



## A Bibliometric Analysis of Parental Involvement in Students' Mathematics Activities

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### **Abstract**

This research conducts a bibliometric analysis to assess the effects of parental participation in students' mathematics learning. This study aims to highlight developing themes in the literature, review dominant trends, and recommend potential future research avenues regarding parental involvement in mathematics learning. The study aims to provide insights that can inform the development of more effective educational strategies, especially within culturally and educationally diverse settings. Scopus and ERIC databases served as the sources of data, collected through a structured search query. OR parents) AND (involvement OR support) AND (mathematics OR math) AND students.” After a rigorous screening process, 944 relevant articles were selected and analyzed using tools such as Harzing’s Publish or Perish 8, Biblioshiny, and VOSviewer 1.6.20. The results show that research in this area has developed over 42 years, generating 17,392 citations in total. The year 2023 saw the highest publication output, with 80 articles. Jianzhong Xu and James Reed Campbell were identified as the most productive authors, each publishing six papers. Keyword co-occurrence analysis revealed new research directions, including psychological interventions, longitudinal approaches, interdisciplinary methods, and the integration of technology to strengthen parental engagement in mathematics education. These findings highlight the increasing academic attention to the topic and emphasize the need for inclusive, culturally responsive approaches to effectively support student learning through parental involvement.

**Keywords:** *Parental Involvement; Mathematics; Students; Bibliometric*

### **Introduction**

Parental involvement in children's education has been extensively studied within educational research. A wealth of evidence indicates that parents' active engagement plays a vital role in shaping students' academic performance, especially in mathematics. Various types of parental support influence children's success in mathematics through multiple channels and differing degrees of effectiveness (Huang et al., 2021). Educational research has consistently emphasized the importance of parental involvement in children's learning. A substantial body of evidence demonstrates that students, particularly in mathematics, benefit greatly from their parents' active participation. Various forms of parental support have been shown to influence children's mathematical success through different approaches and degrees of impact (Rodríguez et al., 2017; Silinskas & Kikas, 2019). Active parental participation in a child's

learning often boosts the child's confidence, motivation, self-regulation, and engagement all of which contribute to more effective mathematics learning (Rodríguez et al., 2017; Wu et al., 2022; Y. Shukla et al., 2015). Studies have shown that children's math anxiety can be lessened through consistent and supportive involvement from their parents (Choi & Han, 2020; Vukovic et al., 2013).

Parental anxiety about mathematics can negatively influence children's attitudes and achievement, and may hinder their capacity to effectively approach mathematical problems (Bellon et al., 2022). Such anxiety may adversely shape children's perceptions of mathematics and reduce their engagement, potentially leading to the development of a negative attitude toward the subject (Bellon et al., 2022; Soni & Kumari, 2017). Such anxiety can diminish children's enthusiasm for mathematics and negatively shape their attitudes toward the subject, potentially leading to a discouraging or unfavorable perspective (Jay et al., 2018). By providing encouragement and fostering a positive outlook on mathematics, parents can help children cope with math anxiety and become more engaged in the learning process (Serin, 2023). Through collaborative efforts between parents and children, challenges in mathematics can be successfully addressed, resulting in enhanced academic achievement and the strengthening of essential Mathematical competence (Møller & Kaup, 2023; Sheldon & Epstein, 2005).

A large volume of research has emphasized the essential role that parental involvement plays in supporting children's learning of mathematics. Yaro (2015) Research in Ghana has demonstrated that even parents with limited formal education can significantly influence their children's mathematics learning, particularly by fostering a learning environment grounded in daily business practices and real-world transactional experiences. Ing (2014) Research has highlighted the impact of parental motivational approaches on children's math proficiency and their sustained interest in STEM disciplines. In mathematics education, parents contribute by offering learning tools, assisting with homework tasks, and exemplifying productive study behaviors (Kyeremeh & Dorwu, 2022). Ashton et al. (2011) Gaining insight into parents' intentions and viewpoints is essential for delivering meaningful support in nurturing their children's growth in mathematics. Silinskas and Kikas (2019) Researchers analyzed the impact of parental support during math homework on students' achievement levels and learning motivation. Results indicated that children who experienced anxiety or uncertainty about math were more likely to encounter controlling behavior from their parents, which was associated with lower academic outcomes, reduced perseverance, and decreased self-confidence in mathematics. The study's results illustrate the complexity of parental participation in math education and call for personalized methods of support.

Extensive research on parental involvement in children's mathematics education has uncovered specific biases, underscoring the need for ongoing studies to deepen understanding in this area. Additionally, there has been a lack of comprehensive studies that consolidate existing literature to uncover dominant patterns and emerging areas of interest through data-driven approaches. A thorough analysis of current trends and research gaps could offer valuable insights and establish a strong basis for enhancing future educational strategies. In light of this, the present bibliometric study aims to examine recent trends and identify possible directions for future research on parental involvement in mathematics education. It seeks to contribute meaningfully to the field by addressing two central research questions:

1. What are the major trends and patterns in publications concerning parental involvement in students' mathematics education?
2. What potential pathways can future studies explore in relation to parental involvement in students' mathematics learning?

## ***Literature Review***

Parental involvement in a child's education is a crucial contributor to academic success, with different types of engagement leading to diverse outcomes (Kantova, 2024; Sachdeva, 2023). Actively

involved parents play a vital role in creating a supportive learning environment and enhancing their children's motivation to succeed academically (Coulombe, 1995). Parental involvement may manifest in multiple ways, including participating in school activities, maintaining regular communication with teachers, and offering academic support at home (Averill et al., 2016; Coulombe, 1995). Such involvement is especially important for children from diverse backgrounds, as it strengthens the link between home and school settings (Averill et al., 2016). Hence, fostering strong partnerships between schools, families, and communities is vital for enhancing children's academic achievement (Đurišić & Bunijevac, 2017).

Involvement in mathematics by parents may take the form of homework assistance, encouragement through a supportive home setting, and recognition of their children's dedication and achievements (Goshin & Mertsalova, 2018). Family dynamics play a vital role in shaping children's attitudes toward learning and their overall academic performance (Soni & Kumari, 2017). Helping children solve difficult math problems and understand intricate concepts is one way parents contribute to their academic success. Recognizing students' hard work and accomplishments in mathematics plays a vital role in inspiring them, supporting consistent learning, and strengthening their math proficiency (Hernández-Padilla et al., 2023). A higher level of parental participation is vital for enhancing children's mathematical development and achievement (Silinskas & Kikas, 2019). This form of encouragement strengthens students' motivation to learn by promoting a sense of self-direction and confidence, empowering them to choose independently and take part in solving challenges (Wu et al., 2022). Despite their benefits, these interactions are heavily affected by aspects like parents' academic background, financial situation, and cultural influences (Cui et al., 2021; Goshin & Mertsalova, 2018).

The proficiency in mathematics possessed by both parents and their children can significantly strengthen the effectiveness and quality of their interactions in math learning (DiStefano et al., 2023). Parents' engagement, reflected in their attitudes and acknowledgment of their children's accomplishments in mathematics, has a positive impact on students' ongoing motivation and achievement in the subject (Hong et al., 2010; McDonnall et al., 2012; Y. Shukla et al., 2015). In addition, children whose parents are involved in their learning show higher levels of participation in math-related activities and better comprehension of mathematical concepts (Yang et al., 2023) the influence of parental involvement on children's math abilities can differ depending on its intensity and form, making it vital to consider these variations (Huang et al., 2021). Zhou et al. (2022) Studies reveal a positive correlation between strong parental support and both reduced math-related stress and improved performance in children. Furthermore, a positive parental attitude toward mathematics enhances children's confidence in the subject and offers valuable insights for designing strategies to strengthen parental involvement and reduce math anxiety (Choi & Han, 2020).

## **Methods**

This analysis draws on bibliometric techniques to review the comprehensive research landscape surrounding parents' participation in children's mathematical learning, including studies published through 2024. Bibliometric analysis is a widely used method for systematically analyzing large volumes of scholarly literature (Block & Fisch, 2020; Donthu et al., 2021). On June 4, 2024, data obtained from the Scopus and ERIC databases were analyzed for this study. Their structured metadata and accessible search functionality led to the selection of these databases as the core references for the bibliometric investigation.

The search query “(parent OR parents) AND (involvement OR support) AND (mathematics OR math) AND students” was applied to conduct a detailed investigation into how parents are involved in mathematics instruction. The results are intended to inform and guide future studies focusing on the role of parents in supporting children's learning in mathematics.

As depicted in Figure, the research procedure comprises five essential phases: designing the research, collecting the data, analyzing it, visualizing the results, and interpreting the findings (Secinaro et al., 2020; H. Zhu et al., 2023; Zupic & Čater, 2015). The research design stage includes several key components, such as defining parental involvement in students' mathematics education as the central theme, formulating research questions related to citation trends, current developments, and future research paths, and choosing Scopus and ERIC as the primary data sources.

The data gathering phase yielded 747 records from Scopus and 2,553 from ERIC in the initial retrieval process. After filtering by document type, 556 articles were retained from Scopus, and 622 peer-reviewed publications that met the defined criteria were selected from ERIC. Combining both sources initially yielded 1,178 articles. Subsequently, duplicate entries were removed using MS Excel, resulting in the elimination of 234 duplicates and leaving a final dataset of 944 documents. This filtering process was intended to enhance scientific communication by concentrating on peer-reviewed literature, facilitate the formulation of relevant research questions, and strengthen the reliability of the study's findings (Kelly et al., 2014). Key metadata from the selected articles were extracted for this study, with the information system format serving as the main data source during the analysis phase.

After the data collection phase, the study proceeded to the analysis stage, which concentrated on assessing publication trends and citation metrics across different time periods. This stage also included creating visual representations to highlight the patterns and developments within the dataset (Donthu et al., 2021). The analysis employed Harzing's Publish or Perish 8, Biblioshiny, and VOSviewer 1.6.20, three open-access tools selected for their functionality and user-friendly nature. At the early phase of data analysis, Biblioshiny and Harzing's Publish or Perish were used to analyze patterns in publication and citation metrics. Biblioshiny produced graphical outputs illustrating the progression of publications on the chosen topic from the beginning to the present, based on database-derived data. Meanwhile, Harzing's Publish or Perish was applied to track citation patterns over time, offering insights into the academic influence of the research in this domain.

Next, the study progressed to the data visualization phase, where relationships among authors and keywords were mapped through network, overlay, and density visualizations using the VOSviewer software. In the final stage, the focus shifted to interpreting the data, evaluating the meaning of the analyses and visualizations in the context of the research questions. This interpretation led to the development of conclusions grounded in the study's results.

## ***Findings and Discussion***

An overview and interpretation of the research topic and results regarding parents' involvement in children's math activities are presented in this section. It includes network mapping through data visualization, an examination of publication trends, and a review of citation metrics based on the collected metadata.

### **Analysis of Publication Trends and Citation Metrics**

Table 1 summarizes key themes associated with parental involvement in mathematics education, informed by citation statistics over a 42-year span (1982–2024). The data, drawn from Scopus and ERIC, include 944 published articles that have received a collective total of 17,392 citations. The average annual citation figure, 414.10, highlights the notable academic contribution of the literature.

Table 1. Citation metrics (the authors' elaboration using Publish or Perish 8)

Main information	Value
Publication years	1982-2024
Citation years	42 (1982-2024)
Papers	944
Citations	17,392
Cites/year	414.10
Cites/paper	18.42
Cites/author	9,062.88
Papers/author	481.39
Authors/paper	2.76
h-index	60
g-index	118
hI, norm	43
hI, annual	1.02
hA-index	14

The average citation count per article stands at 18.42, reflecting the relevance and academic influence of the research. Authors collectively received 9,062.88 citations, with an average of 481.39 publications each—demonstrating a core group of highly productive contributors. The average of 2.76 authors per paper further indicates substantial collaborative efforts in this domain.

An h-index of 60 indicates that no fewer than 60 publications have each been cited at least 60 times, reflecting a strong academic presence. A G-index of 118 suggests that several works have received a disproportionately high number of citations, underscoring the prominent influence of certain key studies in this research area. The normalized hI index of 43, along with an annual hI index of 1.02, points to consistent and growing scholarly impact over time. Additionally, the hA index, which evaluates the lasting relevance of earlier citations to current scholarship, stands at 14. Collectively, these metrics illustrate the high academic significance of the literature and emphasize the foundational role of frequently cited works in driving forward research and innovation in the field.

Figure 1 illustrates the growth in academic publications related to parental involvement in children's mathematics activities throughout the study period. The data reveal a steady upward trend in publications from 1982 to 2024. In the early years, publication counts were relatively low, with no publications recorded in 1984. Beginning in the 1990s, the number of publications gradually increased, although there were occasional fluctuations along the way. A significant rise began in the mid-2000s, with the number of annual publications gradually climbing to approximately 20 by 2005. This growth trend persisted, reaching a peak of 80 publications in 2023, followed by a modest decline in 2024.

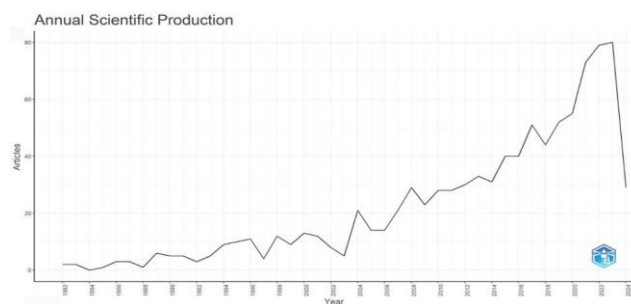


Figure 2. Distribution of publications (Source: Authors' elaboration, using Biblioshiny)

Table 2. Top-five articles with the most citations (Source: The authors' elaboration using Publish or Perish 8)

Cites	C/Y	Authors	Year	Title	Source
1,574	68.43	Xiao Fan and Michael Chen	2001	Parental involvement and students' academic achievement: A meta-analysis	Educational Psychology Review
593	21.18	Esther Ho Sui-Chu and J. Douglas Willms	1996	Effects of parental involvement on eighth-grade achievement	Sociology of Education
496	18.37	Andrew J. Fuligni	1997	The academic achievement of adolescents from immigrant families: The roles of family background, attitudes, and Behavior	Child Development
422	23.44	Carrie R. Leana and Frits K. Pil	2006	Social capital and organizational performance: Evidence from urban public schools	Organization Science
396	11.00	Camilla Persson Benbow	1988	Sex differences in mathematical reasoning ability In intellectually talented preadolescents: Their nature, effects, and possible causes	Behavioral and Brain Sciences

The initial research on this topic dates back to 1982, marking the beginning of scholarly investigation into parental involvement in mathematics education, starting with a study carried out in that year by Scheer & Henniger (1982), the first known research on this topic appeared in 1982, focusing on a diagnostic math clinic at Southern Illinois University, Carbondale. This initiative aimed to assist students facing challenges in mathematics by actively involving their parents in the learning process. That same year, Anderson (1982) evaluated a government-supported intensive learning program designed to enhance reading and math outcomes among junior high students. His findings emphasized the importance of securing written parental consent as a significant contributor to improving ninth-grade students' test performance.

In a more recent study, Kassis et al. (2024) the study investigated how the COVID-19 pandemic affected adolescents' mental health, particularly focusing on symptoms of anxiety and depression, along with their capacity to adjust and perform academically in secondary education. It emphasized the importance of both personal and social adaptability, with a special focus on the role of parental involvement. The results revealed a strong positive relationship between parental support and student academic achievement, showing that those with substantial parental involvement tended to perform better in school.

Table 2 presents the top five most-cited publications on parental involvement in children's mathematics activities from 1982 to 2024. It includes citation metrics such as the total citation count and average citations per year (C/Y) for each article. Additionally, the table lists the authors, year of publication, article titles, and the journals or sources where they were published.

As shown in Table 2, the article by Fan and Chen (2001), published in the *Educational Psychology Review*, is the most cited work from the 1988–2006 period. This meta-analysis explores the connection between parental involvement and student academic performance, amassing 1,574 citations and averaging 68.43 citations annually. Another notable study by Sui-Chu and Willms (1996), appearing in *Sociology of Education*, analyzes various types of parental engagement in relation to academic achievement, particularly in reading and mathematics. It has received 593 citations, with an annual average of 21.18.

Meanwhile, the study by Fuligni (1997), This article, featured in *Child Development*, analyzed the extent to which academic performance in children from immigrant families is shaped by their family background, parental aspirations, social support from peers, and individual attitudes and behaviors. It has accumulated 496 citations, with a yearly average of 18.37. In fourth place is the study conducted by Leana & Pil (2006), appearing in the journal *Organization Science*, the paper analyzes the impact of



As illustrated in Figure 4, authors frequently use keywords such as “foreign countries,” “mathematical achievement,” “human,” “longitudinal study,” “gender differences,” “self-determination,” and “age differences” to define their research clusters. For instance, the red-colored cluster demonstrates the association between the term “foreign countries” and several related concepts, including “parental participation,” “mathematics teaching,” “elementary school mathematics,” “student attitudes,” “homework,” and “numeracy skills.” The cluster represents scholarly attention to parental involvement in math education within diverse international contexts. Scholars in this group explore how cultural influences and regional policy frameworks shape parental engagement and student performance in mathematics.

These results align with the findings by Atasoy et al. (2022), the study analyzed how information and communication technology (ICT), parental involvement, and learning barriers influence students’ science performance in Turkey, the United States, and South Korea, drawing on data from PISA 2018. Furthermore, Kaya and OK (2022) explored the difficulties encountered by math and science teachers working in multicultural environments with Syrian students under temporary protection, offering strategies to address these challenges.

The phrase “mathematical achievement” found within the green cluster is linked to several related terms, including “academic achievement,” “parent-school relationship,” “program effectiveness,” “primary and secondary education,” and “science achievement.” This cluster centers on topics related to students’ success in mathematics and explores how parental involvement and the influence of educational institutions play a role in fostering that success. These findings emphasize the significant influence of parental engagement on student achievement, as supported by previous research conducted by J. Zhu and Chiu (2019). The findings indicated that parental engagement in basic counting exercises at home contributed positively to children’s success in mathematics, with this influence being partially mediated by gains in early numeracy and greater self-assurance in dealing with math.

In the blue cluster, the keyword “human” is associated with terms like “mathematics,” “students,” “children,” “education,” “parents,” and “motivation.” This cluster covers a wide range of research related to education and parental engagement. Its main emphasis is on examining different aspects of parental involvement in the educational process, especially in supporting mathematics learning and boosting student motivation.

In contrast, the yellow cluster centers around the keyword “longitudinal study,” linked to terms like “mathematical ability,” “parent-child relationship,” “student characteristics,” “educational achievement,” “family environment,” and “socioeconomic status.” This cluster reflects a long-term research approach focused on assessing the progression of students’ academic outcomes over time. Studies in this group provide meaningful perspectives on how family and social influences continue to shape children’s performance in mathematics. These results align with the research carried out by Atasoy et al. (2022). These results align with previous research emphasizing the value of longitudinal studies in exploring the effects of ICT usage, parental engagement, and learning barriers on student academic achievement. It is suggested that future research employ a more holistic methodological approach that takes into account students’ background contexts to gain deeper insights into the long-term impact on educational performance.

Positioned in the brown cluster, the keyword “self-determination” stands independently, unconnected to other terms. This thematic group revolves around educational autonomy, highlighting components like confidence and inner drive, and illustrates the important influence of parental involvement in aiding children’s learning in mathematics.

In contrast, the seventh cluster, represented in orange, revolves around the sole keyword “age differences.” This cluster explores the influence of age variation on educational experiences, with particular attention to its impact on mathematics learning and the extent of parental involvement.



Subsequently, an overlay visualization of keyword occurrences is utilized to identify and illustrate dominant research trends within the field. This overlay mapping, presented in Figure 4, highlights the yellow cluster as a collection of keywords that reflect a relatively recent and emerging area of focus in the academic literature.

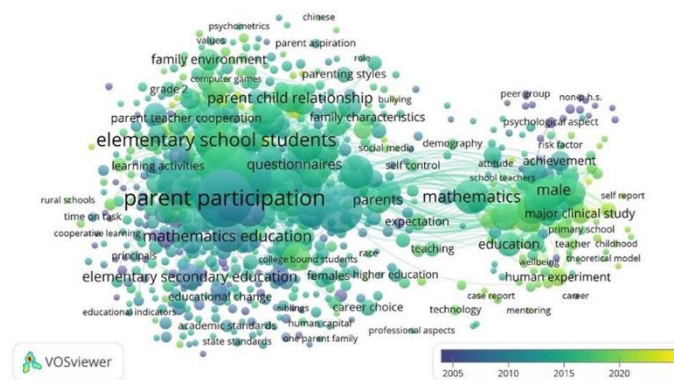


Figure 4. Overlay visualization of the co-occurrence of author keywords (Source: processed by the author using VOSviewer software version 1.6.20).

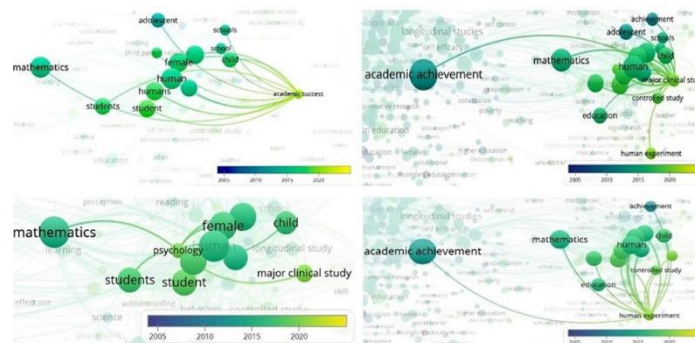


Figure 5. Overlay visualization of the co-occurrence of several author keywords (Source: processed by the author using VOSviewer software version 1.6.20).

Recent studies conducted since 2020 are represented in newer publications (Marín-Marín et al., 2021; Moral-Muñoz et al., 2020). This cluster includes a wide range of keywords such as “main clinical study,” “human trials,” “academic success,” “psychology,” “public health,” “well-being,” “physiological stress,” “e-learning,” “Covid-19,” “pandemic,” “bullying,” “video recording,” “distance education,” and “technology use in education.” A targeted examination was also conducted on selected emerging terms specifically “main clinical study,” “human trials,” “academic success,” and “psychology” to explore potential directions for upcoming research. Figure 5 illustrates this keyword analysis visually.

Figure 5 illustrates that current research has identified strong interrelations between keywords linked to parental engagement in children's mathematics learning. The term "academic success" was recorded 16 times, establishing links with 107 keywords and achieving a total link strength of 312. Frequently co-occurring terms include "children," "school," "male," "female," "adolescents," "parent-child relationship," "human," "article," "students," and "mathematics."

In addition, the keyword “psychology” appeared 18 times and was linked to 162 other terms, resulting in a total link strength of 411. Frequently linked keywords include “mathematics,” “students,”

“undergraduate,” “male,” “female,” “human,” “article,” “children,” and “main clinical study.” Similarly, the keyword “main clinical study” was recorded 26 times, demonstrating connections with 153 distinct terms and a cumulative link strength of 533. Commonly associated keywords include “achievement,” “school,” “children,” “adolescents,” “male,” “female,” “human,” “article,” “psychology,” “students,” “undergraduate,” and “academic achievement.”

These results offer valuable guidance for informing future research paths. A promising direction involves creating psychological interventions that engage parents in fostering their children's emotional well-being and motivation in learning. Upcoming studies may concentrate on developing and assessing these interventions to boost students' motivation and promote more positive perceptions of mathematics.

Another promising avenue for future research is the use of longitudinal designs that follow individuals from childhood through adulthood, allowing for an assessment of the long-term effects of parental involvement in mathematics education. This method could offer vital insights into the key factors influencing children's academic development and their subsequent achievements in both educational and career contexts.

## **Conclusion**

This study offers an in-depth bibliometric review of research related to parental involvement in children's mathematics education, analyzing the academic landscape, identifying major research trends, and highlighting possible directions for future studies. The results show steady academic interest in the topic from 1982 to 2024, with a significant surge in 2023 when 80 articles were published. Fan and Chen (2001) stand out as among the most influential contributors, having received 1,574 citations. In addition, notable scholars such as Jianzhong Xu, James Reed Campbell, Marta Civil, Xin Ma, and Sandra D. Simpkins have significantly contributed to the development and enrichment of this field.

The visual mapping of co-authorship and keyword co-occurrence has illuminated the collaborative networks and thematic structures within this research domain. Seven distinct clusters were identified, each representing a unique area of focus: cross-national studies on parental involvement, academic achievement through family school collaboration, motivational dimensions, longitudinal research, gender differences, self-determination theory, and age-related factors influencing mathematics learning.

While the bibliometric approach provides valuable insights, it is limited by the specificity and inconsistency of keyword usage in database indexing, which may constrain the comprehensiveness of the retrieved literature. Therefore, this analysis should be viewed as an initial step, ideally complemented by systematic literature reviews to gain a more nuanced understanding. Undertaking a more rigorous and integrative review will enrich our knowledge of how parental involvement in mathematics education evolves across varied cultural, educational, and social contexts an understanding that is crucial for informing the development of effective, inclusive, and equitable educational policies and practices in the future.

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