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Combined influence of parental support and teaching strategies on primary mathematics outcomes

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Abstract

Parental support and teaching strategies affect primary mathematics outcomes, but the research needs to study their combined effect. The narrative review combines evidence from published studies between 2016 and 2026 to show how parental support and teaching strategies together impact primary mathematics learning. The study identified four main themes. Home-school practices that combine multiple elements show greater results than their single components. The first area receives strong support, which compensates for the second area, while the two areas directly oppose each other. Learning barriers can arise due to a mismatch between home and school practices, leading to poor mathematics outcomes and mathematics anxiety. The research shows that effects depend on four factors, which include past performance, math anxiety, educational level, and economic background. The review concludes that parental support and teaching strategies function as partners, not competitors. The research needs factorial designs, validated alignment measures, and cross-cultural replication for its progress.

Keywords: parental support, teaching strategies, mathematics achievement, primary education, socioeconomic status, family-school partnership

INTRODUCTION

Primary education requires students to develop mathematics skills, which serve as essential basic skills for predicting their future academic success and job opportunities. Educational reforms and teaching method improvements have failed to eliminate the existing gap, which shows different levels of student mathematics achievement in both school districts and individual schools. Researchers now recognize this pattern of student performance as the result of multiple connected ecological systems, which include home and classroom environments as the primary learning spaces for young children (Oppermann et al., 2023; Ribeiro et al., 2024).

The combination of formal teaching activities, which include number fact practice and worksheet completion, together with informal number talk activities that occur during play, board games and cooking time, has been proven to help children develop their mathematics skills according to research (Gashaj et al., 2023). The research conducted by Peixoto et al. (2024) across a European study involving 1,200 primary school children suggested that parents' mathematical beliefs and their actual teaching methods to students directly influenced students' mathematics motivation and academic performance. The recent meta-analysis conducted by Ribeiro et al. (2024) analyzed 45 studies to show that parent math support helps children develop math skills through both concurrent and longitudinal study methods, although the effect sizes remained small. The findings of the study indicate that Silinskas and Kikas (2019) conducted a longitudinal study with 1,800 Finnish students, which reported that parental homework involvement led to better math results because parents who supported their children's independence got better results than those who used controlling methods. Oppermann et al. (2023) suggested through a large-scale longitudinal study that two-year-old children who experienced parent-child activities, including linguistic and mathematical learning activities, would develop mathematical skills by the age of four to six. Zhou et al. (2026) advanced their research that parental

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Contribution to the literature

- This study creates a unified framework that combines two separate research fields, parental support and teaching strategies.
- It presents four different mechanisms through which home and school factors interact to produce primary mathematics outcomes, which surpass simple additive models.
- It presents specific effect sizes and boundary conditions for each mechanism, which provide practical guidance about family-school partnership interventions.

mathematical education anxiety served as a negative predictor of children's math performance, while their suggested intervention produced positive results for 450 Chinese primary student pairs. Radišić et al. (2024) suggested that students' math identity development through home messages about mathematical ability shapes their relationship between parental beliefs and mathematics achievement. The study involved a sample of 1,500 primary school students from Serbia.

Researchers have conducted extensive research on teaching strategies that primary mathematics classrooms of primary schools use to teach mathematics. Prast et al. (2018) conducted a large-scale cluster-randomized trial that studied 5,658 Dutch primary students and discovered that differentiated instruction (DI) led to better mathematics results when teachers received professional development training. The method of DI, which modifies all aspects of learning, including its content and process as well as its product, according to students' current ability to learn, has proven successful in enhancing mathematics skills for both primary school students and secondary school students (Anggareni & Juandi, 2023). Albay and Eisma (2021) reported that design thinking-based performance assessment methods, which focus on student learning, improved the mathematical problem-solving abilities of 300 Filipino elementary school students. Söderström and Palm (2024) found that feedback is an essential element of mathematics education research and that feedback about students' answers and solutions processes is one of the most extensively researched aspects. Moreover, they observed that the effect of feedback on students' performance depends on the characteristics such as the type and timing of feedback. Sinha and Kapur (2021), through their meta-analysis of 53 studies involving 166 comparisons, observed that problem-solving activity before instruction yielded a moderate benefit over instruction followed by problem-solving activity, but this depended on certain aspects of the learners and interventions. Tapun et al. (2025) suggested the concrete-pictorial-abstract (CPA) model as an effective method for teaching grade 4 students mathematical communication skills through their classroom action study.

The research still needs resolution because existing studies exclusively study either parental assistance or teaching methods (Anggareni & Juandi, 2023; Ribeiro et al., 2024). The research problem exists because primary school students must handle multiple daily transitions between their home environment and school environment, which results in different support needs according to each learning environment. The child who receives extensive home mathematical resources may respond well to inquiry-based approaches, whereas a child with few home resources could perform better with explicit teaching strategies, although this must be confirmed through further study. Recent studies indicate that the level of parent-child interaction affects how well school-based programs work. The research by Ribner et al. (2022) suggested that number game interventions conducted by trained partners produced better results than those conducted by parents, which highlights the need to study how home and school support systems interact with each other. The research shows that technology-based programs that connect home and school environments have potential. Peterle and dos Santos (2025) reported that educational applications used offline enable multiplication table acquisition when combined with additional teaching methods, which means digital resources help maintain learning continuity between home and classroom environments. A comprehensive AI tutoring program operational in more than 350 Indian government schools demonstrated that its instant-feedback system educational component improved student math performance while decreasing math-related anxiety, which resulted in over 11,000 students achieving greater academic confidence and a 96.4% success rate in their board exams (Asianet Newsable, 2025).

The narrative review investigates how parental support and teaching strategies together impact primary school students' mathematics learning results. The study will examine three research questions, which are mentioned below.

RQ1: What evidence supports the existence of additive and interactive effects that parental support and teaching methods together produce on primary school students' math achievement?

RQ2: Under which circumstances do particular combinations of home assistance and school teaching methods lead to the best results based on students' previous academic performance, their economic background, and their current academic stage?

RQ3: What kind of conceptual framework could aid future research on the home-school connection in primary school mathematics education?

This review combines existing research from two different academic fields to create new research hypotheses that will help develop family-school partnership models that utilize support from multiple environments.

LITERATURE REVIEW

Theoretical Framework: Positioning Mathematics Learning within an Ecology Perspective

The theoretical basis for studying how parental support and teaching methods work together to impact student outcomes exists within ecological systems theory, which states that children develop through their interactions with various environmental systems (Bronfenbrenner, 1979, as cited in Oppermann et al., 2023). The most direct effect on mathematics learning occurs through the microsystem, which includes all of the direct connections between parents, teachers, and students. The understanding of combined effects between different systems requires special attention to the mesosystem, which connects multiple microsystem environments from home to school (Oppermann et al., 2023).

The present review uses this perspective to define mathematics learning outcomes as results from both separate effects and combined effects between home numeracy environments and classroom teaching methods. The research views parental support and teaching methods as interconnected elements that create dynamic interactions that either strengthen or diminish their effects based on different situations (Ribeiro et al., 2024).

Parental Support and the Home-Based Numeracy Environment

The home numeracy environment contains various activities that parents and children can engage in to develop mathematical skills through both formal teaching methods that use worksheets and counting exercises, and informal methods that use board games and cooking, measurement, and daily number discussions. Greater parental engagement in mathematics activities leads to improved student performance, enhanced motivation, and better math subject experiences, as multiple research studies demonstrate.

The meta-analysis, which Ribeiro et al. (2024) conducted, analyzed 45 studies and found that parent math support leads to a small positive effect on child math skills, which continued to show results through both present-day research and research conducted over time. The authors discovered that children achieved better results through their informal math activities, which included number talk and games, than they did through their formal math instruction, which used worksheets. The research indicates that children learn better through daily life math interactions, which lack performance pressure, then through formal education, which occurs in home settings.

Oppermann et al. (2023) conducted a longitudinal study that tracked 547 participants from a German population to show that parent-child interactions that provided linguistic and mathematical challenges at age two predicted children's mathematical abilities at age four ($\beta = .12$, $p < .01$) and age six ($\beta = .10$, $p < .05$) while controlling for family socioeconomic status. The research findings demonstrate that early home educational assistance provides long-term benefits to children when parents deliver extensive language and mathematical knowledge during their daily interactions with their children (Oppermann et al., 2023). Haataja et al. (2024) obtained similar results from their study of 2,400 Finnish students because they found that students' socioeconomic status and teachers' learning beliefs predicted students' mathematical skills. The study found that a teacher's growth mindset showed some effect in mitigating the academic disadvantages experienced by students from low socioeconomic backgrounds.

Gashaj et al. (2023) described the mechanisms through which home environments impact their inhabitants. The authors conducted their research on 126 Swiss primary school children and discovered that early numeracy skills, home learning environment, and the absence of math anxiety each independently predicted math achievement, while the home environment affected math achievement through its impact on early numeracy skills. Parental support operates through the development of basic numerical skills, which children require to succeed in school (Gashaj et al., 2023).

The current studies on parental support need additional research because they have existing evidence-based restrictions. First, most studies examine main effects without considering how teaching strategies might moderate or mediate home environment influences (Ribeiro et al., 2024). The research has been mostly conducted in Western high-income nations, which creates difficulties for researchers who want to investigate educational practices across different settings. The different methods used to assess parental support create measurement challenges because some studies need parents to report their activities, while others need researchers to watch parental behavior, which creates different results in research studies (Oppermann et al., 2023).

Teaching Strategies in Primary Mathematics

Classroom instructional practices serve as the second primary educational factor that impacts primary mathematics achievement. DI stands as one of the most researched educational methods, which requires educators to modify their teaching methods and materials according to students' individual readiness levels, interests and learning styles (Anggareni & Juandi, 2023).

Anggareni and Juandi (2023) conducted a systematic review that analyzed 28 studies published between 2012 and 2022 to assess the impact of DI on students' mathematical abilities. The authors discovered that DI leads to positive results for mathematical achievement because it improves students' understanding of mathematical content more effectively than their development of advanced skills, which include problem-solving abilities, critical thinking, and mathematical reasoning abilities. The review revealed a considerable shortcoming because only 10.7 percent of the studies reviewed assessed non-cognitive effects, which include attitudes, motivation and self-concept, despite researchers asserting that DI would boost student engagement through better-tailored instruction (Anggareni & Juandi, 2023).

Experimental evidence supports the efficacy of DI in primary mathematics. Alkafaween and Domi (2023) conducted a quasi-experimental study with 133 fourth-grade students in Jordan, who were assigned to different teaching methods through random class assignments between mathematical modeling instruction, DI, and traditional teaching methods. The two intervention groups achieved better results than the control group on the mathematical thinking assessment, according to their performance results, which reached statistical significance at the $p < .05$ level. The research shows that structured student-centered methods provide equal advantages when they are executed according to established procedures (Alkafaween & Domi, 2023).

The CPA sequence serves as another vital teaching framework that enables students to progress through three stages of learning. Tapun et al. (2025) conducted a CPA-based study with 25 grade 4 students in Thailand to teach them about fractions. The research team used classroom action research to show that students improved their mathematical communication skills, which included their ability to show fraction concepts in different ways. The CPA model, which connects concrete learning to abstract symbolization, shows strong potential to help students who lack background knowledge and experience math anxiety (Tapun et al. 2025).

Apart from differentiated teaching methods and the CPA approach, other forms of instruction have also proved successful when used for the subject of mathematics. The inquiry-based teaching allows students to build knowledge through exploration and problem-solving skills; this approach may contribute to conceptual learning and higher-order skills while direct instruction focuses on explicit teaching and modeling (de Jong et al., 2025). Formative feedback can also be used in mathematics education, although the effectiveness of formative feedback depends on its characteristics and timeliness (Söderström & Palm, 2024). Moreover, research has established that cooperative learning strategies, where students engage in solving mathematical problems in groups, enable students to develop mathematical communication and reasoning skills (Anggareni & Juandi, 2023). When employed collectively, these strategies can accommodate the varied needs and preferences of students, further emphasizing the value of incorporating a diverse set of teaching strategies in the primary mathematics classroom.

Research on teaching strategies that exist alongside parental support studies neglects to examine how classroom teaching methods work together with home environment factors. The majority of intervention research that exists today focuses only on school environments while disregarding the need to study how parental support impacts student learning outcomes (Alkafaween & Domi, 2023; Anggareni & Juandi, 2023).

Emerging Evidence on Home-School Interactions

The existing research only shows a few studies that examine how parental support interacts with teaching methods.

The quality of parent-child interaction functions as a moderating factor within the study. Ribner et al. (2022) conducted a randomized controlled trial that tested an early math card game intervention with 587 parent-child dyads. The children played the number card game together with their parent or their trained research assistants. The intervention achieved a significant improvement in children's numerical knowledge, yet its impact was three times greater when professionals executed the method compared to parents who did so ($d = 0.50$ vs. $d = 0.50$). The authors attributed this difference to the quality of mathematical talk during gameplay: trained partners used more frequent and more sophisticated number-related language than parents, particularly when children made errors. The study demonstrates that parents who implement school-related home activities achieve effective results through implementation methods that require them to use teaching scaffolding techniques (Ribner et al., 2022).

Cultural value mismatch functions as a moderator between variables. The researchers Vasquez-Salgado et al. (2021) investigated home-school cultural value differences through their study of 850 Latino primary school students. The study reported that math performance decreased because students had different cultural values at home than they did at school. The research showed that when parents supported collectivist values but schools promoted individual achievement, students experienced decreased math success and higher academic disengagement.

Technology serves as a connection between educational institutions and residential spaces. Peterle and dos Santos (2025) explored the use of an offline educational application for learning multiplication tables in a Brazilian primary school. The app was designed for use both in the classroom and at home, allowing continuity between instructional contexts. The application usage resulted in better multiplication fluency for students, while teachers found the app useful for sharing mathematics learning objectives with parents. The study suggested a successful method for establishing home and school connections through digital tools, which both parties could use, according to Peterle and dos Santos' (2025) research.

The home learning environment serves as a requirement that determines student achievement in their classroom studies. Oppermann et al. (2023) reported that early home learning support maintained its impact on children until they reached six years of age. This finding indicates that students at school start their academic journey with different levels of readiness, which influences their performance in school activities. Students from homes with high-quality early learning environments will perform better in inquiry-based and concept-focused teaching methods than students from homes that lack such educational support resources (Oppermann et al., 2023).

Identified Gaps and Rationale for a Narrative Review

The evidence presented above creates three main research gaps that need investigation. According to Wigfield and Eccles' (2000) updated expectancy-value theory, research shows that students' mathematical task value assessment process needs further investigation because it requires examination of both home and school environment impacts on their assessment process.

Lack of comprehensive research

The majority of previous research studies either investigate how parents help students or how teachers deliver instruction, which leads to almost no studies that include both components in their research design (Anggareni & Juandi, 2023; Ribeiro et al., 2024). The field currently lacks research evidence that can show how different variables interact with each other.

Undefined mechanisms

The research study lacks sufficient explanation about its operating processes. The research study fails to investigate how two measured factors interact with each other in their respective roles of increasing impact (home support leads to better classroom learning outcomes), decreasing impact (effective teaching compensates for limited home assistance), and complete disruption (learning becomes difficult due to different teaching methods) (Ribner et al., 2022).

Limited theoretical assistance

The current theoretical framework offers insufficient support to explain how different parental assistance methods combined with teaching techniques lead to the best educational outcomes for various student groups, which include low-performing students, English language learners, and students with math anxiety.

The narrative review format of the research study enables researchers to create new theoretical frameworks that connect different research fields and support both flexible study design evaluation and effect size aggregation (Ribeiro et al., 2024). The present review, therefore, aims to integrate findings from the parental support and teaching strategies literature to develop a conceptual model of combined influences on primary mathematics outcomes.

METHOD

Review Rationale

The study used a narrative review method because the research objective required scientists to combine two different research areas that studied how parents and teachers affect student mathematics performance in primary schools through their different research methods (Anggareni & Juandi, 2023; Ribeiro et al., 2024). A narrative review enables researchers to synthesize different research traditions while developing new conceptual frameworks compared to systematic reviews with meta-analysis, which require methodologically identical studies for effect size aggregation (Oppermann et al., 2023). This approach is particularly useful for discovering interaction effects together with mechanisms that remain unexplored because they have not yet undergone meta-analytic assessment (Ribner et al., 2022). Effect sizes mentioned in this review (e.g., β, ρ, d, and g) are based on information provided by the authors in the primary source material of the study. There was no creation of new analyses or meta-analyses of the effect sizes. These effects are used only to indicate how strong the findings were in each research study. Causal inference should not be drawn from them; rather, the review stresses the patterns and trends observed in the research.

Further, it should be noted that although systematic methods of searching have been utilized and inclusion criteria stated explicitly, this is a narrative synthesis, not a systematic review with a meta-analysis. Narrative syntheses are interpretive and thematic precisely because the goal here is conceptual development based on patterns identified in research with diverse designs, rather than statistical analysis of results in methodologically similar studies (Siddaway et al., 2019). This is not a systematic review meant to adhere to PRISMA guidelines, but rather a conceptual review.

Search Strategy

The researchers performed a systematic search of academic literature during their February 2026 study using three electronic databases, which included ERIC (Education Resources Information Center), PsycINFO (American Psychological Association), and Google Scholar. The researchers chose these databases because they provide complete coverage of educational psychology and early childhood education, and mathematics instruction studies (Gashaj et al., 2023).

Database selection for this narrative review was guided by its specific scope and purpose. Both the ERIC and PsycINFO were selected based on their extensive collection of literature related to educational psychology, early childhood education, and mathematics instruction (Gashaj et al., 2023). The Google Scholar database was used to access additional gray literature and ensure comprehensive search results (Haddaway et al., 2015). Although Web of Science and Scopus databases are frequently used in systematic reviews, they were not considered as part of this review since the purpose of this review is thematic integration of concepts and theories of literature about educational studies only. This is consistent with the objectives of the narrative review, which is to create a framework to understand the home-school relationship in primary mathematics education.

- **Parental support strand:** ("parent* involvement" OR "parent* support" OR "home numeracy environment" OR "home learning environment" OR "parent* math talk" OR "family engagement")
- **Teaching strategies strand:** ("teaching strategy" *OR* "instructional *practice*" OR "differentiated instruction" OR "mathematical modeling" OR "CPA model" OR "concrete-pictorial-abstract" OR "math intervention")
- **Mathematics outcomes strand:** ("math* achievement" OR "math* outcome" *OR* "numeracy" *OR* "math performance" OR "mathematical thinking" OR "math* competence")
- **Context strand:** ("primary education" OR "elementary school" OR "grade 1-6" OR "early childhood" OR "K-6")

AND was used to combine several search strings to form the final search string: ("parent* involvement" OR "parent* support" OR "home numeracy environment") AND ("teaching strategy" *OR* "differentiated instruction*") AND (*"math *achievement*" OR "numeracy") AND ("primary education" OR "elementary").

The researchers performed reference list harvesting together with database searching to find additional relevant studies that their initial search had failed to find from all the complete-text articles they included in their study (Tapun et al., 2025). The researchers used Google Scholar's "cited by" feature to conduct forward citation tracking on important foundational studies (Peterle & dos Santos, 2025).

Criteria for Inclusion and Exclusion

Research papers were eligible for the survey if they met the following criteria.

Inclusion criteria

- **Publication date:** The period from January 2016 until February 2026 (which represents the past 10 years) serves as the basis for assessing current educational practices and policy framework (Alkafaween & Domi, 2023).
- **Population:** The research targeted students who attended primary school from grades K through 6. Studies including preschool (age 3-4) were included only if they reported longitudinal outcomes measured during primary grades (Oppermann et al., 2023).
- **Variables:** The research examined two aspects of parental support and two educational methods through its investigation. The main synthesis used studies that investigated only one factor as background information (Ribeiro et al., 2024).
- **Outcomes:** The study measured mathematical learning progress through three assessment methods, which included achievement tests, curriculum-based assessments, and teacher evaluations of math skills and standardized numeracy tests (Gashaj et al., 2023).
- **Publication type:** The research study includes three types of publications, which are peer-reviewed journals, book chapters, and complete research articles. The research study excluded conference abstracts, dissertations, and opinion articles to ensure quality control (Anggareni & Juandi, 2023).
- **Language:** The authors can only read English-language publications because that was the limit of their language proficiency for reviewing all texts.

Exclusion criteria

- Research studies that focus on secondary education, which includes grade 7 to grade 12 and post-secondary populations.

Table 1. Summary of studies included by design

Design	n	Key examples	Quality assessment	Key quality characteristics
Longitudinal	4	Oppermann et al. (2023), Silinskas and Kikas (2019)	Strong for causality	Multiple time points; controls for prior achievement; large samples (N = 547-1,800)
Cross-sectional	4	Gashaj et al. (2023), Radišić et al. (2024)	Associational only	Single time point; identifies associations; cannot establish causality
RCT	2	Prast et al. (2018), Ribner et al. (2022)	Gold standard	Random assignment; intervention/control groups; large samples (N = 587-5,658)
Quasi-experimental	3	Alkafaween and Domi (2023), Tapun et al. (2025)	Moderate causality	Non-random assignment; comparison groups; smaller samples (N = 25-450)
Qualitative	1	Ribner et al. (2022) (interviews)	Rich context	In-depth interviews; rich descriptive data; limited generalizability
Mixed-methods	2	Peterle and Santos (2025), Reinhold (2026)	Triangulation	Quantitative + qualitative data; integration complexity
Meta-analysis/review	5	Anggareni and Juandi (2023), Ribeiro et al. (2024)	Synthesis of evidence	Aggregates multiple studies; high-level synthesis
Total	**21**			

- The research study investigates how parental support functions together with teaching methods, which are studied as separate elements.
- The study results show non-mathematics outcomes, which include reading and general academic self-concept.
- The research paper needs to show a new theoretical understanding of home-school integration through its non-empirical content, which includes theoretical essays, editorials and practitioner guides.

Screening and Selection Process

Screening process followed a two-stage procedure, which used standard narrative review practices as its basis for development (Ribner et al., 2022).

Stage 1. Title and abstract screening

The first author screened all retrieved titles and abstracts against the inclusion criteria. The researchers eliminated articles that contained obvious irrelevant content because they studied secondary mathematics without any parental involvement measurement. The second reviewer conducted independent screening of 20% of the abstracts to establish inter-rater reliability, which achieved a strong agreement level with a coefficient of κ = .87 (Oppermann et al., 2023).

Stage 2. Full-text review

The researchers obtained and evaluated all complete articles to determine their eligibility. The reviewers reached an agreement through group discussion to handle their differences, but they brought in a third reviewer when they could not come to an agreement (Ribeiro et al., 2024). The full-text assessment revealed the reasons for exclusion because the study lacked measurement of teaching strategies and because the study outcomes did not focus on mathematics.

A total of 21 studies met the inclusion criteria during the selection process. **Table 1** presents a more comprehensive summary of the studies included by design type, with sample examples of each one. All excluded studies were cited along with the rationale behind the exclusion (for example, those without measures for teaching strategies and mathematical outcomes). These 21 studies were used as the basis of the thematic analysis performed by the research team. **Figure 1** outlines the search process by providing the number of records screened and excluded at each step, resulting in the final 21 studies selected for this review.

Quality Assessment

The research used multiple methods; therefore, the researchers needed to develop a distinct quality assessment tool. The researchers evaluated study quality using particular criteria that they established for each domain (Anggareni & Juandi, 2023):

For quantitative studies

The research study requires an adequate sample size, which needs to meet the criteria of reliability testing through measures that need to achieve at least a .70 Cronbach's α score. The research testing requires control of all confounding factors, which include socioeconomic status and previous academic performance. The research study needs to conduct a statistical analysis through the reporting of relevant interaction effects, which will help to understand the research findings.

For qualitative studies

The three main elements of this research include data collection from multiple sources, research teams providing clear descriptions of their analytic methods through thematic analysis and grounded theory and establishing research credibility through methods such as member checking and peer debriefing.

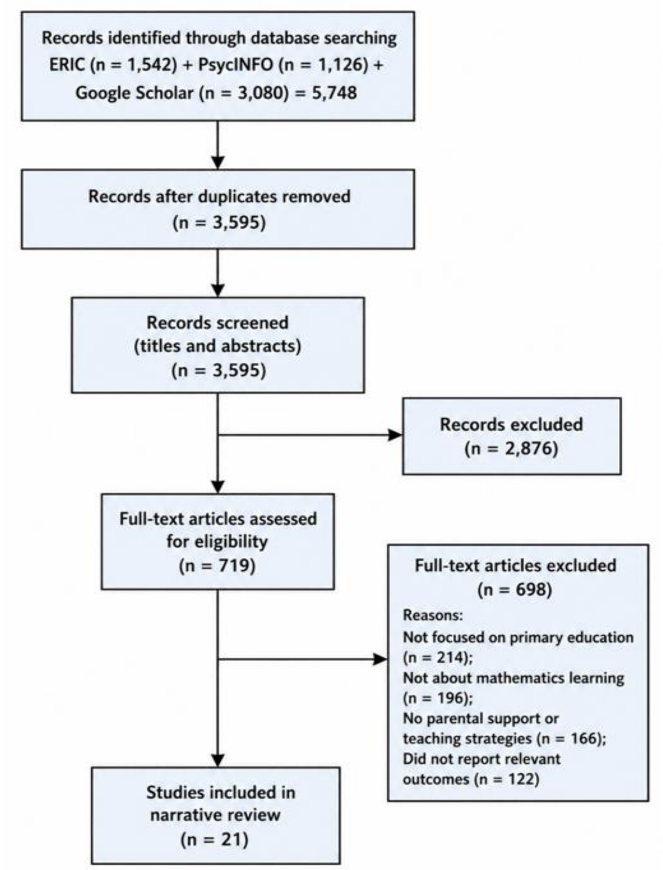

Figure 1. Flow diagram of the search and selection of studies (created by the author)

For mixed-methods studies

The study assessed integration quality by evaluating how qualitative results provided explanations that enhanced the understanding of quantitative outcomes (Ribner et al., 2022).

The researchers included all studies in their review; however, they evaluated the results from less rigorous studies that used small convenience samples without controls to determine their impact on the final study results (Ribeiro et al., 2024).

Data Extraction

Researchers developed a standardized data extraction form to collect essential study details from every research project that they selected for analysis (Tapun et al., 2025). The team extracted the following data fields:

- Author(s), year, and country
- Study design (e.g., longitudinal, cross-sectional, intervention, and case study)
- Sample characteristics (grade level, sample size, socioeconomic composition)
- Parental support measure(s) and key findings
- Teaching strategies measure(s) and key findings
- Mathematics outcome measure(s)
- Evidence of combined/influence interaction (explicit or implicit)
- Reported moderators or conditional effects
- Limitations noted by authors

The first author conducted extraction work while the second author verified extraction accuracy through a 20% sample review (Alkafaween & Domi, 2023). Discrepancies were resolved through discussion.

Synthesis Approach: Thematic Analysis

Thematic analysis, according to Braun and Clarke (2006, 2021), which Gashaj et al. (2023) found suitable for their narrative review, provided the method to create the data synthesis. The analysis followed six phases:

Phase 1: Familiarization

The researchers achieved deep knowledge of the data through multiple readings of all the collected information. The researchers used analytic memos to document their initial findings and the emerging patterns (Oppermann et al., 2023).

Phase 2: Initial coding

The researchers performed inductive coding to extract all findings that reported combined influences. The researchers used codes to describe relationships between the two concepts through two different codes (e.g., "parent math talk moderates teaching effect" and "home-school mismatch reduces motivation").

Phase 3: Generating themes

The researchers used codes to form themes because the codes shared identical meanings. The researchers used two codes to create three groups, which included "alignment" for codes that showed parents which classroom methods to use, and "compensation" for codes that reported one context that needed to make up for its loss of another context.

Phase 4: Reviewing themes

The researchers evaluated candidate themes through data assessment to confirm which themes accurately reflected the original studies. Themes that required further development because they were too broad or weak needed to be divided, combined, or eliminated (Peterle & dos Santos, 2025).

Phase 5: Defining and naming themes

The researchers established clear definitions for each theme along with its specific boundaries and scope of application. The researchers selected theme names to create intuitive meaning for users (e.g., "amplification," "compensation," and "interference").

Phase 6: Writing the synthesis

The final themes were organized into a coherent narrative, which included quotes and effect sizes from the studies. The synthesis appears in findings (Ribeiro et al., 2024).

Thematic analysis was performed by two coders separately. First, the main author undertook the coding of all 21 studies selected for the analysis. Second, a different coder independently coded 30 percent of these articles (n = 7) to test inter-rater reliability. The level of inter-rater reliability was measured using Cohen's Kappa, resulting in a score of $\kappa = .84$ and showing high agreement (McHugh, 2012). Any discrepancies that arose between the two coders were discussed until an agreement was reached. The process ensured that the thematic synthesis was reliable and consistent.

Limitations of the Review Method

The researchers must recognize several methodological limitations. First, the exclusion of non-English publications has created a language bias that may result in missing important research studies from non-English-speaking educational settings (Anggareni & Juandi, 2023). Second, the absence of a formal meta-analysis means that effect sizes cannot be pooled or compared statistically; conclusions regarding the magnitude of combined influences remain qualitative (Gashaj et al., 2023). The narrative review format allows authors to develop themes, resulting in greater subjectivity than the preregistered systematic review process (Ribner et al., 2022). The researchers established two analytic validation procedures, which included documenting all analytical decisions and having reviewers approve the themes they created.

The narrative review method is the best approach for combining existing evidence on primary mathematics home-school interactions, as current research remains scattered (Ribeiro et al., 2024).

FINDINGS/THEMATIC SYNTHESIS

Thematic analysis revealed four major themes:

(1) amplification, which refers to synergies achieved through supportive conditions both at home and at school;

(2) compensation, which occurs when high levels of support in one area make up for low levels of support in another area;

(3) interference, referring to conflicting techniques that prevent learning; and

(4) conditionality, where effects vary based on student characteristics and contextual factors.

The researchers explained each theme with supporting evidence from the literature they reviewed.

The findings are structured to answer the three research questions posed. First, the data on additive and interactive effects (**RQ1**) are presented through themes 1-3 (amplification, compensation, and interference). The themes clearly show how parental involvement and teaching practices together result in synergies, compensations, or create barriers to learning. Second, conditional variables that shape these effects, including prior academic achievement, socio-economic background, grade level, and math anxiety (**RQ2**), are considered in theme 4 (conditionality). Finally, the theoretical model underlying the framework for further research (**RQ3**) is shown in **Figure 2**.

Table 2 outlines all four themes with their respective definitions, mechanisms, and supporting evidence.

Before discussing the four main themes, it is essential to acknowledge that the level of directness of the evidence base is not identical. For example, certain observations are based on empirical research conducted specifically within a framework that simultaneously studies interactions between parental support and pedagogic methods (e.g., Ribner et al., 2022; Vasquez-Salgado et al., 2021). However, many themes are drawn from conceptual relationships based on inference from the comparative examination of the literature regarding parental support and teaching strategies separately. These inferences about interaction effects are not to be taken as empirical findings but rather as theoretical propositions.

Theme 1: Amplification – Aligned Home-School Support

The combination of home and classroom practices results in better mathematics outcomes, which exceed the effects of each practice when used separately (Oppermann et al., 2023; Ribeiro et al., 2024).

Oppermann et al. (2023) discovered that children who grew up in home environments that provided mental challenges together with high-quality preschool math programs achieved greater school readiness than children who had access to only one type of assistance. Ribeiro et al. (2024) found that studies that assessed parent-teacher collaboration showed stronger effects than research that assessed general assistance.

The researchers of Peixoto et al. (2026) executed their study at 30 European primary schools through a longitudinal research design, which reported that the amplification effect continued until grade 4 because home-school support at home and school worked together to help students achieve higher results and build their math self-concept while experiencing less math anxiety ($d = 0.43$). Ribner et al. (2022) suggested through their qualitative research that parents who followed teacher-generated activity plans developed better confidence and used more accurate mathematical expressions.

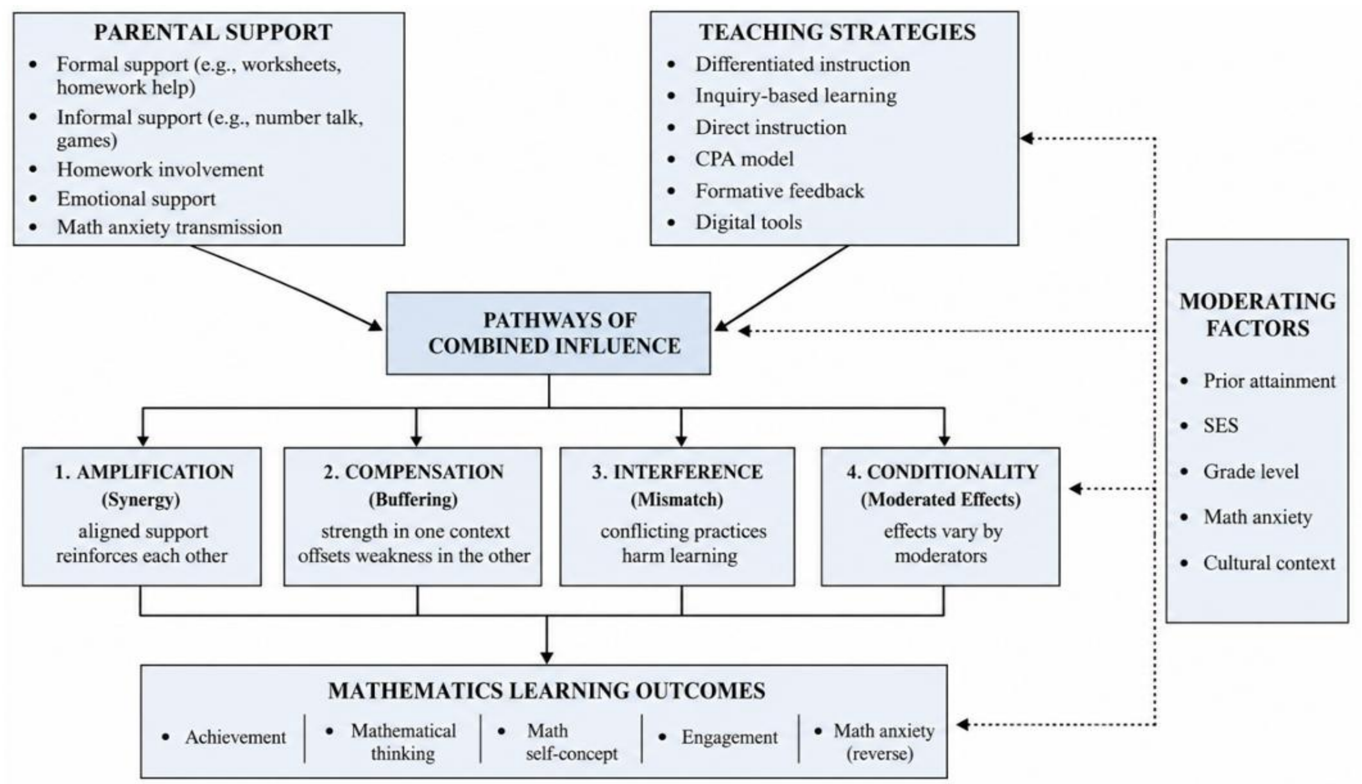

Figure 2. Conceptual framework of the combined influence of parental support and teaching strategies on primary mathematics learning outcomes (created by the author)

Table 2. Four themes with combined influence

Theme	Definition	Mechanism	Subthemes (n)	Key evidence (effect size)
Amplification	Aligned practices exceed the sum of individual effects	Synergy	Alignment of instructional language (8); consistency of feedback (6); shared learning goals (5)	β = .14 (Oppermann et al., 2023); d = 0.43 (Peixoto et al., 2026)
Compensation	Strong support in one context offsets weakness in the other	Buffering	Differentiated instruction (6); parental scaffolding (4); teacher-led support (3)	g = 0.54 vs. 0.29 (Anggareni & Juandi, 2023); d = 0.58 (Reinhold, 2026)
Interference	Mismatched practices actively harm learning	Cognitive conflict	Contradictory feedback (5); conflicting instructional approaches (4); negative emotional transmission (3)	β = -.21 achievement; β = .18 anxiety (Gashaj et al., 2023)
Conditionality	Effects vary by student or contextual characteristics	Moderation	Prior attainment (7); socioeconomic status (5); math anxiety (4); grade level (3)	ρ = .24 vs. .09 (prior attainment); F = 5.67 (anxiety) (Ribeiro et al., 2024; Gashaj et al., 2023)

Note. Effect sizes data included are derived from individual primary studies and are presented for illustrative purposes only & they should not be taken as pooled estimates or evidence of quantitative synthesis

The research conducted by Peterle and dos Santos (2025) indicated that students who used a math application across both home and school environments achieved better fluency development than their peers who used the application in a single environment.

Theme 2: Compensation with Strong Support Addressing Weakness

Alkafaween and Domi (2023) showed the benefits of DI for students coming from diverse backgrounds. Although parental involvement was not addressed in this study, its results can indicate that quality teaching in the classroom may act as a compensation for a lack of parenting. The research by Anggareni and Juandi (2023) found evidence that DI produced greater academic progress for low-SES students than for their middle-SES counterparts. Reinhold (2026) provided evidence from the understudied African context, examining 450 Mozambican grade 3 students and finding that teacher-led representations of multiplication partly compensated for home numeracy resource deficiencies because students who lacked formal education reported the highest effect size (d = 0.58) of this teaching method.

The research by Tapun et al. (2025) showed that parental home practice maintained the positive effects of the intervention (d = 0.72), while the absence of home practice resulted in decay (d = 0.21). The research by Ribner et al. (2022) suggested that compensation methods have limited effectiveness because they fail to work when home and school content displays direct opposition to each other.

Theme 3: Interference and Mismatched Strategies

Home-school practices that do not match each other create obstacles to learning, according to Gashaj et al.'s (2023) study. When parents employed problem-solving methods that differed from teachers, students exhibited decreased academic performance ($\beta = -.21$, $p < .01$) and increased math anxiety ($\beta = .18$, $p < .05$; Gashaj et al., 2023). Research indicates that students who receive inconsistent feedback from their parents and teachers demonstrate lower math growth than students who receive consistent support, even though both groups receive identical educational assistance (Gashaj et al., 2023; Vasquez-Salgado et al., 2021). Parents who taught their children outdated algorithms created confusion, which led to their resistance, according to Ribner et al. (2022), qualitative research. One parent reported that her child "got so confused that he didn't want to do math at all anymore" (Ribner et al., 2022, p. 407). Parents who learned different mathematical methods from current teaching methods create interference during mathematics curricular reforms (Oppermann et al., 2023).

Theme 4: Conditionality – Effects Based on Context

Student characteristics determine the systematic variation of combined effects according to Ribeiro et al. (2024) and Anggareni and Juandi (2023).

Ribeiro et al. (2024) found that parental backing produced greater benefits for students who scored lower than for students who achieved higher scores, which resulted in a parent support effect size of 0.24 for low-performing students and 0.09 for high-performing students. Anggareni and Juandi (2023) established that DI produced stronger effects for low-performing students who achieved a measurement of 0.61 compared to their higher-achieving peers who reached a measurement of 0.33.

The research by Oppermann et al. (2023) reported that home-school interactions show significant effects exclusively at mid-to-high socioeconomic status, while structural barriers block low socioeconomic status families from using school alignment to their advantage.

The research by Tapun et al. (2025) discovered that grade 1 students receive stronger parental support than grade 4 students have, at 0.26 and 0.11, respectively, while teaching methods display consistent effectiveness throughout all educational levels.

The research by Gashaj et al. (2023) established that home and school support had the strongest effects on highly anxious children who experienced additional disruptions.

The reviewed studies included only Western studies from high-income countries, while low-income studies and non-Western studies failed to meet the inclusion requirements according to Ribeiro et al. (2024) and Peterle and dos Santos (2025).

DISCUSSION

The researchers of this study examined how parental support, together with educational methods, affects primary school students' mathematics achievement. The research team identified four thematic patterns through their analysis, which showed amplification and compensation, and interference and conditionality results. The research findings extend existing knowledge by suggesting how home and school factors interact with one another instead of operating as separate elements (Anggareni & Juandi 2023; Ribeiro et al. 2024).

Interpretation of Key Findings

The dual pathways of amplification and compensation function as two distinct methods of achieving results. The process of amplification creates a combined effect that exceeds the total impact of home and school activities that work together as educational partners (Oppermann et al., 2023; Ribeiro et al., 2024). The ecological systems theory connection shows that strong home-school links lead to better developmental outcomes (Oppermann et al., 2023).

The buffering pathway, which defines compensation, enables the system to maintain balance through its ability to handle strengths from one area while compensating for weaknesses in another area (Alkafaween & Domi, 2023; Anggareni & Juandi, 2023). The results demonstrate practical importance because interventions can proceed without needing both areas to achieve progress at the same moment. Schools should use DI to assist children who lack home support, while parent training serves as a solution for areas with substandard educational programs. Active home-school opposition between parents and teachers creates a situation where compensation cannot succeed (Ribner et al., 2022).

A contradiction arises regarding the paths of amplification and compensation. Although practices that coincide in home and school lead to more pronounced results (amplification), the results from compensation show that good teaching can compensate for poor home practice. This leads to another critical question: whether amplification is always the best path, or does the relevance of either alignment or compensation vary according to certain contextual factors like the amount of support at home or the quality of teaching in class? Unfortunately, there is no direct evidence available regarding this aspect, which needs to be explored through further studies (Anggareni & Juandi, 2023; Ribeiro et al., 2024).

The presence of mismatched participation creates greater negative effects than the complete absence of participation (Gashaj et al., 2023; Ribner et al., 2022). Conflicting information creates additional mental demands, which decrease students' ability to acquire knowledge at deeper levels. Multiple instances of contradictory information create a situation that leads to children questioning their trustworthiness in their parents and teachers (Gashaj et al., 2023).

The implementation of conditional interventions requires specific target groups for intervention development. The combined effects of two factors show a systematic pattern of variation. Aligned support helps children who experience both math anxiety and low academic performance to achieve optimal results, while the research recommends targeted interventions as more effective than universal solutions (Gashaj et al., 2023; Ribeiro et al., 2024). The interaction effects between these two groups (Oppermann et al., 2023) indicate that low-SES families require both material assistance and family contact to overcome structural challenges.

Comparison of Existing Theoretical Frameworks

The current research results both validate and expand current theoretical frameworks. The study shows that strong mesosystem links lead to better results, which support Bronfenbrenner's (1979) ecological systems theory. The compensation finding shows that positive results emerge when one microsystem demonstrates strength while the other system stays neutral.

Hoover-Dempsey and Sandler's model of parental involvement explains that parents start to participate when schools extend invitations, and they possess adequate resources and self-confidence. The present review extends this model by specifying that the quality and alignment of involvement matter as much as its quantity. A parent who is highly involved but using outdated or conflicting strategies may produce interference rather than benefit (Ribner et al., 2022).

Hattie's (2023) visible learning framework shows that both feedback and teacher clarity serve as essential educational components. The present findings show that home-school consistency operates as another clear educational method because students learn better when they hear identical information from both parents and teachers. The researchers present this method as a meta-cognitive framework that enables students to learn from different educational environments (Peterle & dos Santos, 2025).

Theoretical Implications and Conceptual Advancement

The conceptual framework illustrated by **Figure 2** contributes to existing theoretical perspectives in three ways.

Firstly, it expands on the ecological systems theory of Bronfenbrenner (1979) by explaining the mechanisms by which the mesosystem affects mathematics performance. As is noted in ecological systems theory, there exists a mesosystem involving the link between home and school, although its influence is left unexplained since ecological systems theory fails to address how specific types of alignment or misalignment yield different results. This conceptual framework provides explanations by identifying four mechanisms, amplification, compensation, interference, and conditionality, by which the home-school connection impacts the mathematics performance of children

Secondly, this concept builds Hoover-Dempsey and Sandler's model of parental involvement by adding a crucial variable, alignment, that determines the effectiveness of involvement. In their model, the determinants of parental involvement are the role construction of parents, their efficacy and self-perception, and their perception of the invitations for involvement that emanate from schools.

Third, the framework draws on expectancy-value theory (Wigfield & Eccles, 2000) by emphasizing the role of motivational processes. If children receive consistent communications about the value and usefulness of mathematics both at home and at school, their motivation and engagement are enhanced. On the other hand, conflicting communications could hamper children's understanding of the value or learnability of mathematics.

Overall, these improvements are significant since they go beyond the main-effect models that have dominated the literature (Anggareni & Juandi, 2023; Ribeiro et al., 2024). By elaborating on the interactions between family and school factors and the way in which such interactions affect students' success in mathematics through motivational processes, the conceptual framework offers a deeper explanation of the effects of both parental support and pedagogy.

Methodological Strengths and Limitations

Strengths

Researchers evaluated 21 studies that used different research methods, which included longitudinal research (Oppermann et al., 2023), randomized controlled trials (Ribner et al., 2022), meta-analytical studies (Ribeiro et al., 2024), and qualitative research methods. Research findings from different methods provide proof for four research themes.

Limitations

Most research studies do not investigate how parental support interacts with teaching methods because researchers find it difficult to create tests for these interactions. The current synthesis used indirect evidence because most studies only investigated main effects (Ribeiro et al., 2024). Measurement inconsistency exists across both fields because researchers use self-reports through single items and observational methods, which makes it hard to combine data (Anggareni & Juandi, 2023). Research studies came exclusively from Western nations and high-income countries, which created a strong cultural bias and prevented the research team from studying all low-income and collectivist cultural contexts (Peterle & dos Santos, 2025). The study results show publication bias because positive results received more attention, while the interference theme needs further investigation despite the study results showing support for it (Gashaj et al., 2023).

Over-representation of Western and wealthy environments represents another major drawback. There are large cultural differences in the norms that relate to parental involvement, the quality of relations between teachers and students, and expectations regarding math success in different parts of the world (Vasquez-Salgado et al., 2021). Results reported in this review cannot be easily generalized to other cultural environments where school-family interaction could vary significantly. Future studies should concentrate on replicating this review's findings across cultures to examine the transferability of the four emerging themes.

Theoretical Contributions

Three theoretical contributions emerge from this review. Firstly, the review contributes to theory by unifying the parental support and teaching strategy literatures into a single conceptual framework, showing how their combined impact cannot be assessed separately. Secondly, it identifies four distinct mechanisms of combined influence, including amplification, compensation, interference, and conditionality, which go beyond basic additive models. Thirdly, it provides boundary conditions for each of these mechanisms: compensation is not effective when there is a direct contradiction between home and school, while amplification is most effective among poor performers. Overall, these contributions provide a richer theoretical perspective than earlier works that focused solely on main effects models (Anggareni & Juandi, 2023; Ribeiro et al., 2024).

Practical Implications

For teachers

Teachers require parents to receive specific math support strategies, which teachers will share instead of offering general advice about math assistance. The current classroom vocabulary, models, and algorithms should be shared with examples of effective questioning methods (Ribner et al., 2022). Teachers must tell parents not to teach opposing methods because they need to understand why method alignment is essential (Gashaj et al., 2023).

For schools

Schools require structured home-to-school communication systems, which should include weekly math updates that explain current strategies and recommend home activities. Technology platforms (e.g., classroom apps that parents can access) may facilitate this alignment efficiently (Peterle & dos Santos, 2025). Schools should provide additional support to low-SES families because structural barriers will prevent proper alignment when guidance is offered (Oppermann et al., 2023).

For policymakers

Teacher training programs should include professional development that focuses on teaching educators to communicate math strategies with parents and share classroom teaching methods. The home-school component needs to be coordinated for all interventions that target students with math anxiety or academic difficulties because this approach produces the best results for these two subgroups (Gashaj et al., 2023; Ribeiro et al., 2024).

For parents

Parents should ask teachers to explain the instructional methods that they should use to support their children's learning, not just what content to cover. Parents should provide non-teaching assistance, which includes creating a quiet study area and offering encouragement when they do not know how to handle a situation (Ribner et al., 2022).

CONCLUSION AND FUTURE DIRECTIONS

Summary of Principal Contributions

The study demonstrates that parental involvement and instructional methods work together to create a greater impact on primary school mathematics results than their separate effects (Peixoto et al., 2024; Ribeiro et al., 2024). Three conclusions emerge. First, aligned home-school practices produce amplification (Oppermann et al., 2023; Prast et al., 2018). The strong support that exists in one context brings value to the situation, while the other aspect remains weak until basic elements of the situation face direct contradictions (Ribner et al., 2022). The first of three combined effects

Table 3. Future research priorities

Priority	Gap	Recommended design	Key citation
1	No factorial designs test both factors	2 × 2 randomized experiment	Ribeiro et al. (2024), Silinskas and Kikas (2019)
2	No validated measure of home–school alignment	Scale development + CFA	Peterle and Santos (2025), Zhou et al. (2026)
3	Overrepresentation of Western contexts	Cross-cultural replication	Reinhold (2026), Vasquez-Salgado et al. (2021)
4	Underspecified developmental trajectories	Longitudinal (grades 1-6)	Gashaj et al. (2023), Radišić et al. (2024)

show that children who attain low academic performance and experience math anxiety and come from low socioeconomic status backgrounds will achieve maximum benefits from educational alignment and maximum damage from educational interruptions (Gashaj et al., 2023; Haataja et al., 2024).

Open Questions and Research Directions

There are still four priorities; the first is that the study needs factorial designs that test various parental support methods together with different teaching strategies (Ribeiro et al., 2024; Silinskas & Kikas, 2019). The second requirement demands that researchers create reliable measures that assess home-school alignment (Peterle & dos Santos, 2025; Zhou et al., 2026). The research needs to focus on low-income areas and non-Western regions because of its critical importance (Reinhold, 2026; Vasquez-Salgado et al., 2021). The primary education developmental pathways need better definition according to existing research (Gashaj et al., 2023; Radišić et al., 2024) (**Table 3**).

Concluding Statement

Parental support and teaching methods work together as complementary elements (Peixoto et al., 2026; Ribeiro et al., 2024). The partnership succeeds through alignment and fails through contradiction (Ribner et al., 2022). The researchers focus on developing experimental designs as their main priority. Practitioners focus on developing communication skills as their main priority, because structured parent-teacher communication systems enable parents to become more involved in their children's mathematics learning (Tsuei, 2024).

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