Lickona, 2012; Sawyer, 2015) and creative thinking skills (Torrance, 2018) as separate constructions, limited research has investigated the intersection between the two, particularly within the context of mathematics learning(Aditya, 2024; Yudistira, 2023). Most existing literature tends to treat character development and creativity as isolated domains, without examining how

character-based interventions may influence students' ability to think creatively in mathematical problem-solving contexts.

This indicates a clear gap in the literature, where there is a lack of integrative studies that address how character education can be systematically incorporated into mathematics instruction to enhance students' creative thinking. Moreover, prior studies seldom adopt a comprehensive analytical framework that synthesizes both domains through a structured and methodical lens.

To address this gap, the novelty of this study lies in its focus on mapping and analyzing the relationship between character education and creative thinking skills specifically within mathematics education using a Systematic Literature Review (SLR) approach. This method allows for a structured synthesis of existing studies, categorization of relevant themes, and identification of effective educational strategies.

Therefore, the aim of this study is twofold: (1) to identify and classify existing approaches to character education that have potential relevance for enhancing creativity, and (2) to explore how these approaches can be meaningfully applied in mathematics learning to foster students' creative thinking skills. The findings are expected to contribute to the development of more innovative and integrative instructional models, while also laying the groundwork for future empirical research on the synergy between character education and creativity in mathematics education.

Methods

This research focuses on previous findings from various articles that have been published in scientific journals in Indonesia in the field of mathematics education, especially regarding the character education approach to improve students' creative thinking skills. The method used is a systematic literature review (SLR) by following the stages in the flowchart Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) (McKenzie, 2018).

In the first stage the initial search identification 500 article using the Publish or Perish device with the keywords "character education", "creative thinking ability", and "mathematics education" for the period 2010 to 2025. From these search results, the title of the article and abstract that correspond to the context of mathematics education are selected. In the

second stage, the screening, classified based on the suitability of the title used, resulted in 400 articles from reputable journals. Instead of relying solely on the number of citations, this study employed a recognized quality appraisal method (McKenzie, 2018) to assess the relevance and rigor of each article. Through this rigorous screening process, 100 articles met the established criteria for quality and relevance. In the third stage, inclusion, 50 of these

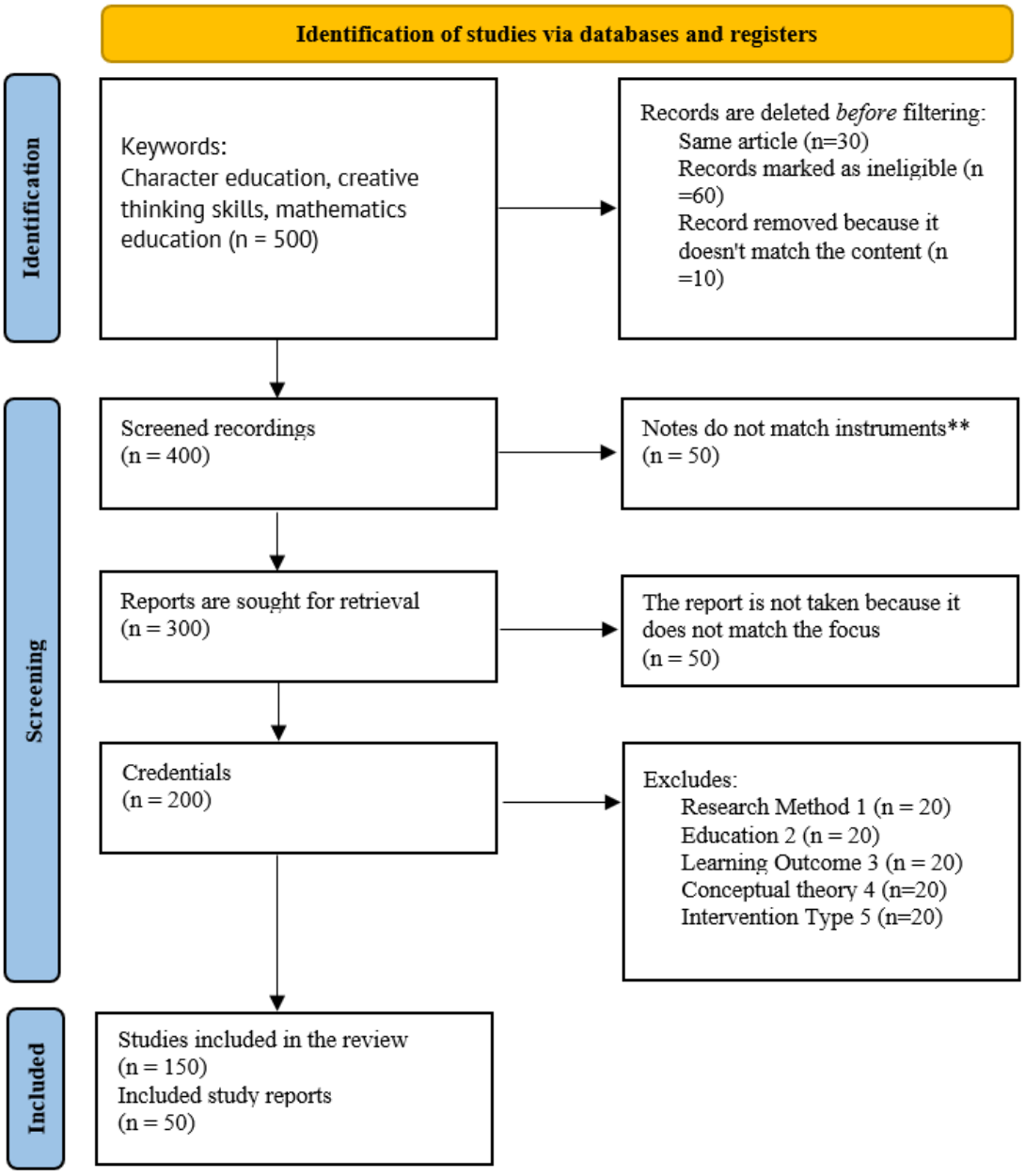

Figure 1 Flowchart of Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)

Articles—those that are openly accessible and most pertinent—were selected for further detailed analysis. These articles are then grouped based on several categories, namely research approaches that include qualitative (in-depth interviews and *Focus Group*

Discussions) and quantitative (surveys and experimental trials), educational contexts (formal contexts such as elementary, junior high, high school, and non-formal contexts such as teacher training programs), and learning outcomes that include creative thinking skills and academic achievement. In addition, the theory or conceptual framework used includes character education theory and creativity theory, as well as types of interventions that include curricular and pedagogical interventions. Evaluation and assessment are carried out through formative and summative evaluations to assess the impact of character education on creative thinking skills as shown in Figure 1.

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Data Sources

The data used in this study was obtained through the Publish or Perish software, which allows researchers to identify and collect relevant scientific articles through Google Scholar-based searches. The search process began by entering the keywords 'character education', 'creative thinking ability', and 'mathematics education', which were chosen for their relevance to the research topic. From the search results, The researchers identified 500 articles published in scientific journals between 2010 and May 2025, as shown in Figure 2. The articles are then screened for relevance, journal quality, and accessibility to ensure that

only articles that meet those criteria are used in the analysis as shown in Figure 2. Include a table or explanation of: Language criteria, Journal indexation SINTA, Exclusion of duplicates, non-peer-reviewed sources, Peer-review status, and Quality appraisal SLR tools.

Research Instrument

The instrument was developed to systematically classify and analyze relevant studies across

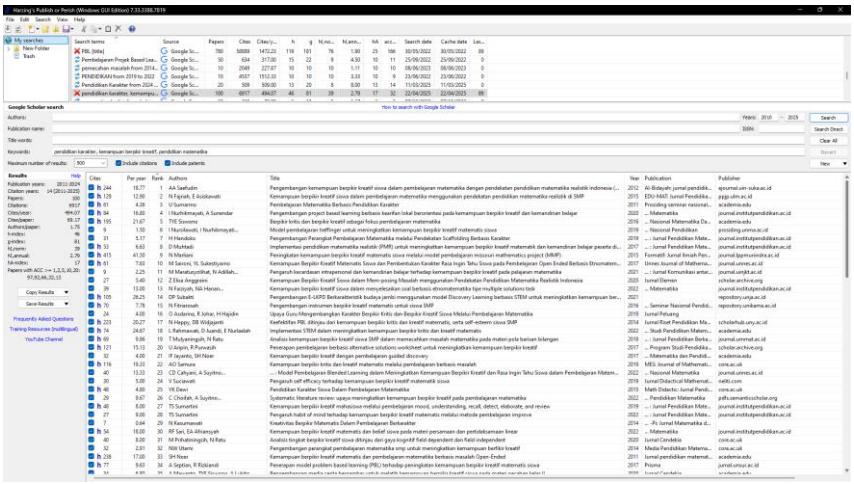

Figure 2 Publish or Perish *Assisted Article Search*

multiple dimensions. in the development of students' character and creative thinking skills through various aspects related to approaches, contexts, theories, interventions, and evaluations in mathematics learning. The first aspect is the research approach, which includes different types of approaches such as quantitative, qualitative, mixed methods, experimental, quasi-experimental, descriptive, case studies, class actions, grounded theory, and phenomenology. These approaches provide flexibility for researchers to tailor research designs according to the objectives and studies, as well as provide deeper insights into the topic being studied. The second aspect is the educational context, which includes the level of education from elementary school (SD) to college. In education, this instrument is applied at various levels of formal education, influencing the learning approaches and strategies applied at each level (Hayaturraiyan, 2022). The third aspect focuses on learning outcomes, which includes measuring students' creative thinking abilities through divergent and convergent thinking measurements, as well as students' math scores before and after the intervention. This is an indicator of the success of learning strategies in improving students' creative thinking skills. The fourth aspect is the theory or conceptual framework, which is the basis for this research.

The theoretical frameworks used include character education theory, character development, as well as creativity theory and creativity psychology. These theories provide a solid basis for the design of instruments to ensure that the interventions carried out are in accordance with the moral and ethical values that are intended to be developed in students. Furthermore, aspects of the type of intervention involve various approaches such as the integration of character education in the curriculum, the development of learning modules, collaborative teaching methods, and project-based learning. This intervention aims to create a learning environment that supports the development of students' creative thinking and motivates students to be more active in the learning process. Finally, the evaluation and assessment aspects include formative and summative evaluation, assessment of the learning process, and feedback from teachers and students. This evaluation is important to assess the effectiveness of learning and its impact on student character development, where constructive feedback is needed to ensure that learning focuses not only on academic achievement, but also on the development of students' character and creativity. By integrating these various aspects and categories, this research instrument aims to provide a systematic tool in collecting valid and reliable data, in accordance with the focus of the study on character education and the improvement of students' creative thinking skills in mathematics learning.

Table 1 Research Instruments

No	Aspects	Category	
1.	Research Approach	1. Quantitative 2. Qualitative 3. Mixed Methods 4. Experimental 5. Quasi-Experimental	6. Descriptive 7. Case Studies 8. Class Action 9. Grounded Theory 10. Phenomenology
2.	Education	1. Elementary School (SD) 2. Junior High School (SMP)	3. Senior High School (SMA) 4. Universitas
3.	Learning Outcomes	1. Creative Thinking Skills 2. Divergent Thinking Measurement 3. Convergent Thinking Measurement	4. Math Scores Before and After the Intervention 5. Learning Outcomes
6.	Theory/Conceptual Framework	1. Character Education Theory 2. Moral and Ethical Values 3. Character Development	4. Creativity Theory 5. Creativity Theory 6. Constructivist Learning
7.	Types of Interventions	1. Character Education Integration 2. Learning Module Development	3. Collaborative Teaching Methods 4. Project-Based Learning

8.	Evaluation and Assessment	1. Formative Evaluation 2. Learning Process 3. Feedback from Teachers and Students	4. Summative Evaluation 5. The Impact of Character Education

Data Analisis

Each article that has been found is classified based on a predetermined category based on a predetermined aspect with the note that each article must meet each predetermined category. This decision-making is based on every piece of information contained in the abstract, research method, discussion, and research results. Furthermore, The selected data were analyzed using content analysis to identify key themes and patterns. The results were then synthesized and presented in the form of a bar chart to visually illustrate the distribution of these themes across the studies. So that data can be obtained systematically, transparently and documented in detail.

Results

Research Methods

The analysis reveals significant variation in the research methods employed to study character education and the enhancement of students' creative thinking skills. Quasi-experimental designs dominate the field, utilized by 60 researchers, indicating a strong preference for assessing character education interventions in practical, real-world settings. Experimental methods follow closely, with 40 studies applying rigorous hypothesis testing to establish causal relationships. The qualitative descriptive approach, adopted by 35 researchers, highlights a commitment to exploring the lived experiences of students and teachers. Classroom action research, used in 25 studies, demonstrates efforts to iteratively improve teaching practices through reflection. Quantitative and qualitative approaches were also applied by 15 and 10 researchers, respectively, enriching the field with both numerical data and in-depth narratives. Although mixed methods were less common, with only 8 studies, this approach shows promise in combining the strengths of quantitative and qualitative paradigms. Meanwhile, case studies, phenomenology, and grounded theory were rarely used, each represented by only a handful of studies. Overall, these patterns suggest a predominant focus on measurable, evidence-based evaluations through quasi-

experimental and experimental methods, while qualitative designs remain crucial for contextual understanding.

Education Level

Research on character education and creative thinking skills predominantly focuses on the secondary education level. Junior High School (SMP) accounts for the largest share with 60 studies, followed by Senior High School (SMA) at 55 studies. Primary Schools (SD) contribute 50 studies, while Higher Education has the fewest, with 35 studies. This distribution indicates a greater emphasis on character education interventions during adolescence, possibly due to the developmental significance of this stage, while suggesting a need to increase research attention in higher education.

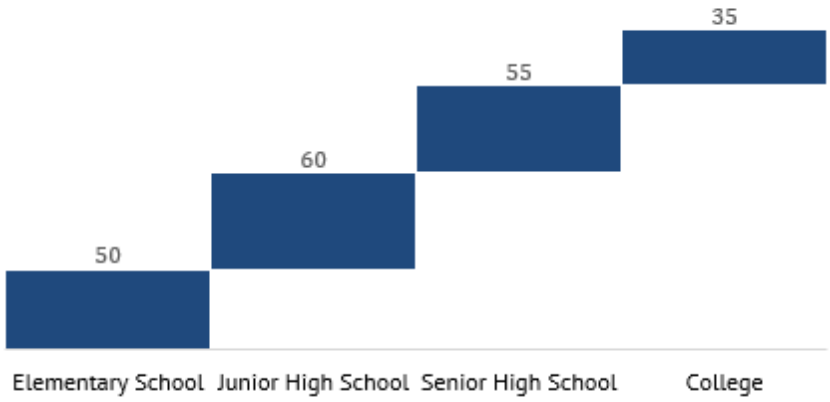

Figure 3 Education Levels

Measured Learning Outcomes

The findings demonstrate a strong emphasis on creative thinking skills, with 90 articles focusing on this key learning outcome. Further analysis reveals 35 studies measuring divergent thinking and 20 assessing convergent thinking, underscoring the multidimensional nature of creativity. Additionally, 30 articles evaluated math scores pre- and post-intervention, and 25 studies reported comparative learning outcomes, reflecting efforts to quantify the educational impact of character education. These results suggest that while creativity remains the central focus, researchers also attend to academic achievement and various cognitive processes influenced by character education.

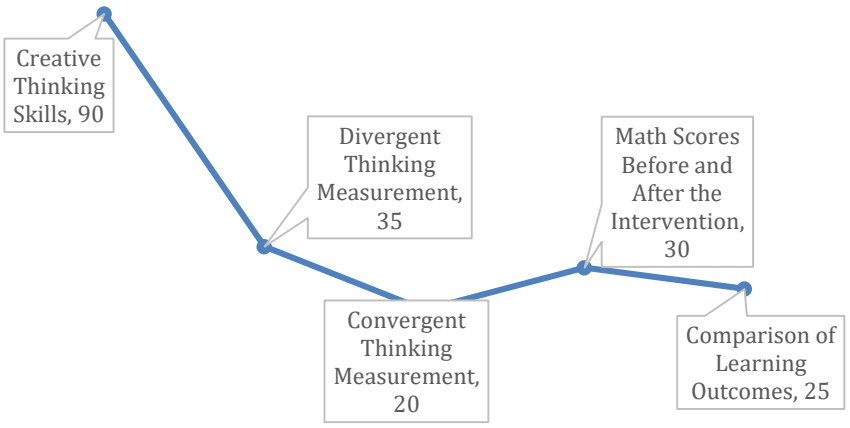

Figure 4 Learning Outcomes

Conceptual Framework

Character education theory emerges as the dominant conceptual framework, discussed in 60 articles, underscoring its foundational role in this research area. Complementing this, 40 articles focus on character development, and 30 address moral and ethical values,

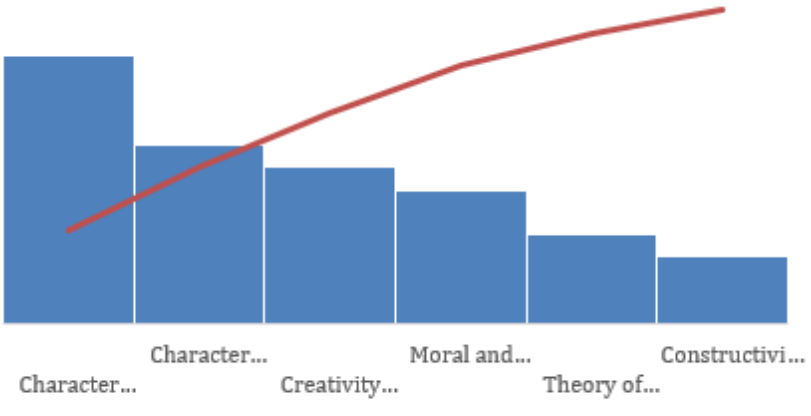

Figure 5 Conceptual Framework

highlighting the moral underpinnings of education. Creativity theory and creativity psychology are examined in 35 and 20 articles respectively, while constructivist learning theory appears in 15 studies. This theoretical diversity suggests an integrative approach, where moral, cognitive, and constructivist perspectives jointly inform the development of students' creative thinking abilities.

Types of Interventions

Integration of character education stands out as the most frequently applied intervention, featured in 70 articles, which illustrates a strong emphasis on embedding character values within learning processes. Learning module development is also prominent, with 50 studies creating structured resources to support instruction. Collaborative teaching methods, reported in 45 articles, emphasize interactive and cooperative learning environments. Project-based learning, cited in 35 studies, reflects an experiential approach that actively engages students in skill development. Together, these interventions reveal a multifaceted effort to enhance creativity through both content and pedagogical strategies.

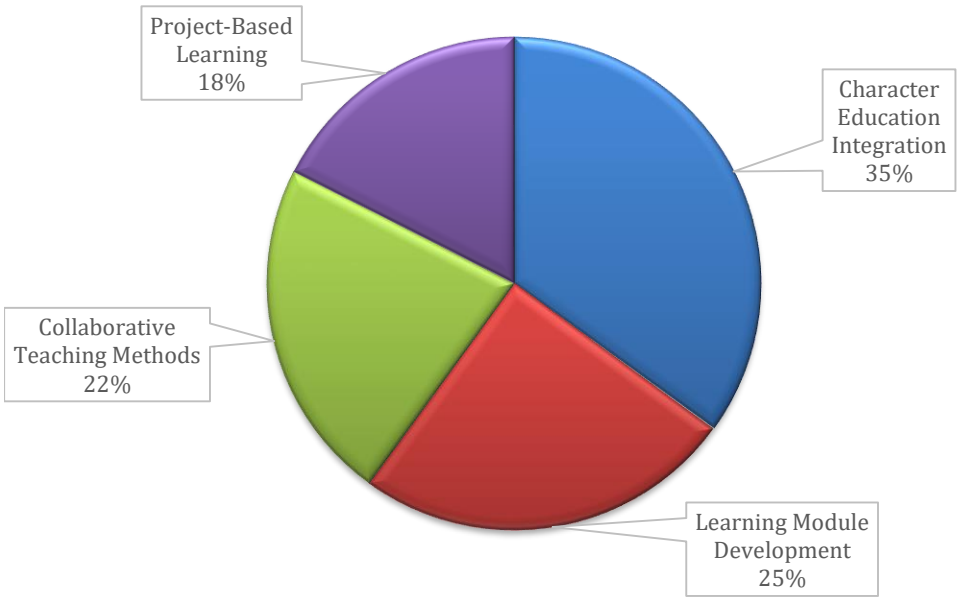

Figure 6 Types of Intervention

Evaluation and Assessment

Evaluation practices within these studies show a balanced concern across multiple dimensions. Forty articles address formative evaluation, the learning process, and feedback from teachers and students, indicating continuous monitoring and reflective practices. Summative evaluation and the broader impact of character education are also covered by 40 studies each, highlighting the importance of assessing overall effectiveness. This comprehensive focus on evaluation demonstrates researchers' intent to rigorously assess both the implementation and outcomes of character education interventions, thereby

Figure 7 Types of Intervention

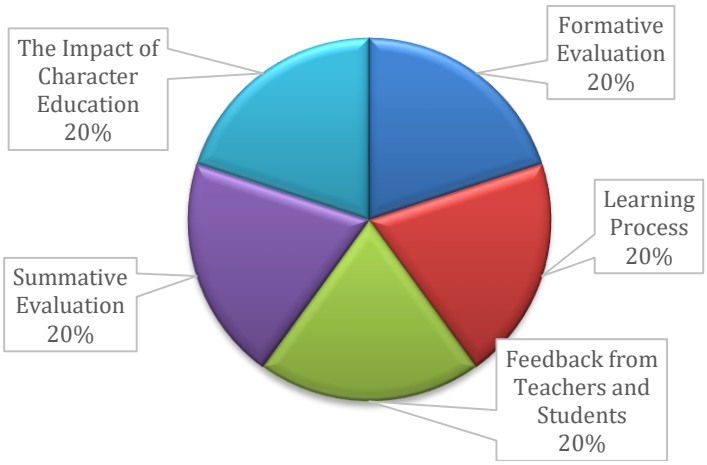

Figure 8 Evaluation and Assessment

contributing to evidence-based improvements in educational practice.

Discussion

Methodological Tendencies and Gaps

The analysis reveals that the quasi-experimental method dominates research on character education and creative thinking skills, with 60 studies employing this approach to evaluate intervention effectiveness in real but controlled learning environments. Experimental methods (40 studies) rigorously test causal relationships, while qualitative descriptive studies (35) provide deep insights into learners' experiences. Classroom action research (25 studies) reflects teachers' reflective practices aimed at improving instruction. Meanwhile, purely quantitative and qualitative methods were used by 15 and 10 studies, respectively, illustrating systematic numerical and narrative data collection efforts. Although mixed

methods appear less frequently (8 studies), their potential to produce comprehensive findings by combining quantitative and qualitative strengths is promising. However, in-depth exploratory approaches like case studies, phenomenology, and grounded theory remain scarce despite their value in contextualizing value internalization. This suggests a need for future research to adopt more mixed methods and deepen qualitative explorations to provide richer, contextualized understandings. Strengthening the design quality of quasi-experimental studies and enhancing classroom action research implementation is crucial for both researchers and practitioners. Capacity building through training and cross-disciplinary collaboration will help align methodological choices with research objectives rather than trends.

Developmental Appropriateness and Educational Levels

Most research focuses on junior high school (SMP) students (60 studies), followed closely by senior high school (SMA) (55 studies) and elementary school (SD) (50 studies), with the fewest studies at the tertiary level (35). This distribution highlights the strategic emphasis on adolescence as a critical period for identity formation and the development of complex thinking skills. Adolescence presents social and academic challenges making character education and creative thinking development highly relevant. Elementary education remains important as a foundational stage for habit and value formation, though its focus on higher-order thinking is less intensive. University-level research remains limited, possibly due to assumptions that foundational character formation is mostly complete and learners are more autonomous. Yet, the increasing complexity of ethical and critical challenges in higher education underlines the need for expanded research at this level. Future longitudinal studies tracing character and creativity development across educational stages are recommended to provide a holistic, sustainable understanding. Moreover, tailoring interventions to developmental characteristics per educational level can enhance program effectiveness.

Integration of Theory and Practice

Character education theory emerges as the predominant framework (60 articles), underscoring its central role in shaping attitudes and behaviors conducive to creative

thinking. Research also pays considerable attention to moral and ethical values (70 articles combined), foundational for fostering critical and creative thinking. Creativity theory (35 articles) and psychology of creativity (20 articles) further contribute to understanding the creative process. Constructivist learning theory (15 articles) connects creativity development to active, student-centered knowledge construction. These findings affirm the interrelated nature of character and creativity development. However, current studies often treat these theories separately. There is a pressing need to explicitly integrate character education and creativity theories into cohesive learning designs that simultaneously nurture both domains. Longitudinal research could evaluate the sustained impact of such integration, while practical learning models should be developed that embed these theoretical insights into diverse educational contexts.

Assessment and Feedback in Character-Based Learning

Research shows balanced attention to formative and summative evaluation, learning processes, and feedback from teachers and students (about 40 articles each). This indicates a comprehensive effort to understand and measure the effectiveness of character education within learning contexts. Formative and summative assessments help monitor student progress continuously, while feedback mechanisms foster constructive dialogues that improve learning quality. Studies highlighting the impact of character education on academic and social outcomes emphasize the value of character development beyond cognitive gains. However, deeper exploration is needed on how feedback influences student motivation and creativity, and how assessment practices can better support character development. Future research should explore optimized evaluation models that simultaneously address academic achievement, character formation, and creative skill growth.

Conclusion

Based on the results of this literature review, it can be concluded that the integration of character education into mathematics learning demonstrates a consistent positive impact on students' creative thinking skills. The findings indicate that character education—when

centered on moral values, ethics, and social competence—can significantly enhance students' divergent and convergent thinking, both of which are essential for solving mathematical problems creatively. This impact is supported by empirical evidence from diverse intervention models, such as the incorporation of character values in instructional modules, collaborative teaching methods, and project-based learning frameworks.

This review contributes to the academic field by offering a comprehensive synthesis of how character education frameworks can be operationalized to support mathematical creativity, particularly in middle-school contexts in Indonesia. While existing interventions show promise, there remains a need for more robust investigations into the long-term influence of character education on creative thinking development, especially within mathematics.

Moreover, the current body of literature reveals an imbalance in educational level coverage. Most studies are concentrated at the secondary level, while research at the elementary and higher education levels remains scarce. Future research should address this gap by exploring character-based mathematics learning across a broader educational spectrum. It is also recommended that future studies develop holistic instructional models that integrate theoretical foundations of character and creativity education with practical mathematics pedagogy.

This review is not without limitations. The geographic focus on Indonesian contexts and the predominance of journal-based sources may introduce a degree of bias in the scope and generalizability of the findings. Future studies are encouraged to include more diverse contexts and source types, as well as conduct longitudinal research to better understand the sustained impact of character education on mathematical creativity.

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