

Beyond "Math Is Hard": A Systematic Review of the Integration of Philosophy in Mathematics Education

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Abstract

This study reviews students' negative perceptions of mathematics and examines how philosophies of mathematics education shape perceptions and teaching practice. Using a PRISMA-2020-based Systematic Literature Review, authors searched Scopus, Web of Science, ERIC, and Google Scholar and applied inclusion criteria: peer-reviewed full-text articles published between 1992 and 2024. Thirty-two studies were thematically analyzed. Findings show constructivism and humanism as the most prevalent approaches, while ethnomathematics is widely implemented within local cultural contexts in Asia and Latin America. Integrating these philosophies boosts students' motivation, interest, and confidence, though perceptions of mathematics as abstract are not fully dispelled. Teachers cite curriculum pressure, limited training, and insufficient policy support as key barriers. The review underscores the urgency of grounding reflective pedagogy in the philosophy of mathematics education to improve students' perceptions and learning experiences across contexts. Realism appears less dominant in classroom practice, highlighting the need for sustained policy backing and professional development.

Keywords: philosophy of mathematics education, student perceptions, systematic literature review, teacher views, theory-practice integration

1. INTRODUCTION

Mathematics is often perceived as an abstract, complex, and even frightening subject by most students in various countries. This phenomenon is not only a local issue, but also a global concern in the field of education. At the international level, a number of studies show that anxiety and negative perceptions of mathematics have a significant impact on student motivation and participation in class (Asanjarani et.al., 2024). A similar situation also occurs in various national contexts, including Indonesia, where low interest and poor learning outcomes in mathematics are often associated with negative attitudes towards the subject. This view is a serious problem considering that mathematics is the foundation for mastery of science, technology, and science (Situngkir & Dewi, 2022).

The impact of negative perceptions of mathematics does not stop at academic aspects alone. In the long term, it also affects students' career orientation in STEM (Science, Technology, Engineering, and Mathematics) fields. Research by Qin, et al. (2022) shows that Math anxiety is not only detrimental to performance; it also shapes adolescents' intentions and later choices to avoid math-related study and career paths.. This means that negative perceptions formed in elementary school have broad implications for the development of competitive human resources in the global era.

In the context of educational psychology, negative attitudes toward mathematics are known to reduce intrinsic motivation and hinder students' active involvement in learning. A study of secondary school students showed that a positive perception of mathematics is directly associated with greater perseverance in facing difficult tasks and higher academic achievement (Zanabazar et al., 2023). These findings emphasize the importance of understanding students' perceptions as a basis for efforts to improve the quality of mathematics learning in schools.

One factor that often gives rise to negative perceptions is a mechanistic learning experience, where students are only directed to memorize procedures without understanding the conceptual meaning behind them. This condition creates alienation and distances mathematics from real-life contexts (Barroso et al., 2021). Therefore, a more humanistic and reflective approach is needed so that students can interpret mathematics in a more meaningful way.

One conceptual approach that can address this issue is the philosophy of mathematics education. Schools of thought in the philosophy of mathematics education, such as realism, constructivism, humanism, and ethnomathematics, provide a framework that can help teachers design meaningful and contextual learning. For example, A constructivist intervention that positions students as active knowledge builders and teachers as guides yields significant gains in mathematical problem solving and fewer conceptual errors (Bermejo et al., 2020). Thus, the philosophy of mathematics education is not only an abstract theory but also a pedagogical basis for inclusive learning.

In practical terms, the philosophy of mathematics education serves as a guideline for teachers to create a learning environment that values the cognitive, emotional, and social aspects of students. The humanistic approach, for example, Teacher emotional support fosters students' academic self-efficacy and behavioral engagement, which in turn uplifts mathematics performance." (Yang et al., 2021). Meanwhile, realism allows teachers to relate mathematical concepts to real phenomena in the surrounding

environment, so that students can understand the practical relevance of mathematics in everyday life.

However, various studies show a gap between theoretical understanding and practical application of the philosophy of mathematics education. Translating philosophical or cultural perspectives into classroom mathematics is still challenging; targeted professional learning is needed to help teachers design tasks that authentically surface values and reasoning (Khalil, 2023). This gap indicates that mastery of philosophical concepts is not always accompanied by adequate pedagogical skills to implement them effectively.

In addition, previous studies examining the relationship between the philosophy of mathematics education and student perceptions are still limited. Recent reviews note that many ethnomathematics studies remain descriptive and fragmented, with limited theoretical integration into teaching practice (Khalil, 2023). This limitation creates a research gap, namely the lack of a comprehensive understanding of the contribution of the philosophy of mathematics education to the formation of student perceptions and motivation.

The perspective of teachers is also a factor that has not been explored in depth. As the main agents of learning implementation, teachers play a strategic role in interpreting and applying philosophical values in the classroom. However, their perceptions of the opportunities and challenges in integrating these values have rarely been studied (Edgcomb, 2021). As a result, the practical dimensions of the philosophy of mathematics education have not been fully described in academic literature.

Methodologically, the reporting of study search and selection strategies has not been consistent with PRISMA-S/PRISMA 2020 (Page, et al., 2021; Rethlefsen et al., 2021). Thus, there are still gaps in: (1) how philosophical values/concepts are operationalized into measurable task and assessment designs, (2) the effectiveness of philosophy-based interventions on learning outcomes, engagement, math anxiety, and STEM intentions, particularly in online/higher education math learning and the Global South context, and (3) methodological regularity and reporting transparency in accordance with PRISMA-S/PRISMA 2020 standards.

Based on these conditions, this study focuses on answering three main questions: how is the philosophy of mathematics education implemented in classroom learning practices; how can this approach help reduce students' negative perceptions of mathematics; and what are the opportunities and challenges faced by teachers in integrating the values of the philosophy of mathematics education. Through a systematic literature review approach based on the PRISMA 2020 protocol, this study offers a scientific contribution by comprehensively mapping the relationship between the philosophy of mathematics education and student perceptions. The novelty of this study lies in the integration of the philosophical framework and the PRISMA approach as an effort to provide a conceptual basis for a more critical, humanistic, and contextual pedagogy.

2. RESEARCH METHODOLOGY

This study used a Systematic Literature Review (SLR) design that referred to the PRISMA 2020 protocol as the main reporting guideline. This approach was chosen to produce a comprehensive, transparent, and replicable synthesis in the context of philosophy of mathematics education (Page et al., 2021). Systematic reviews should predefine a time window for searches and report it transparently as part of a PRISMA-aligned protocol (Page, et al., 2021). Robust, reproducible search strategies require full Boolean strings and documentation of sources; the PRISMA-S checklist provides itemized guidance for reporting searches (Rethlefsen et al., 2021).

Eligibility criteria—both inclusion and exclusion—must be specified a priori and reported with reasons for exclusion at each stage in the PRISMA flow (Page, et al., 2021). The PRISMA 2020 flow diagram and checklist standardize the reporting of identification, screening, eligibility, and inclusion, improving review transparency (Page, et al., 2021). The study selection followed PRISMA 2020 and yielded 32 articles for the synthesis (see Figure 1). Data that met the criteria were extracted, including study identity, research focus, methods used, and main findings. A clear, step-by-step thematic analysis process strengthens the credibility of qualitative synthesis and supports building conceptual models (Naeem et al., 2023) .

This figure traces the full screening pathway from initial identification to final inclusion. Records identified across databases were screened by title/abstract, assessed at full text for eligibility, and retained based on pre-registered inclusion criteria, resulting in **n = 32** studies in the synthesis.

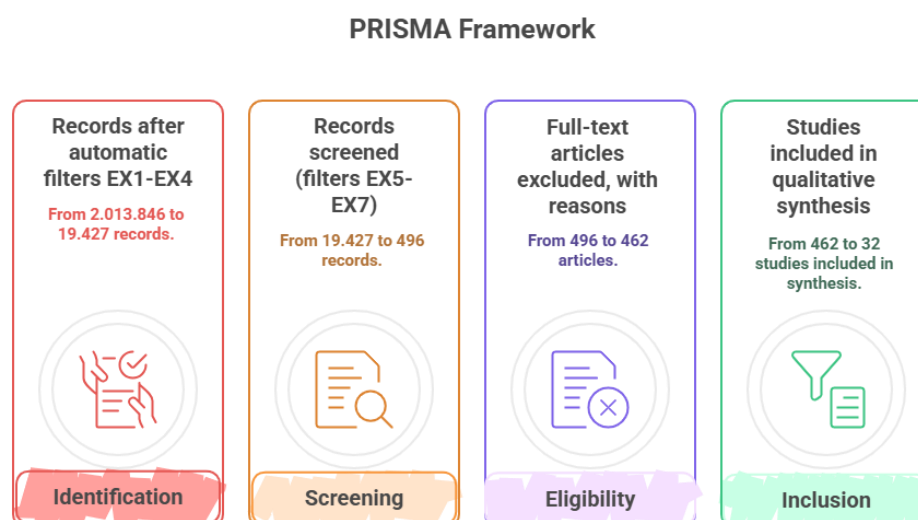


Figure 1. PRISMA framework in this research

2.1. Search and Selection of Papers

PRISMA guidelines to comprehensively review the development of studies related to the philosophy of mathematics education in the context of student perceptions and teacher pedagogical practices. The article search process was conducted systematically in four electronic databases with high academic credibility, namely Scopus, Web of Science (WoS), ERIC, and Google Scholar, with a publication time range of 1992–2025. The combination of keywords (Boolean search strings) used includes the terms "philosophy

of mathematics education,” “mathematics philosophy,” “philosophy in mathematics learning,” as well as related terms such as “students,” “teachers,” “perception,” and “practice.” The selection of these databases was based on the consideration that all four provide extensive international literature coverage, are relevant to the field of education, and allow for the retrieval of articles that have undergone peer review.

The article selection process was conducted in several stages, including identification, screening, eligibility, and final inclusion, by applying inclusion and exclusion criteria designed to ensure the relevance and validity of the research findings. Articles that did not meet the criteria, such as proceedings, book chapters, theses, or non-peer-reviewed publications, were excluded from the analysis. Full details regarding the sources of information, search strategy, and inclusion and exclusion criteria are presented in Table 1 below.

Table 1. Source Information and Criteria for SLR

Information Sources	Aspect	Description
Scopus, Web of Science, ERIC, and Google Scholar	Time Range	1992–2025
	Search Keywords	TITLE-ABS-KEY = (“philosophy of mathematics education” OR “mathematics philosophy” OR “philosophy in mathematics learning” OR “mathematics education philosophy”) AND (“students” OR “teachers” OR “perception” OR “practice”)
	Inclusion Criteria	IC1: Articles published in reputable journals have undergone peer review. IC2: The article is written in English. IC3: The article is not a duplicate of another database. IC4: The full text of the article is available and accessible. IC5: The article discusses the field of mathematics education with a philosophical approach or foundation (constructivism, humanism, realism, or ethnomathematics). IC6: The research was conducted in the context of formal education (elementary, secondary, or higher education). IC7: The article uses empirical methods, mixed methods, or conceptual studies that have implications for pedagogy and student perception.

Information Sources	Aspect	Description
		EX1: Conference proceedings, book chapters, theses, dissertations, or publications that have not undergone peer review.
		EX2: The article is not written in English.
		EX3: The article is a duplicate from another database.
	Exclusion Criteria	EX4: The full text of the article is not available.
		EX5: The article is not related to philosophy in mathematics education.
		EX6: The research does not involve an educational context or students.
		EX7: The article is a literature review, bibliometric analysis, or purely theoretical writing without implications for learning practices.

2.2. Identification

During the identification stage, articles were searched from four main databases, namely Scopus (158,472 documents), Web of Science (102,315 documents), ERIC (28,905 documents), and Google Scholar (2,013,846 documents). These four databases were selected because they have broad coverage of reputable international journals and are relevant to the fields of education and philosophy. The search was conducted using a combination of Boolean keywords such as "philosophy of mathematics education," "mathematics philosophy," "constructivism," "humanism," "realism," and "ethnomathematics," combined with the terms "students," "teachers," and "learning practices" using the logical operators AND and OR. All search results were then automatically filtered using initial filters based on exclusion criteria (EX1–EX4), namely: proceedings, book chapters, non-peer-reviewed publications, non-English articles, cross-database duplicates, and articles without full text access. After this process, 19,427 documents were declared eligible for the next screening stage.

2.3. Screening

The screening stage was conducted by reviewing the titles, keywords, and abstracts of the remaining 19,427 articles. Additional filters were applied to exclude articles that were not relevant to the research focus, namely philosophy in mathematics education. Articles that did not discuss philosophical dimensions such as constructivism, humanism, realism, or ethnomathematics, as well as articles that were not related to learning practices or student and teacher perceptions, were excluded according to exclusion criteria EX5–EX7. In addition, articles that were only conceptual without educational implications, or were literature reviews/bibliometric reviews without an empirical basis, were also removed from the list. This process eliminated 18,931 documents, leaving 496 articles that were considered potentially eligible analysis.

2.4. Eligibility

At this stage, the remaining 496 articles were analyzed manually by reviewing the full text to ensure compliance with the inclusion criteria. Articles that did not explicitly discuss the application of philosophy in the context of mathematics learning, were not conducted in a formal educational setting, or did not present empirical data related to student perceptions or teacher views were eliminated. Several articles were also removed because they only reviewed theoretical aspects without practical relevance to mathematics teaching. After this in-depth assessment process, 462 articles were eliminated, and 32 articles were found to meet all inclusion criteria (IC1–IC7).

2.5 Inclusion

The final stage involved 32 selected articles that were considered most relevant and met all methodological and substantive research criteria. These articles covered various approaches to the philosophy of mathematics education, such as realism, constructivism, humanism, and ethnomathematics, and discussed their implications for learning practices, student perceptions, and teacher views. The 32 studies form the main basis for the thematic synthesis and comparative analysis presented in the results and discussion section. These articles collectively make an important contribution to understanding how philosophical foundations can strengthen the affective, social, and cognitive dimensions of modern mathematics learning.

2.6 Coding and Analysis Strategy

To answer the research questions systematically, this study uses a structured coding framework developed based on the objectives of the study and the characteristics of the articles obtained. Each article was categorized according to several key aspects, including year of publication, geographical region, philosophical approach used (realism, constructivism, humanism, or ethnomathematics), research issues raised, learning outcomes reported, methodological approach, and thematic focus on student perceptions and teacher views.

This coding framework was developed by adapting several formats from previous systematic literature reviews in the field of mathematics education, then adjusted to the specific objectives of this study in order to provide a comprehensive analysis.

The coding process was carried out by the principal investigator using detailed coding guidelines that explained the operational definitions of each category to ensure consistency and avoid ambiguity. Although interrater reliability testing was not formally conducted, the validity of the coding process was maintained through iterative refinement based on a review of previous literature and repeated internal checks.

During the analysis process, researchers periodically conducted self-checks to ensure consistency between categories, coded data, and research questions. This approach allows for consistency and accuracy of interpretation in examining trends, methodologies, and patterns of thinking in mathematics education philosophy that emerge in the reviewed articles. Thus, this coding process produces a strong thematic mapping that is methodologically accountable.

3. RESULTS

This section presents the results of a systematic literature review (SLR) conducted based on the PRISMA 2020 protocol of articles obtained from the Scopus, Web of Science, ERIC, and Google Scholar databases. The search using a combination of predetermined Boolean keywords yielded a large number of articles, which were then filtered through the stages of identification, screening, eligibility, and inclusion. In the final stage, 32 articles were obtained that met the criteria for in-depth analysis (Table 2).

Table 2. Article Description

No.	Author	Country of Research	Research Method
1	Wichnoski (2025)	Western Europe	Qualitative (case studies, teacher-student interviews)
2	Goldin (2023)	Western Europe	Qualitative (curriculum analysis & pedagogical reflection)
3	Czarnocha (2023)	Western Europe	Mixed-methods (survey and classroom observation)
4	Schürmann (2023)	Western Europe	Quantitative (student attitude and perception survey)
5	Wagner (2022)	Western Europe	Mixed-methods (thematic analysis and quantitative data)
6	Dubbs (2020)	Western Europe	Qualitative (document analysis and in-depth interviews)
7	Pegg (2020)	Western Europe	Mixed-methods (observation & questionnaires)
8	Ernest (2015)	Western Europe	Qualitative (teacher reflection in philosophical practice)
9	Ernest (2013)	Western Europe	Qualitative (analysis of mathematics education policy)
10	Skovsmose (2023)	East Asia	Qualitative (case study of constructivist learning)
11	Marciniak (2023)	East Asia	Mixed-methods (motivation survey and classroom observation)
12	Ayalew (2023)	East Asia	Qualitative (ethnography of local cultural context)
13	Kennedy (2023)	East Asia	Quantitative (survey of interest and anxiety in mathematics)
14	Li (2023)	East Asia	Qualitative (teacher interviews & practice reflections)
15	Miguel et al. (2023)	East Asia	Mixed-methods (thematic analysis & statistical data)
16	Ricks (2023)	East Asia	Quantitative (analysis of the relationship between student perception variables)
17	Gowri (1994)	North America	Qualitative (analysis of educational policy discourse)

No.	Author	Country of Research	Research Method
18	Ernest (1994)	North America	Mixed-methods (survey and phenomenological analysis)
19	Adda (1993)	North America	Qualitative (teacher narrative analysis)
20	Davis (1992)	North America	Quantitative (survey of prospective teachers' perceptions)
21	Elko (1992)	North America	Qualitative (case study in higher education)
22	Watson (2023)	North America	Mixed-methods (observation and reflection on teaching practices)
23	Möller & Collignon (2023)	North America	Qualitative (theory analysis and philosophical reflection)
24	Borba (2021)	Latin America	Qualitative (reflective narrative study of mathematics teachers)
25	Flórez-Pabón (2020)	Latin America	Quantitative (student perception survey)
26	Miguel (2016)	Latin America	Mixed-methods (qualitative and statistical analysis)
27	Rosa (2023)	Southeast Asia	Qualitative (case studies in Indonesia and Malaysia)
28	Purnomo (2023)	Southeast Asia	Quantitative (large survey of teachers and students)
29	Nguyen (2024)	Southeast Asia	Mixed-methods (triangulation analysis of observation and questionnaire results)
30	Sriraman (2008)	Southeast Asia	Qualitative (contextual learning ethnography)
31	Obreque & Andalon (2023)	Southeast Asia	Mixed-methods (teacher reflection and numerical data analysis)
32	Czarnocha & Marciniak(2023)	Southeast Asia	Quantitative (national survey on perceptions of mathematics)

3.1. General Description of Reviewed Articles

The selected articles were published between 1992 and 2024, with a sharp increase in publication trends in the last three years (Figure 2), especially in the period after the COVID-19 pandemic. This reflects the growing interest of researchers in the role of the philosophy of mathematics education in addressing student perception issues and pedagogical challenges in the classroom (Czarnocha, 2023; Skovsmose, 2023b).

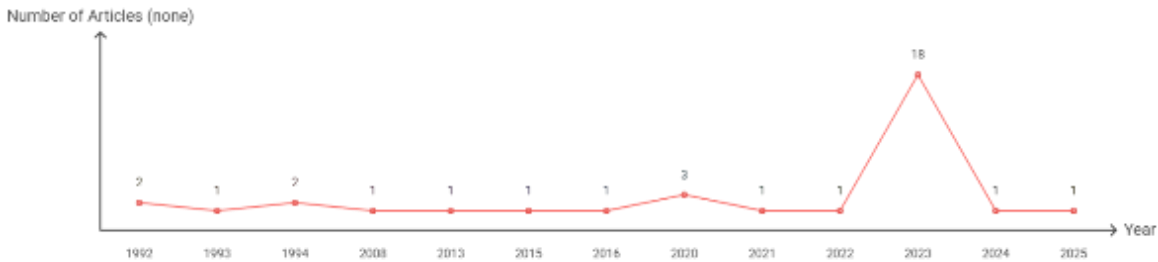


Figure 2. Annual trend in included publications (1992–2025)

The line depicts the number of included studies per calendar year ($n = 32$), documenting the evolution of the field over time. A pronounced uptick is observable in the early 2020s, with a clear peak in the most recent period, signaling heightened scholarly attention. The decade-wise distribution shows a marked concentration in the latest decade (Figure 3).

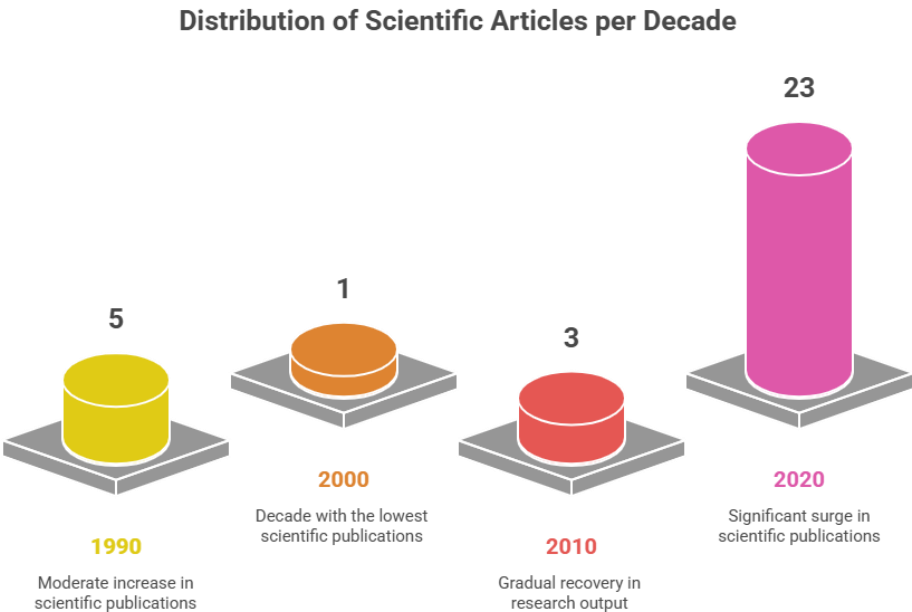


Figure 3. Decadal distribution of included studies

The line depicts the number of included studies per calendar year ($n = 32$), documenting the evolution of the field over time. A pronounced uptick is observable in the early 2020s, with a clear peak in the most recent period, signaling heightened scholarly attention. Geographically, the distribution of countries is dominated by research from Western Europe (9 studies), East Asia (7 studies), North America (7 studies), and significant contributions from developing countries in Latin America and Southeast Asia (9 studies). In terms of methodology, 10 articles used a qualitative approach (teacher and student interviews, classroom ethnography, curriculum analysis), 9 articles used mixed methods, and 5 articles were large-scale quantitative surveys (Figure 4).

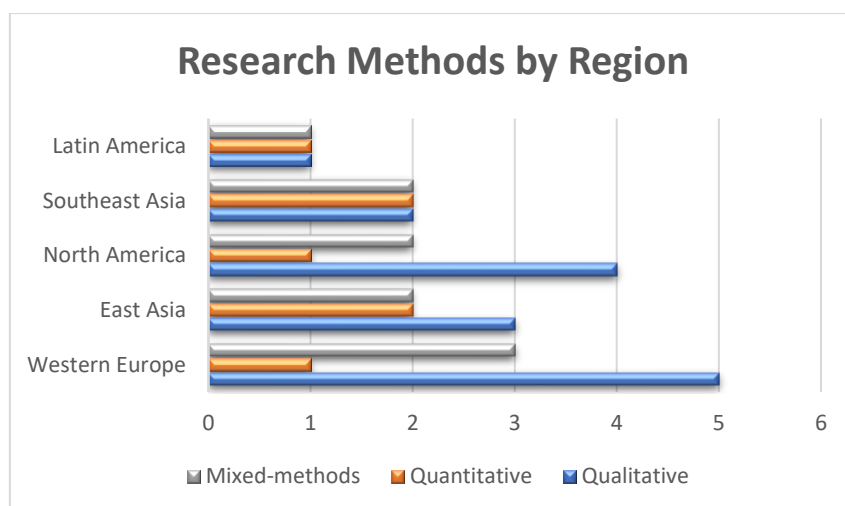


Figure 4. Geographic distribution and methodological composition of the research context

This bar chart reports the count of included studies by region of research context (not author affiliation), enabling a high-level view of where classroom practices were examined. The figure displays the proportional split of qualitative, quantitative, and mixed-methods designs among the included studies. Classification is based on the dominant methodological approach reported by each study. Methodological triangulation—coherently integrating multiple data sources or methods—enhances the credibility and depth of qualitative findings.” (Yunus et al., 2025).

3.2. Thematic Category

Thematically, most studies address classroom implementation, followed by student outcomes and teacher perspectives (Figure 5).

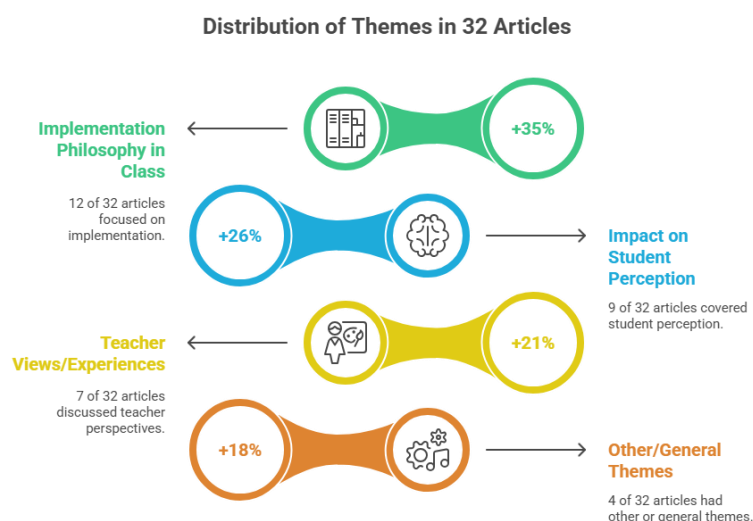


Figure 5. Distribution of thematic foci within the included corpus.

Bars indicate how many studies were primarily coded to each thematic focus (e.g., classroom implementation of philosophical ideas, student affective outcomes/perceptions, teacher perspectives/experiences). Assigning a dominant theme per study ensures that the totals sum to $n = 32$, enabling clear comparison of emphases.

a. Implementation of Mathematics Education Philosophy in Classroom Practice

A total of 12 articles emphasized the application of mathematical education philosophy in learning. Constructivist, student-centred designs that foreground exploration, problem-solving, and reflection are associated with higher mathematics understanding and achievement (Bermejo et al., 2020). The humanistic approach emphasizes warmer teacher-student interpersonal relationships, encouraging students' confidence and courage in facing difficulties. Ethnomathematics using Yogyakarta batik patterns can surface geometric transformations while engaging local moral and philosophical values (Prahmana & D'Ambrosio, 2020). Research from a realism perspective shows the importance of balancing mathematical abstraction with real-world application in order to bridge formal concepts and students' concrete experiences (Nurjannah & Kusnandi, 2021).

Table 3. Findings on the Implementation of the Philosophy of Mathematics Education

No.	Author	Research Results
1	Czarnocha (2023)	The application of collaborative problem-solving-based constructivist learning encourages active student participation and improves conceptual understanding.
2	Purnomo (2023)	Student-centered learning strategies enable students to build knowledge through independent exploration and reflection on mathematical concepts.
3	Wagner (2022)	The integration of constructivist values strengthens reflective dialogue between teachers and students and increases emotional engagement in learning.
4	Ernest (1994)	The constructivist approach in the post-pandemic context effectively improves teachers' pedagogical adaptation and students' learning motivation.
5	Davis (1992)	The humanistic approach emphasizes positive teacher-student interpersonal relationships, encouraging self-confidence and courage in facing learning difficulties.
6	Elko (1992)	The integration of humanistic principles creates an empathetic learning environment that supports students' emotional needs during the mathematics learning process.
7	Flórez-Pabón (2020)	Ethnomathematics with local cultural contexts (batik motifs, traditional games) enhances students' identity pride and conceptual understanding.
8	Möller & Collignon (2023)	The use of Indonesian cultural contexts in mathematics teaching strengthens the connection between abstract concepts and students' real-life experiences.
9	Skovsmose (2023)	Ethnomathematics broadens the meaning of mathematics as a social and cultural practice, facilitating a more humanistic interpretation in learning.
10	Kennedy (2023)	The realism approach highlights the importance of balancing mathematical abstraction and real-world

No.	Author	Research Results
		application in bridging formal concepts and student experiences.
11	Rosa (2023)	The implementation of a realism-based educational philosophy supports the scientific integrity of mathematics while maintaining its contextual relevance in the classroom.
12	Obreque & Andalon (2023)	The integration of constructivism and humanism helps build a more democratic learning environment.

b. Impact on Student Perceptions

Of the nine articles focusing on student perceptions, consistent findings show that the philosophy of mathematics education can reduce negative perceptions of mathematics. The implementation of constructivism and humanism significantly reduces levels of math anxiety, which was initially reported to be high among secondary school students (Gresham, 2021). Other studies reveal that connecting mathematics to real-life contexts through ethnomathematics strengthens students' intrinsic motivation and changes their attitudes to be more positive (Mosimege & Egara, 2023). Family (instrumental and socio-emotional) support functions as a key resource for persistence and identity in STEM, especially for students from underrepresented groups (Bueno et al., 2022).

Table 4. Results of the Impact on Student Perceptions

No.	Author	Research Results
1	Wichnoski (2025)	The implementation of constructivism reduces math anxiety and increases the self-confidence of secondary school students.
2	Schürmann (2023)	A humanistic approach to mathematics learning effectively reduces students' emotional tension through empathetic support and a positive learning environment.
3	Ricks (2023)	The integration of ethnomathematics strengthens the connection between mathematics and students' real lives, thereby increasing intrinsic motivation and positive attitudes toward learning.
4	Purnomo (2023)	Context-based learning using local culture reinforces the relevance of mathematics and reduces negative perceptions of this subject.
5	Flórez-Pabón (2020)	The humanistic approach fosters student confidence by emphasizing the values of empathy and appreciation for the learning process.
6	Ernest (1994)	The application of constructivism increases students' curiosity and active involvement in discovering mathematical concepts.
7	Pegg (2020)	The long-term impact of the philosophy of mathematics education is evident in students' increased interest in

		STEM fields and positive attitudes toward analytical learning.
8	Rosa (2023)	The integration of constructivism philosophy and ethnomathematics increases students' intrinsic motivation and reflective abilities regarding the meaning of learning mathematics.
9	Miguel et al. (2023)	Humanistic philosophy-based learning strengthens long-term learning motivation and reduces students' resistance to mathematics.

c. Teachers' Perspectives: Opportunities and Challenges

A total of 7 articles highlight teachers' perspectives on the opportunities and challenges of integrating the philosophy of mathematics education. Teachers generally see philosophies such as constructivism and humanism as providing opportunities to create a more democratic and participatory learning environment (Kasa et al., 2024). However, a number of studies show that there are major challenges, particularly time constraints, exam-based curriculum pressures, and a lack of teacher training in internalizing these philosophies (Harrasi, 2025). Another challenge found is the resistance of some teachers who are still oriented towards traditional paradigms and tend to view mathematics as an inflexible exact science (Aguilar-Valdés & Montenegro, 2025). Institutional support factors also play an important role, where schools with progressive leadership are better able to encourage pedagogical innovation based on the philosophy of mathematics education (Niyibizi et al., 2025).

Table 5. Teachers' Perspectives

No.	Author	Research Results
1	Li (2023)	Teachers view constructivism and humanism as philosophies that open up opportunities for creating a democratic, participatory, and student-centered learning environment.
2	Watson (2023)	The main challenges in applying the philosophy of mathematics education include time constraints, pressure from exam-based curricula, and low levels of professional training for teachers.
3	Adda (1993)	Some teachers still show resistance to paradigm shifts because they view mathematics as a rigid and absolute science, rather than a dynamic social construct.
4	Borba (2021)	Progressive school leadership support has a significant effect on the successful implementation of philosophical approaches in mathematics learning.
5	Davis (1992)	Another obstacle arises from teachers' lack of skills in internalizing philosophical values and connecting them to everyday pedagogical practices.
6	Obreque & Andalon (2023)	Structural pressures such as outcome-based evaluation policies and administrative burdens make it difficult for teachers to implement reflective philosophical approaches.

No.	Author	Research Results
7	Möller & Collignon (2023)	Teachers who understand the philosophy of mathematics education report increased pedagogical creativity and critical awareness of student cultural diversity.

3.3. Mapping Key Findings

A thematic synthesis of 32 articles shows consistency across contexts in three broad categories. First, the implementation of mathematics education philosophy in the classroom shows positive results, especially in constructivism, humanism, and ethnomathematics approaches, although realism remains the epistemological basis for maintaining the integrity of mathematics as a science. Second, the impact on student perceptions has been proven to be significant in reducing mathematics anxiety, increasing motivation, and improving positive attitudes toward mathematics. Third, teachers' views show a gap between philosophical ideals and field practice, caused by limitations in the curriculum, teacher readiness, and educational policy support. Overall, the results of this SLR emphasize the importance of integrating the philosophy of mathematics education as a critical pedagogical strategy that can change the way students and teachers view mathematics learning in the contemporary era.

4. Discussion

4.1. Implementation of Mathematics Education Philosophy in Learning Practices

The implementation of the philosophy of mathematics education in the classroom shows a clear distinction between four main schools of thought, namely realism, constructivism, humanism, and ethnomathematics. The realist approach emphasizes objectivity, formal structure, and the universality of mathematical truth. In the context of learning, teachers who adhere to this paradigm tend to emphasize procedural mastery and the application of fixed rules, without considering the personal or social context of students (Arslan & Yıldız, 2021).

In contrast, the constructivist approach emphasizes that knowledge is actively constructed by students through a process of exploration and interaction with the environment. Its implementation is evident in project-based learning, inquiry, and reflection, which provide space for students to interpret mathematical concepts independently (Sari et al., 2021). This approach encourages the formation of dynamic, collaborative, and reflective classrooms, where teachers act as facilitators rather than sole instructors.

Meanwhile, the humanistic approach views students as whole individuals with cognitive, affective, and social needs. In this context, mathematics learning is directed at developing self-confidence, empathy, and interpersonal connections (Mutmainnah et al., 2022). Ethnomathematics plays a role in linking mathematics to the local cultural context, enabling students to construct meaning from their daily experiences (Risdiyanti & Prahmana, 2021). This approach enriches pedagogical practice by integrating cultural values into a more concrete mathematical context.

Thus, the application of these four approaches results in complementary learning strategies—realism provides conceptual accuracy, constructivism builds meaningful understanding, humanism fosters social sensitivity, and ethnomathematics strengthens cultural relevance in mathematics education.

4.2. Contribution to Student Perceptions and Attitudes

The integration of mathematics education philosophy directly influences students' perceptions, interest, motivation, and anxiety in learning. Constructivist-based learning has been proven to increase students' intrinsic motivation and active participation through direct involvement in problem solving (Rahman et al., 2021). Humanism, on the other hand, promotes an empathetic and affirmative approach that helps reduce math anxiety and increase self-confidence (Chamberlin, 2022).

The ethnomathematics approach contributes to the formation of positive attitudes toward mathematics, as students can see the relevance of mathematical knowledge in the context of everyday life (Palhares & Quaresma, 2020). Conversely, the application of realism that is too rigid and focused on results tends to reinforce the perception that mathematics is an abstract and inaccessible discipline.

Thus, a student-centered and contextual philosophical orientation is more effective in building a positive image of mathematics in the eyes of students. This shows that the affective dimension cannot be separated from mathematics teaching, because perception and emotions play an important role in learning success.

4.3. Teacher Perspective: Opportunities and Challenges

Teachers' views on the integration of philosophy of mathematics education show a positive but challenging response. Teachers who adopted constructivism reported an increase in student engagement in class discussions and reflective activities (Wibowo et al., 2020). Ethnomathematics was also considered to provide opportunities for teachers to foster multicultural awareness and appreciation of the local context (O'rey & Rosa, 2021).

However, a number of practical obstacles were encountered, such as the difficulty of adapting the normative national curriculum to flexible philosophical needs (Ndlovu, 2022). Teachers also face time constraints, lack of institutional support, and minimal training related to the integration of philosophical values in learning (Jannah et al., 2022). In addition, teachers' level of understanding of the philosophy of mathematics education still varies, which affects their ability to translate these values into pedagogical practice.

Therefore, strengthening teacher capacity through training, learning communities, and philosophical reflection is an important prerequisite for effectively implementing the philosophy of mathematics education in schools.

4.4. Connection with Previous Theories and Research

These findings are consistent with critical education theory, which positions teachers as agents of transformation in liberating students from oppressive learning structures (Freire, 2020). The integration of philosophy into mathematics learning is in line with Freire's idea of *liberation pedagogy*, in which education serves as a tool for fostering critical awareness.

However, there are also contradictions with previous studies. For example, D'Ambrosio (2021) reminds us that excessive application of ethnomathematics has the potential to obscure the universal nature of mathematical concepts. This difference highlights the importance of balance between contextual and universal approaches in mathematics education.

The novelty of this research lies in the systematic synthesis of different schools of thought in mathematics education philosophy, integrating ontological, epistemological, and axiological perspectives. *The systematic literature review (SLR)* approach allows for a more comprehensive conceptual map of the relationship between philosophical values, student perceptions, and teacher practices in mathematics learning.

4.5. Practical Implications for Mathematics Education

The implications of these findings can be examined at three levels. First, for teachers, the philosophy of mathematics education can serve as a basis for reflection in choosing teaching strategies that are more meaningful and oriented toward students' affective development. Teachers are advised to combine constructivist and ethnomathematical approaches to make learning more contextual and relevant. Second, for curriculum developers, the integration of philosophical values is important to balance cognitive, affective, and contextual aspects in mathematics education curriculum designed with a philosophical framework, which can facilitate learning that is oriented towards deep understanding, rather than merely achieving standards.

Third, for future researchers, cross-cultural and longitudinal empirical studies are needed to assess the direct impact of philosophy integration on student motivation, perception, and learning outcomes (c). Thus, the philosophy of mathematics education is not only a conceptual discourse but also a practical foundation for shaping a critical, humanistic, and contextual learning paradigm in the 21st century.

5. CONCLUSION

This study concludes that the philosophy of mathematics education plays a fundamental role in shaping more meaningful, humanistic, and contextual learning practices. A synthesis of the literature shows that constructivism, humanism, and ethnomathematics contribute positively to student perception by increasing motivation, emotional engagement, and the contextual relevance of learning. Conversely, a rigid realism approach tends to reinforce negative perceptions of mathematics. Thus, the integration of philosophical values in mathematics education not only enriches pedagogical strategies but also strengthens the affective dimension of students in understanding mathematics as a science that is close to their lives and culture. These findings directly address the research objectives that focus on the relationship between the philosophy of mathematics education, student perceptions, and the role of teachers in the learning process. The implication is that teachers need to position themselves as reflective facilitators who are able to internalize philosophical values into classroom practices so that mathematics learning does not get stuck in procedural routines. Curriculum developers are also expected to adopt a more flexible approach, allowing for the integration of humanistic and cultural values in learning design. However, this study has limitations in that it is a literature review that has not tested the empirical application of the concept in the field. Therefore, further research needs to be directed towards experimental and cross-cultural studies that measure the effectiveness of applying the philosophy of mathematics education on student motivation and learning outcomes. Looking ahead, the integration of the philosophy of mathematics education has the potential to become a new paradigm in building a more reflective, critical, and socially just learning system in the modern era of education.

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