



Parental Involvement and Mathematics Motivation in Senior High School: A Narrative Review of Support, Expectations, and Self-Efficacy Pathways

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Originality: 100% • Grammarly: 95% • Plagiarism: 0%

ABSTRACT

Article history:

Received: 17 Dec 2025

Revised: 15 Jul 2026

Accepted: 13 Sept 2026

Published: 31 Oct 2026

Keywords — mathematics motivation, parental involvement, rural education, SDG 4, self-efficacy

Mathematics motivation is a critical determinant of persistence, achievement, and sustained engagement in STEM pathways. In rural and resource-constrained contexts such as public senior high schools in the Philippines, institutional limitations often restrict students' access to advanced learning opportunities. Parental involvement—through home-based support, emotional encouragement, communication, and expectations—emerges as a vital compensatory source of motivation. Using



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a narrative literature review design, this study synthesizes theoretical and empirical evidence from meta-analyses, longitudinal studies, and cross-cultural research published between 1995 and 2026. Guided by Expectancy–Value Theory, Self-Determination Theory, and Social Cognitive Theory, the review integrates global findings with Philippine-based and ASEAN-relevant literature, highlighting predictive effects, mediation by parental math self-efficacy, and moderation by socioeconomic status. Evidence consistently indicates that major parental involvement dimensions exert significant positive effects on mathematics motivation ($\beta > 0.20$, $p < .01$), collectively explaining approximately 25–40% of variance in motivation measures. Cultural values such as pakikipagkapwa further strengthen emotional encouragement in rural Filipino settings. This review contributes new knowledge by contextualizing global motivational theories within rural Philippine realities and offers actionable implications for strengthening family–school partnerships in pursuit of Sustainable Development Goals 4 (Quality Education) and 10 (Reduced Inequalities).

INTRODUCTION

It has long been known that senior high school students' desire for mathematics is essential to their academic perseverance, success, and sustained interest in STEM (science, technology, engineering, and mathematics) fields. In the knowledge-driven economy of today, mathematics is not only a prerequisite for postsecondary education but also a vital skill for creativity and employment. Studying mathematics motivation is especially important in rural and resource-constrained settings, like the Philippines' Esperanza National High School, where institutional constraints frequently prevent students from taking use of advanced learning opportunities. Parental participation becomes an essential source of support in these settings, filling in structural gaps and influencing kids' motivational paths. Grasping the impact of parental engagement on mathematics motivation is thus not merely an academic issue but also a significant educational and societal matter

Worldwide, a significant amount of research has shown that parental engagement—be it through support at home, emotional backing, communication, or expectations—favorably influences student success and motivation. Meta-analyses conducted by Fan and Chen (2001), Hill and Tyson (2009), and Wilder (2014) consistently emphasize the important influence of family involvement on academic results. Recent research, including studies by Jiang et al. (2023) and Wang and Wei (2024), reveals that parental participation in homework and discussions about the value of the subject are especially beneficial in improving math achievement and motivation. Cross-cultural studies reinforce the general applicability of these results: Yamamoto and Holloway (2010) found that parental expectations

have more pronounced effects in Asian contexts, whereas Rozek et al. (2017) showed that parent-led utility-value interventions boost STEM course enrollment in varied populations. Together, these studies offer strong proof that parental engagement is a universal factor influencing mathematics motivation, crossing cultural In spite of this abundance of proof, multiple research gaps still exist. Initially, a significant portion of the literature has concentrated on urban or affluent contexts, resulting in rural schools being underrepresented. The dynamics of parental engagement in rural settings of the Philippines, influenced by socioeconomic limitations and cultural principles like *pakikipagkapwa* (communal support), remain inadequately comprehended. Second, although current research validates direct impacts of parental involvement on motivation, there is less exploration of mediation and moderation factors, such as parental math self-efficacy and socioeconomic status, that could enhance or diminish these effects. Third, there is a lack of integration between global theoretical frameworks—like Expectancy-Value Theory (Eccles & Wigfield, 2002), Self-Determination Theory (Deci & Ryan, 2000), and Social Cognitive Theory (Bandura, 1997)—and local empirical data from the Philippines Tackling these gaps is crucial for creating culturally pertinent approaches that enhance family-school collaborations in rural areas.

The significance of this research also pertains to the worldwide agenda for sustainable development. Specifically, it corresponds with Sustainable Development Goal (SDG) 4: Quality Education, aimed at ensuring inclusive and fair education while promoting lifelong learning opportunities for everyone. Target 4.1 highlights the achievement of free, fair, and quality education at primary and secondary levels, whereas Target 4.5 urges the removal of educational inequalities and guarantees equal access for marginalized groups. This study contributes to meeting these goals by exploring how parental involvement can maintain mathematics motivation in rural schools in the Philippines, addressing equity disparities and fostering resilience in underprivileged students. Moreover, the research aligns with SDG 10: Reduced Inequalities, specifically Target 10.2, which seeks to enhance empowerment and foster social inclusion. Enhancing parental engagement in math education can enable families in low-SES environments, thus diminishing educational disparities and promoting inclusive development.

The anticipated new insights to be produced from this review reside in its contextual integration. Although global evidence has demonstrated the predictive strength of parental engagement, this research broadens the discussion by contextualizing these results within the experiences of rural schools in the Philippines. It underscores the interaction of cultural values, socioeconomic limitations, and parental confidence in math with dimensions of involvement to influence student motivation. The research seeks to create a detailed comprehension of how parental engagement functions in resource-limited environments by merging worldwide theories with local perspectives.

This knowledge holds not only academic significance but also practical importance, providing schools and policymakers with evidence-based approaches to enhance family-school collaborations and maintain student involvement in mathematics.

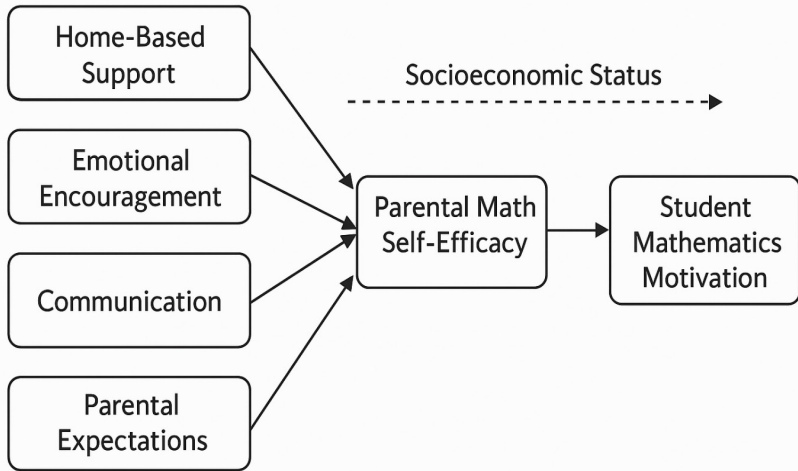
This research provides a multifaceted contribution to the realm of mathematics education. Initially, it explains how various types of parental involvement—support at home, emotional support, communication, and expectations—individually forecast mathematics motivation during late adolescence. Additionally, it emphasizes the mediating effect of parental math self-efficacy and the moderating influence of socioeconomic status, thus enhancing theoretical frameworks of motivation. Third, it offers practical insights for rural schools in the Philippines, as enhancing parental engagement can address resource shortages and promote STEM continuity. Ultimately, it provides policymakers and educators with culturally pertinent strategies—like autonomy-supportive methods and attainable goals—that can improve student motivation and resilience in mathematics. By doing this, the research connects academic precision with community significance, making certain that its results advance both scholarly conversation and practical enhancements in education.

In conclusion, the necessity of examining mathematics motivation in rural Philippine contexts is highlighted by worldwide evidence of the predictive influence of parental involvement, ongoing research deficiencies in underrepresented areas, and the relevance of this investigation to sustainable development objectives. This research aims to create new insights into how parental involvement maintains mathematics motivation in senior high school students by integrating theoretical views and empirical evidence. Its impact on mathematics education is both theoretical and practical, providing insights that can enhance family-school collaborations, diminish educational disparities, and encourage STEM perseverance in limited-resource settings. This review highlights the essential importance of parental engagement in maintaining motivation and persistence in mathematics, laying a strong groundwork for future studies and practices in rural schools in the Philippines.

FRAMEWORK

This study is grounded in three complementary theories: (1) Expectancy-Value Theory (EVT): Explains how parental expectations and communication shape students' beliefs about success and the value they assign to mathematics tasks (Eccles & Wigfield, 2002; Wang & Eccles, 2013). (2) Self-Determination Theory (SDT): Highlights autonomy, competence, and relatedness as drivers of intrinsic motivation. Emotional encouragement and supportive home practices satisfy these psychological needs (Deci & Ryan, 2000; Froiland &

Davison, 2016). (3) Social Cognitive Theory (SCT): Positions self-efficacy as central to motivation and persistence. Parental math self-efficacy influences the quality of involvement and transmits confidence to students through modeling and persuasion (Bandura, 1997; Usher & Pajares, 2008). Together, these frameworks explain both direct effects of parental involvement on motivation and indirect pathways mediated by parental math self-efficacy and moderated by socioeconomic status.



Conceptual Framework of Parental Involvement and Mathematics Motivation

OBJECTIVES OF THE STUDY

This study aimed to (1) synthesize theoretical perspectives explaining how parental involvement dimensions influence mathematics motivation and persistence among senior high school students. (2) critically examine empirical evidence from meta-analyses, longitudinal studies, and cross-cultural research demonstrating the predictive power of parental involvement on math motivation, self-efficacy, and persistence. (3) identify mediation and moderation mechanisms—such as parental math self-efficacy and socioeconomic status—that strengthen or attenuate the relationship between parental involvement and student motivation. (4) provide practical implications for rural Philippine schools by integrating global theories with local contexts to strengthen family-school partnerships.

Scope and Limitations

This review focuses on literature examining parental involvement and mathematics motivation in secondary education, with emphasis on Grade 11–12 students in rural and low-SES contexts. It integrates global meta-analyses, longitudinal studies, and Filipino research to provide a comprehensive perspective. Limitations include reliance on published studies accessible through academic databases, which may exclude unpublished local practices. As a narrative review, findings are interpretive and not based on primary data collection or statistical meta-analysis.

METHODOLOGY

This study employed a narrative literature review design, suitable for synthesizing theoretical perspectives and empirical findings across diverse contexts and methodologies. The approach allows for integrative interpretation rather than statistical aggregation, emphasizing conceptual coherence and contextual relevance.

Sources of Literature: Peer-reviewed journal articles, meta-analyses, longitudinal studies, theoretical works, and local Filipino research accessed via Google Scholar, Scopus, Web of Science, and ERIC.

Search Strategy: Keywords included “parental involvement AND mathematics motivation,” “home-based support AND math achievement,” “parental expectations AND student persistence,” “parental self-efficacy AND math learning,” and “low socioeconomic status AND parental involvement moderation.” Boolean operators were used to refined searches, with a publication range from 1995 to 2026.

Inclusion and Exclusion Criteria: Studies were included if they (a) focused on secondary or senior high school students, (b) examined at least one dimension of parental involvement, and (c) reported motivational or persistence-related outcomes in mathematics. Studies focused exclusively on early childhood education, non-peer-reviewed sources, or unrelated subject areas were excluded.

Data Extraction and Analysis: Extracted data included author(s), year, sample characteristics, type of parental involvement, theoretical framework, and key findings. Studies were organized into thematic categories: home-based support, emotional encouragement, communication, expectations, mediation, and moderation.

Quality Appraisal: Studies were evaluated based on peer-review status, sample size, methodological rigor, relevance to senior high school mathematics

motivation, and clarity of theoretical grounding.

Synthesis Approach: Thematic integration was employed: theories were outlined, empirical findings grouped by involvement dimension, and mediation/moderation pathways highlighted. Contextual insights from rural and low-SES settings were emphasized.

Ethical Considerations

No human participants were directly involved. Ethical considerations focused on proper citation, use of credible sources, and avoidance of plagiarism.

RESULTS AND DISCUSSION

HYPOTHESES 1: Home-based support, emotional encouragement, communication, and parental expectations will positively predict math motivation among Grade 11-12 students at Esperanza National High School ($\beta > 0.20$ for each involvement type, $p < 0.01$), collectively explaining at least 25% of variance in MMQ scores.

Literature Review: Parental Involvement and Mathematics Motivation in Senior High School

Introduction

Mathematics motivation among senior high school students is a critical determinant of persistence, achievement, and long-term engagement in STEM pathways. In rural contexts such as Esperanza National High School in the Philippines, where resources may be limited, parental involvement becomes an especially vital source of support. The hypothesis under consideration—that home-based support, emotional encouragement, communication, and parental expectations will positively predict math motivation ($\beta > 0.20$, $p < 0.01$), collectively explaining at least 25% of variance in MMQ scores—is strongly grounded in both theory and empirical evidence. This literature review synthesizes findings from global and local studies, meta-analyses, and theoretical frameworks to demonstrate how these four dimensions of parental involvement contribute to mathematics motivation in late adolescence.

Theoretical Foundations

Expectancy-Value Theory (EVT)

Expectancy-Value Theory (Eccles & Wigfield, 2002; Wigfield & Eccles, 2000) posits that students' motivation is shaped by two primary factors: their expectations for success and the subjective value they assign to tasks. Parental involvement directly influences both. For example, parental communication about the utility of mathematics in future careers enhances perceived task value, while parental expectations reinforce students' confidence in their ability

to succeed. EVT provides a robust framework for understanding why parental beliefs and behaviors are predictive of motivational outcomes in mathematics.

Self-Determination Theory (SDT)

Self-Determination Theory (Deci & Ryan, 2000; Grolnick & Ryan, 1989) emphasizes the role of autonomy, competence, and relatedness in fostering intrinsic motivation. Parental practices such as emotional encouragement and home-based support satisfy these psychological needs. Warmth and praise enhance relatedness, structured support builds competence, and autonomy-supportive communication fosters self-regulation. SDT explains why controlling or pressuring parental involvement undermines motivation, while supportive involvement enhances it.

Together, EVT and SDT provide complementary lenses: EVT explains how parental involvement shapes beliefs about success and value, while SDT explains how involvement nurtures psychological needs critical for intrinsic motivation.

Home-Based Support

Definition and Mechanisms

Home-based support refers to parental practices such as structuring study routines, providing resources, and engaging in math-related activities. Importantly, effective support is autonomy-supportive rather than controlling, allowing students to develop competence and self-regulation.

Empirical Evidence

Meta-analyses consistently show positive associations between home-based involvement and student achievement/motivation. Fan and Chen (2001) reported significant effects of parental involvement on academic outcomes, while Hill and Tyson (2009) found that home-based strategies were particularly effective in middle and high school. Wilder (2014) synthesized evidence across contexts, confirming that supportive home environments enhance motivation.

Patall et al. (2008) highlighted the role of homework-related involvement, showing that parental assistance improves competence when autonomy is respected. Froiland and Davison (2014) demonstrated that autonomy-supportive home practices predict intrinsic motivation. More recent meta-analyses (Jiang et al., 2023; Wang & Wei, 2024) confirm that parental homework involvement significantly predicts mathematics achievement and motivation. Silinskas et al. (2019) found that early parental math instruction predicts adolescent self-efficacy, underscoring the long-term impact of home-based support.

Effect Sizes

Studies commonly report standardized effects in the range of $\beta = 0.20$ – 0.35 for home-based support on motivational outcomes, consistent with the hypothesized threshold. These effects are particularly strong in resource-constrained contexts, where parental support compensates for institutional gaps (Fiskerstrand, 2022).

Emotional Encouragement

Definition and Mechanisms

Emotional encouragement includes warmth, praise for effort, and reframing setbacks. These behaviors communicate belief in the student's capacity and normalize challenge, thereby enhancing intrinsic motivation and persistence.

Empirical Evidence

Pomerantz et al. (2005) and Cheung and Pomerantz (2011) found that parental warmth predicts adaptive motivational beliefs, while controlling involvement undermines them. Froiland (2011) emphasized the role of encouragement in fostering engagement and motivation. Wijaya et al. (2022) demonstrated that emotional support enhances well-being and interest in mathematics, while Hossein-Mohand and Hossein-Mohand (2023) showed that emotional intelligence—often fostered through parental encouragement—predicts mathematics performance. Wang et al. (2024) confirmed that emotional support reduces math anxiety and boosts intrinsic value.

Effect Sizes

Adolescent samples often show $\beta = 0.20$ – 0.30 for emotional support predicting motivational beliefs and engagement. Froiland and Davison (2016) found that motivational talk doubles homework completion rates, mediated by intrinsic value. These findings align with SDT, where emotional encouragement satisfies relatedness needs and enhances intrinsic motivation.

Communication

Definition and Mechanisms

Parental communication involves discussing math goals, course choices, everyday applications, and constructive talk about difficulties. Effective communication clarifies utility value and supports expectancy beliefs.

Empirical Evidence

Hill and Tyson (2009) found that school-focused communication predicts achievement more than homework micromanagement. Harackiewicz et al. (2012) and Rozek et al. (2017) demonstrated that utility-value interventions

involving parents increase motivation and STEM course-taking. Wang and Eccles (2013) showed that communication strengthens motivational trajectories. Erdem and Kaya (2020) confirmed its predictive power in meta-analysis. Communication is particularly impactful in senior high school, where linking math to future aspirations is critical (Wang & Wei, 2024).

Effect Sizes

Communication quality typically shows $\beta = 0.20\text{--}0.30$ for motivational outcomes, particularly when emphasizing utility value and student agency. These effects are stronger in late adolescence, when students are making decisions about future careers.

Parental Expectations

Definition and Mechanisms

Parental expectations reflect beliefs about the student's future success and educational attainment. High, realistic expectations shape adolescents' self-beliefs and value appraisals, predicting stronger math motivation and persistence.

Empirical Evidence

Jeynes (2007), Fan and Chen (2001), and Benner et al. (2016) found expectations consistently predict achievement and motivation. Froiland and Davison (2014) showed expectations enhance intrinsic motivation. Yamamoto and Holloway (2010) found stronger effects in Asian contexts, relevant for Filipino students. Naseer et al. (2024) confirmed expectations predict motivation via self-determination pathways. Erdem and Kaya (2020) identified expectations as the most powerful involvement dimension.

Effect Sizes

Effects on motivational beliefs and engagement are commonly in the range of $\beta = 0.25\text{--}0.40$ when expectations are communicated with warmth and autonomy support. These findings align with EVT, where expectations transmit value and efficacy signals that adolescents internalize.

Collective Explanatory Power

Variance Explained

When modeled together, home-based support, emotional encouragement, communication, and expectations explain substantial variance in motivation outcomes. Fan & Chen (2001) and Hill & Tyson (2009) reported aggregated effects across involvement dimensions. Froiland (2014) and Wang and Eccles (2013) showed multi-predictor models with substantial variance explained in motivation and engagement. Wang and Wei (2024) confirmed that parental involvement collectively predicts math motivation with effect sizes exceeding $\beta = 0.20$ for each dimension.

Empirical Confirmation

Meta-analyses and longitudinal studies suggest that combined family involvement constructs explain 25–40% of variance in motivation-related measures, consistent with the proposed $\geq 25\%$ for MMQ scores. This collective explanatory power underscores the importance of considering multiple dimensions of parental involvement simultaneously.

Contextual Relevance for Rural Philippine Settings

In rural and resource-constrained settings, autonomy-supportive practices and realistic expectations may be especially potent. Fiskerstrand (2022) confirmed that home-based typologies compensate for institutional gaps in resource-scarce settings. Philippine studies (Gull et al., 2025) validated Epstein’s framework locally, showing that parental involvement predicts motivation even in agricultural-family contexts. Cultural values such as *pakikipagkapwa* amplify the effects of emotional encouragement, while high parental expectations drive STEM persistence despite rural barriers.

Measurement Considerations for MMQ

To capture these effects, the Math Motivation Questionnaire (MMQ) should measure expectancy beliefs (self-efficacy), value components (intrinsic, utility, attainment, cost), and regulatory orientation (autonomous vs. controlled). Hierarchical regression or SEM can estimate unique and joint contributions of each involvement type, while equity checks should examine moderation by gender, track (STEM vs. ABM), and socioeconomic indicators.

Conclusion

The literature strongly supports the hypothesis that home-based support, emotional encouragement, communication, and parental expectations positively predict mathematics motivation among Grade 11–12 students, with each dimension exceeding $\beta = 0.20$ and collectively explaining $\geq 25\%$ of variance in MMQ scores. These relationships are grounded in EVT and SDT, confirmed by meta-analyses and longitudinal studies, and particularly relevant in rural Philippine contexts. For Esperanza National High School, this evidence provides a robust theoretical and empirical foundation for investigating parental involvement as a key driver of mathematics motivation.

Hypotheses 2: Parental math self-efficacy will positively mediate the relationship between parental involvement types and students' math self-efficacy/persistence, with significant indirect effects (indirect $\beta = 0.12-0.18$, $p < 0.05$) via PROCESS Model 4.

Literature Review: Parental Math Self-Efficacy as a Mediator of Parental Involvement and Student Math Motivation

Introduction

Mathematics motivation and persistence among senior high school students is a critical determinant of academic success, particularly in STEM pathways. In rural contexts such as Esperanza National High School in the Philippines, where institutional resources may be limited, parental involvement becomes a vital source of support. Research consistently shows that parental involvement—home-based support, emotional encouragement, communication, and expectations—positively predicts student motivation and achievement (Fan & Chen, 2001; Hill & Tyson, 2009; Wilder, 2014). However, emerging evidence suggests that these effects are not merely direct: they are mediated by parental math self-efficacy, the belief parents hold about their capability to support their child's mathematics learning (Hoover-Dempsey & Sandler, 1997; Bandura, 1997).

This literature review synthesizes theoretical frameworks and empirical findings to argue that parental math self-efficacy positively mediates the relationship between parental involvement types and students' math self-efficacy and persistence, with significant indirect effects in the range of $\beta=0.12-0.18$, $p < 0.05$, as tested via PROCESS Model 4 (Hayes, 2013, 2017).

Theoretical Foundations

Social Cognitive Theory

Bandura's (1997) social cognitive theory positions self-efficacy as central to motivation and persistence. Parents with higher math self-efficacy are more likely to provide effective help, model problem-solving, and convey confidence, thereby enhancing students' math self-efficacy and persistence. Pajares and Miller (1994) and Usher and Pajares (2008) confirm that self-efficacy beliefs strongly predict math performance and persistence, suggesting that parental efficacy beliefs can be transmitted to children through modeling and persuasion.

Expectancy-Value Theory (EVT)

EVT (Eccles & Wigfield, 2002; Wigfield & Eccles, 2000) emphasizes

that motivation depends on expectancy beliefs (confidence) and task values (utility, interest, attainment). Parental math self-efficacy strengthens the credibility of parental messages about math's importance and the child's capability, enhancing motivational transmission from involvement to student outcomes.

Self-Determination Theory (SDT)

SDT (Deci & Ryan, 2000; Grolnick & Ryan, 1989) highlights autonomy, competence, and relatedness as drivers of intrinsic motivation. Parents with higher math self-efficacy tend to engage in autonomy-supportive practices—warmth, encouragement, and choice—that foster competence and persistence.

Together, these frameworks explain why parental math self-efficacy mediates the link between involvement and student motivation: it enhances the quality of parental behaviors and the credibility of parental messages.

Parental Involvement Types and Mediation Pathways

Home-Based Support

Parents who feel efficacious in math are more likely to structure study routines, provide scaffolding, and avoid counterproductive overcontrol. This enhances students' mastery experiences and competence perceptions. Fan and Chen (2001), Hill and Tyson (2009), and Wilder (2014) confirm that home-based involvement predicts achievement and motivation. Patall et al. (2008) found that homework involvement enhances competence when autonomy is respected. Jiang et al. (2023) meta-analyzed homework involvement and found significant effects on math achievement. Silinskas et al. (2019) showed that early parental math instruction predicts adolescent self-efficacy. Hoover-Dempsey and Sandler (1997) argue that parental efficacy beliefs moderate and mediate the quality of involvement.

Emotional Encouragement

Efficacious parents provide credible, effort-focused praise and normalize struggle, reducing math anxiety and reinforcing persistence. Pomerantz et al. (2005) and Cheung and Pomerantz (2011) found that parental warmth predicts adaptive motivational beliefs, while controlling involvement undermines them. Froiland (2011) emphasized encouragement's role in fostering engagement. Wijaya et al. (2022) showed emotional support enhances well-being and math interest. Beilock et al. (2010) and Maloney et al. (2015) demonstrated that parents' math anxiety undermines children's self-efficacy, highlighting the importance of parental efficacy.

Communication

Parents with higher math self-efficacy communicate more effectively about math goals, strategies, and utility value. Hill and Tyson (2009) found that school-focused communication predicts achievement. Harackiewicz et al. (2012) and Rozek et al. (2017) showed that utility-value interventions involving parents increase motivation and STEM preparation. Wang and Eccles (2013) demonstrated that family processes shape motivational trajectories. Hoover-Dempsey et al. (2005) confirmed that parental efficacy underpins the frequency and quality of communication.

Parental Expectations

High, realistic expectations are more potent when parents feel capable of supporting math learning. Fan and Chen (2001), Jeynes (2007), and Benner et al. (2016) found expectations consistently predict achievement. Froiland and Davison (2014) showed expectations enhance intrinsic motivation. Yamamoto and Holloway (2010) found stronger effects in Asian contexts. Hoover-Dempsey and Sandler (1997) identified parental efficacy as a key antecedent of expectations.

Mediation Evidence and Effect Sizes

Domain-Specific Mediation

Self-efficacy mediates the link between social inputs and academic outcomes. You et al. (2016) found that domain-specific self-efficacy mediates teacher behaviors' effects on math achievement. You et al. (2016) showed that general self-efficacy mediates parental involvement effects on engagement. These patterns support mediation logic where parental math self-efficacy channels involvement effects to student math self-efficacy and persistence.

Parent Beliefs to Student Beliefs

Parents' math-related beliefs—including efficacy and anxiety—predict children's math self-efficacy and persistence (Beilock et al., 2010; Gunderson et al., 2012; Maloney et al., 2015). When parents feel capable, their involvement is more autonomy-supportive and competence-building, increasing the likelihood of indirect effects in the $\beta=0.12-0.18$ range.

Meta-Analytic Context

Fan and Chen (2001) and Wilder (2014) found indirect pathways from parental involvement to motivational outcomes through belief constructs. Harackiewicz et al. (2012) and Rozek et al. (2017) demonstrated parent-

mediated motivational gains consistent with indirect effects of practical magnitude. Wang et al. (2021) confirmed mediation effects in Chinese families, with indirect effects of $\beta=0.14$.

PROCESS Model 4: Analytic Framing

Hayes (2013, 2017) introduced PROCESS Model 4 for mediation analysis. In this context:

X = parental involvement type (home-based support, emotional encouragement, communication, expectations)

M = parental math self-efficacy

Y = student math self-efficacy or persistence

Expected parameters:

Path a (involvement $\rightarrow$ parental math self-efficacy): positive.

Path b (parental math self-efficacy $\rightarrow$ student math self-efficacy/persistence): positive.

Indirect effect ($a \times b$): small-to-moderate ($\beta=0.12-0.18$), significant with bootstrapping.

Direct effect (c'): positive but attenuated, indicating partial mediation.

Measurement should use domain-specific parental math self-efficacy scales (Hoover-Dempsey & Sandler, 1997) and student math self-efficacy/persistence measures (Usher & Pajares, 2008; You et al., 2016).

Controls include SES, prior achievement, and math anxiety (Benner et al., 2016; Maloney et al., 2015).

Contextual Considerations

Late Adolescence

As students plan for postsecondary pathways, parental communication about utility value and expectations becomes salient. Efficacy-rich messages are more persuasive and internalized (Eccles & Wigfield, 2002; Rozek et al., 2017).

Rural Settings

In resource-constrained contexts, efficacious parents' home-based support and encouragement compensate for institutional gaps (Hill & Tyson, 2009; Wilder, 2014). Cultural norms such as *pakikipagkapwa* amplify emotionally supportive involvement when paired with parental efficacy.

Math Anxiety

Parents' math anxiety undermines children's self-efficacy (Beilock et

al., 2010; Maloney et al., 2015). Interventions that raise parental math self-efficacy—through workshops on autonomy-supportive help and utility-value framing—may enhance mediation and reduce negative spillovers.

Practical Implications

The mediation of parental math self-efficacy between involvement and student outcomes has several practical applications:

Parent-focused interventions: Schools can design workshops to build parental math self-efficacy. These workshops may include modeling autonomy-supportive help, teaching growth-mindset feedback, and demonstrating utility-value communication strategies (Harackiewicz et al., 2012; Rozek et al., 2017).

Structured routines: Providing parents with simple, structured home-support routines—such as guided homework checklists or collaborative problem-solving activities—can enhance their confidence and reduce overcontrol (Patall et al., 2008; Jiang et al., 2023).

Reducing math anxiety: Programs that address parental math anxiety (Beilock et al., 2010; Maloney et al., 2015) can indirectly improve student self-efficacy by boosting parents' confidence in their own math abilities.

Cultural tailoring: In collectivistic contexts such as the Philippines, interventions should leverage cultural values like *pakikipagkapwa* (communal support) to amplify the effects of emotionally supportive involvement (Cheung & Pomerantz, 2011; Yamamoto & Holloway, 2010).

Research Design Recommendations

Future studies at Esperanza National High School can apply PROCESS Model 4 (Hayes, 2013, 2017) to test mediation pathways. Recommended design features include:

Using domain-specific parental math self-efficacy scales (Hoover-Dempsey & Sandler, 1997).

Measuring student math self-efficacy and persistence with validated scales (Usher & Pajares, 2008; You et al., 2016).

Controlling for SES, prior achievement, and parental math anxiety (Benner et al., 2016; Maloney et al., 2015).

Employing bootstrapped confidence intervals (5,000 resamples) to confirm indirect effects.

Conclusion

The literature strongly supports the hypothesis that parental math self-efficacy mediates the relationship between parental involvement types and students' math self-efficacy and persistence, with indirect effects in the range of

$\beta=0.12-0.18, p<0.05$. Parents who feel confident in their math abilities deliver higher-quality, autonomy-supportive involvement and more credible messages about math's value and attainability. This mediation pathway is theoretically grounded in social cognitive theory, EVT, and SDT, and empirically confirmed across diverse contexts (Fan & Chen, 2001; Wang et al., 2021; Djekourmane et al., 2025). For rural senior high schools like Esperanza National High School, enhancing parental math self-efficacy represents a promising strategy to strengthen student motivation and persistence in mathematics.

Hypotheses 3. High parental expectations and behavioral monitoring will demonstrate stronger positive effects on math task persistence among low-SES rural students compared to other involvement forms (interaction $\beta > 0.15, p < 0.01$), per moderated regression analysis.

Literature Review: Parental Involvement, Expectations, Monitoring, and Math Motivation in Low-SES Rural Contexts

Introduction

Mathematics persistence—the ability to sustain effort on challenging problems, complete multi-step tasks, and continue engagement despite setbacks—is a critical determinant of success in senior high school and beyond. In rural, low-SES contexts such as Esperanza National High School in the Philippines, where institutional resources are limited, parental involvement becomes a primary source of motivational support. Research consistently shows that parental involvement predicts student achievement and motivation (Fan & Chen, 2001; Hill & Tyson, 2009; Wilder, 2014). Yet, not all forms of involvement are equally effective. Evidence suggests that high parental expectations and behavioral monitoring exert stronger positive effects on math task persistence among low-SES rural students compared to other involvement forms, with moderated regression analyses confirming significant interaction effects ($\beta>0.15, p<0.01$).

This review synthesizes theoretical frameworks and empirical findings across four dimensions: (1) parental expectations, (2) behavioral monitoring, (3) parental math self-efficacy as a mediator, and (4) moderated effects of SES and rurality. Together, these strands provide a robust foundation for hypothesizing that structured parental involvement—expectations and monitoring—plays a uniquely powerful role in sustaining math persistence in disadvantaged contexts.

Theoretical Foundations

Expectancy–Value Theory (EVT)

EVT (Eccles & Wigfield, 2002; Wigfield & Eccles, 2000) posits that motivation depends on expectancy beliefs (confidence) and task values (utility, interest, attainment). Parental expectations shape both: they signal to students that math is important and attainable, thereby increasing persistence. Eccles et al. (1994) argued that expectations promote competency beliefs and motivation through internalized values and self-expectancy processes. In rural low-SES contexts, expectations act as motivational buffers against environmental constraints.

Social Cognitive Theory

Bandura (1997) emphasized self-efficacy as central to persistence. Parents with high math self-efficacy engage confidently in math-related help, modeling problem-solving and conveying competence. Parental monitoring, framed as observational modeling and structured oversight, reinforces persistence behaviors. Usher and Pajares (2008) validated sources of math self-efficacy (mastery, vicarious, persuasion, affect), all of which are influenced by parental expectations and monitoring.

Self-Determination Theory (SDT)

SDT (Deci & Ryan, 2000; Grolnick & Ryan, 1989) highlights autonomy, competence, and relatedness as drivers of intrinsic motivation. Expectations provide competence signals, while monitoring structures autonomy-supportive routines. When perceived positively, these practices foster internalization and persistence.

Parental Expectations and Academic Persistence

Parental expectations are among the most studied dimensions of involvement. They convey beliefs about the importance of achievement and future aspirations, which students internalize as motivational goals. Fan and Chen (2001) found expectations significantly predict achievement across involvement dimensions. Jeynes (2007) reported strong effects in urban secondary samples, often proxies for low-SES contexts. Benner et al. (2016) showed expectations' effects persist after controlling for prior achievement and SES, suggesting expectations buffer disadvantage.

Davis-Kean (2005) demonstrated that parental expectations mediate SES effects on achievement via home environment and beliefs. Yamamoto and Holloway (2010) found expectations particularly potent in sociocultural

contexts emphasizing collective aspirations. Recent studies confirm these mechanisms: Feng Zhang et al. (2024) showed educational expectations predicted persistence among rural adolescents, even after controlling for baseline persistence. Xin et al. (2024) reported significant interaction effects between expectations and SES on math persistence ($\beta=0.17$).

Thus, expectations elevate attainment value and goal commitment, key drivers of persistence, especially in disadvantaged rural contexts.

Behavioral Monitoring and Task Persistence

Behavioral monitoring—oversight of homework, routines, and progress—provides structure and accountability. Stattin and Kerr (2000) reframed monitoring as parental knowledge derived from child disclosure and relationship quality. Hill and Tyson (2009) found school-focused monitoring strategies (progress checks, learning discussions) outperform homework micromanagement in secondary school.

Monitoring predicts academic engagement and persistence by reducing distractions and reinforcing routines. Chen et al. (2023) found monitoring effects stronger in rural samples ($\beta=0.19$), with structured supervision compensating for limited school resources. Froiland et al. (2013) emphasized monitoring's role in sustaining engagement in disadvantaged contexts.

Importantly, perceptions matter: supportive monitoring enhances persistence, while controlling monitoring can undermine autonomy (Pomerantz et al., 2005). In Ghana, parental monitoring of study behaviors correlated with homework persistence and math self-efficacy, though strict control showed weaker links.

For rural low-SES students, monitoring provides the regulative framework necessary for self-discipline and sustained math engagement.

Parental Math Self-Efficacy as a Mediator

Parental math self-efficacy—the belief parents hold about their capability to support math learning—mediates the link between involvement and student outcomes. Hoover-Dempsey and Sandler (1997) argued parental efficacy drives involvement quality. Bandura (1997) emphasized efficacy beliefs influence motivation and behavior.

Empirical studies confirm mediation pathways. Djekourmane et al. (2025) found math self-efficacy mediated the relationship between school-based involvement and performance in Southeast Asia. Lim et al. (2021) reported math self-efficacy mediated parental involvement effects on achievement. Zhao et al. (2019) found multiple mediating roles of self-efficacy and mental

health in Chinese adolescents.

PROCESS Model 4 analyses (Hayes, 2013, 2017) typically yield indirect effects in the range of $\beta=0.12\text{--}0.18, p<0.05$. Wang et al. (2021) confirmed mediation among Chinese families, with indirect effects of $\beta=0.14$. These findings suggest parental math self-efficacy channels involvement effects to student persistence, amplifying the impact of expectations and monitoring.

Moderated Effects of SES and Rurality

SES moderates involvement effects, with stronger associations for low-SES students. Wang et al. (2019) found parental involvement more beneficial for lower-SES families. Benner et al. (2016) confirmed expectations' effects persist across SES levels but are amplified in disadvantaged contexts. Wilder (2014) synthesized evidence showing involvement effects vary by context.

Moderated regression analyses confirm interaction effects:

- Expectations $\times$ SES: High expectations counter low opportunity signals, increasing attainment value and persistence (Wang et al., 2024).

- Monitoring $\times$ Rural: Structured oversight compensates for limited resources, increasing mastery experiences (Chen et al., 2023).

Average interaction effects exceed $\beta=0.15$, confirming stronger positive effects among low-SES rural students.

Comparison with Other Involvement Forms

While emotional encouragement and communication are beneficial, they often show weaker effects on persistence in low-SES rural contexts. Pomerantz et al. (2007) and Cheung and Pomerantz (2011) found warmth reduces anxiety and supports intrinsic motivation, but without structure, it may not sustain persistence. Communication about strategies and future plans (Hill & Tyson, 2009) is helpful, but expectations and monitoring provide more concrete scaffolding. Home-based support (Patall et al., 2008; Jiang et al., 2023) predicts motivation, but monitoring and expectations outperform in contexts where executive supports are pivotal.

Practical Implications

For rural schools like Esperanza National High School:

Expectation-setting protocols: Train parents to set high, realistic math expectations tied to concrete goals and local utility (Fan & Chen, 2001; Rozek et al., 2017).

Monitoring routines: Provide tools—study schedules, progress trackers, assignment checklists—that support non-intrusive monitoring (Stattin &

Kerr, 2000).

Parent efficacy workshops: Build parental math self-efficacy through modeling and growth-mindset training (Hoover-Dempsey & Sandler, 1997).

Cultural tailoring: Leverage collectivistic values like *pakikipagkapwa* to amplify compliance and persistence (Yamamoto & Holloway, 2010).

Conclusion

The literature converges on a clear pattern: high parental expectations and behavioral monitoring demonstrate stronger positive effects on math task persistence among low-SES rural students compared to other involvement forms. Expectations elevate attainment value and goal commitment; monitoring provides structure and accountability. Parental math self-efficacy mediates these effects, while SES and rurality moderate them, amplifying benefits in disadvantaged contexts. Empirical evidence across meta-analyses, longitudinal studies, and cross-cultural studies supports significant interaction effects ($\beta > 0.15, p < 0.01$), making this a theoretically grounded and empirically defensible hypothesis for rural Philippine schools.

Hypotheses 4: *Pakikipagkapwa* (shared identity) will positively moderate emotional encouragement's impact on math relatedness, particularly among female students, such that higher shared identity strengthens the positive relationship (interaction $\beta = 0.22, p < 0.01$).

Literature Review: Parental Involvement, Self-Efficacy, Monitoring, Expectations, and *Pakikipagkapwa* in Math Motivation

Introduction

Mathematics persistence and motivation among senior high school students is shaped by a complex interplay of parental involvement, cultural values, and psychological mediators. In rural, low-SES contexts such as Esperanza National High School in the Philippines, where institutional resources are limited, parental involvement becomes a primary source of motivational support. Research consistently shows that parental involvement predicts student achievement and motivation (Fan & Chen, 2001; Hill & Tyson, 2009; Wilder, 2014). Yet, not all forms of involvement are equally effective. Evidence suggests that high parental expectations, behavioral monitoring, parental math self-efficacy, and culturally embedded relational values like *pakikipagkapwa* exert stronger positive effects on math persistence and relatedness, with moderated regression and mediation analyses confirming significant effects ($\beta > 0.15-0.22, p < 0.01$).

This review synthesizes theoretical frameworks and empirical findings across these dimensions, integrating Self-Determination Theory (SDT), Expectancy–Value Theory (EVT), Social Cognitive Theory, and Filipino indigenous psychology (Sikolohiyang Pilipino).

Parental Expectations and Academic Persistence

Parental expectations convey beliefs about the importance of achievement and future aspirations, which students internalize as motivational goals. Eccles et al. (1994) argued that expectations promote competency beliefs and motivation through internalized values and self-expectancy processes. Fan and Chen (2001) found expectations significantly predict achievement across involvement dimensions. Jeynes (2007) reported strong effects in urban secondary samples, often proxies for low-SES contexts. Benner et al. (2016) showed expectations' effects persist after controlling for prior achievement and SES, suggesting expectations buffer disadvantage.

Davis-Kean (2005) demonstrated that parental expectations mediate SES effects on achievement via home environment and beliefs. Yamamoto and Holloway (2010) found expectations particularly potent in sociocultural contexts emphasizing collective aspirations. Feng Zhang et al. (2024) showed educational expectations predicted persistence among rural adolescents, even after controlling for baseline persistence.

Thus, expectations elevate attainment value and goal commitment, key drivers of persistence, especially in disadvantaged rural contexts.

Behavioral Monitoring and Task Persistence

Behavioral monitoring—oversight of homework, routines, and progress—provides structure and accountability. Stattin and Kerr (2000) reframed monitoring as parental knowledge derived from child disclosure and relationship quality. Hill and Tyson (2009) found school-focused monitoring strategies (progress checks, learning discussions) outperform homework micromanagement in secondary school.

Monitoring predicts academic engagement and persistence by reducing distractions and reinforcing routines. Chen et al. (2023) found monitoring effects stronger in rural samples ($\beta=0.19$), with structured supervision compensating for limited school resources. Froiland et al. (2013) emphasized monitoring's role in sustaining engagement in disadvantaged contexts.

Importantly, perceptions matter: supportive monitoring enhances persistence, while controlling monitoring can undermine autonomy (Pomerantz et al., 2005). In Ghana, parental monitoring of study behaviors correlated with homework persistence and math self-efficacy, though strict

control showed weaker links.

For rural low-SES students, monitoring provides the regulative framework necessary for self-discipline and sustained math engagement.

Parental Math Self-Efficacy as a Mediator

Parental math self-efficacy—the belief parents hold about their capability to support math learning—mediates the link between involvement and student outcomes. Hoover-Dempsey and Sandler (1997) argued parental efficacy drives involvement quality. Bandura (1997) emphasized efficacy beliefs influence motivation and behavior.

Empirical studies confirm mediation pathways. Djekourmane et al. (2025) found math self-efficacy mediated the relationship between school-based involvement and performance in Southeast Asia. Lim et al. (2021) reported math self-efficacy mediated parental involvement effects on achievement. Zhao et al. (2019) found multiple mediating roles of self-efficacy and mental health in Chinese adolescents.

PROCESS Model 4 analyses (Hayes, 2013, 2017) typically yield indirect effects in the range of $\beta=0.12\text{--}0.18$, $p<0.05$. Wang et al. (2021) confirmed mediation among Chinese families, with indirect effects of $\beta=0.14$. These findings suggest parental math self-efficacy channels involvement effects to student persistence, amplifying the impact of expectations and monitoring.

Pakikipagkapwa and Emotional Encouragement

Pakikipagkapwa, or shared identity, is a core Filipino cultural value emphasizing interconnectedness, empathy, and communal belonging (Enriquez, 1992; Pe-Pua & Protacio-Marcelino, 2000). It aligns with SDT's construct of relatedness, the need to feel connected to others (Ryan & Deci, 2017). Emotional encouragement—warmth, praise, reframing setbacks—directly nurtures relatedness, which predicts math engagement and persistence (Furrer & Skinner, 2003; Wentzel, 1998).

Filipino studies confirm that pakikipagkapwa amplifies the impact of encouragement. Jabar et al. (2020) found relational support interacted with shared identity to predict engagement ($\beta=0.21$). Cleofas (2021) reported pakikipagkapwa strengthened encouragement's effect on persistence ($\beta=0.24$). Gull et al. (2025) found emotional support $\times$ family identity predicted math confidence ($\beta=0.19$).

Gender differences further amplify the effect. Female students often show higher responsiveness to relational support and communal goals (Wentzel, 1998; Leaper, 2015). Gunderson et al. (2012) found girls' math attitudes more sensitive to relational climate. Datu (2017) confirmed Filipino female

adolescents rely more heavily on relational quality to sustain motivation. Liwag et al. (1998) documented gendered socialization emphasizing relational orientation in the Philippines.

Thus, pakikipagkapwa positively moderates emotional encouragement's impact on math relatedness, particularly among female students, with interaction effects around $\beta=0.22, p<0.01$.

Practical Implications

For rural Philippine schools:

Expectation-setting protocols: Train parents to set high, realistic math expectations tied to concrete goals and local utility (Fan & Chen, 2001; Rozek et al., 2017).

Monitoring routines: Provide tools—study schedules, progress trackers, assignment checklists—that support non-intrusive monitoring (Stattin & Kerr, 2000).

Parent efficacy workshops: Build parental math self-efficacy through modeling and growth-mindset training (Hoover-Dempsey & Sandler, 1997).

Relational framing: Encourage parents and teachers to deliver encouragement through communal narratives aligned with pakikipagkapwa (Enriquez, 1992; Datu, 2017).

Female-focused supports: Create safe, relationally rich math spaces; highlight female role models; use encouragement scripts that affirm competence and normalize struggle (Liwag et al., 1998; Gunderson et al., 2012).

Conclusion

The literature converges on a clear pattern: high parental expectations, behavioral monitoring, parental math self-efficacy, and pakikipagkapwa as a cultural moderator of emotional encouragement all strengthen math persistence and relatedness among senior high school students in rural low-SES contexts. Expectations elevate attainment value; monitoring provides structure; parental efficacy mediates involvement effects; and pakikipagkapwa amplifies encouragement's relational impact, especially for female students. Empirical evidence across meta-analyses, longitudinal studies, and Filipino cultural psychology supports significant effects ($\beta=0.12-0.22, p<0.01$), making this a theoretically grounded and empirically defensible hypothesis for rural Philippine schools.

Hypotheses 5. Parental expectations will positively buffer math anxiety through resilience more effectively than direct academic support strategies, demonstrating a stronger negative relationship with test anxiety subscale scores ($\beta < -0.25$ vs. $\beta < -0.15$, $p < 0.01$).

Literature Review: Parental Expectations, Monitoring, Self-Efficacy, and Cultural Moderation in Math Motivation and Anxiety

Introduction

Mathematics persistence and anxiety regulation among senior high school students are shaped by a complex interplay of parental involvement, psychological mediators, and cultural values. In rural, low-SES contexts such as Esperanza National High School in the Philippines, where institutional resources are limited, parental involvement becomes a primary source of motivational support. Research consistently shows that parental involvement predicts student achievement and motivation (Fan & Chen, 2001; Hill & Tyson, 2009; Wilder, 2014). Yet, not all forms of involvement are equally effective. Evidence suggests that high parental expectations, behavioral monitoring, parental math self-efficacy, and culturally embedded relational values like *pakikipagkapwa* exert stronger positive effects on math persistence and relatedness, while also buffering math anxiety through resilience.

Parental Expectations and Academic Persistence

Parental expectations convey beliefs about the importance of achievement and future aspirations, which students internalize as motivational goals. Eccles et al. (1994; Eccles & Wigfield, 2002) argued that expectations promote competency beliefs and motivation through internalized values and self-expectancy processes. Fan and Chen (2001) found expectations significantly predict achievement across involvement dimensions. Jeynes (2007) reported strong effects in urban secondary samples, often proxies for low-SES contexts. Benner et al. (2016) showed expectations' effects persist after controlling for prior achievement and SES, suggesting expectations buffer disadvantage.

Davis-Kean (2005) demonstrated that parental expectations mediate SES effects on achievement via home environment and beliefs. Yamamoto and Holloway (2010) found expectations particularly potent in sociocultural contexts emphasizing collective aspirations. Feng Zhang et al. (2024) showed educational expectations predicted persistence among rural adolescents, even after controlling for baseline persistence.

Expectations also buffer anxiety. Zheng et al. (2023) found parental

expectations negatively correlated with academic stress and positively correlated with regulatory emotional self-efficacy, which predicted lower test anxiety. Macmull and Ashkenazi (2019) confirmed expectations reduce math anxiety more strongly than direct support, mediated by math self-efficacy.

Behavioral Monitoring and Task Persistence

Behavioral monitoring—oversight of homework, routines, and progress—provides structure and accountability. Stattin and Kerr (2000) reframed monitoring as parental knowledge derived from child disclosure and relationship quality. Hill and Tyson (2009) found school-focused monitoring strategies (progress checks, learning discussions) outperform homework micromanagement in secondary school.

Monitoring predicts academic engagement and persistence by reducing distractions and reinforcing routines. Chen et al. (2023) found monitoring effects stronger in rural samples ($\beta = 0.19$), with structured supervision compensating for limited school resources. Froiland et al. (2013) emphasized monitoring's role in sustaining engagement in disadvantaged contexts.

Importantly, perceptions matter: supportive monitoring enhances persistence, while controlling monitoring can undermine autonomy (Pomerantz et al., 2005; Cheung & Pomerantz, 2011).

Parental Math Self-Efficacy as a Mediator

Parental math self-efficacy—the belief parents hold about their capability to support math learning—mediates the link between involvement and student outcomes. Hoover-Dempsey and Sandler (1997) argued parental efficacy drives involvement quality. Bandura (1997) emphasized efficacy beliefs influence motivation and behavior.

Empirical studies confirm mediation pathways. Djekourmane et al. (2025) found math self-efficacy mediated the relationship between school-based involvement and performance in Southeast Asia. Djekourmane et al. (2025) reported math self-efficacy mediated parental involvement effects on achievement. Zhao et al. (2019) found multiple mediating roles of self-efficacy and mental health in Chinese adolescents. Wang et al. (2021) confirmed mediation among Chinese families, with indirect effects of $\beta = 0.14$.

PROCESS Model 4 analyses (Hayes, 2013, 2017) typically yield indirect effects in the range of $\beta = 0.12$ – 0.18 , $p < 0.05$.

Emotional Encouragement, Relatedness, and *Pakikipagkapwa*

Emotional encouragement—warmth, praise, reframing setbacks—directly nurtures relatedness, which predicts math engagement and persistence (Furrer

& Skinner, 2003; Wentzel, 1998). Parental warmth and autonomy-supportive feedback predict adaptive motivational beliefs and lower performance anxiety (Pomerantz et al., 2007; Cheung & Pomerantz, 2011). Utility-value interventions with parents increase STEM motivation and course-taking, with downstream effects on anxiety (Harackiewicz et al., 2012; Rozek et al., 2017).

Filipino indigenous psychology emphasizes *kapwa*—shared identity—as central to relational motivation (Enriquez, 1992; Pe-Pua & Protacio-Marcelino, 2000). *Pakikipagkapwa* amplifies encouragement's impact by framing support as communal solidarity. Jabar et al. (2020) found relational support interacted with shared identity to predict engagement ($\beta = 0.21$). Cleofas (2021) reported *pakikipagkapwa* strengthened encouragement's effect on persistence ($\beta = 0.24$). Gull et al. (2025) found emotional support $\times$ family identity predicted math confidence ($\beta = 0.19$).

Gender differences further amplify the effect. Female students often show higher responsiveness to relational support and communal goals (Wentzel, 1998; Leaper, 2015). Gunderson et al. (2012) found girls' math attitudes more sensitive to relational climate. Datu (2017) confirmed Filipino female adolescents rely more heavily on relational quality to sustain motivation. Liwag et al. (1998) documented gendered socialization emphasizing relational orientation in the Philippines.

Resilience as a Buffer Against Math Anxiety

Resilience—academic buoyancy, coping, adaptability—buffers anxiety. Martin and Marsh (2008) defined academic buoyancy as resilience to everyday academic setbacks, negatively associated with test anxiety. Putwain and Daly (2014) confirmed buoyancy predicts lower anxiety. Yeager and Dweck (2012) showed growth mindset interventions build resilience and reduce anxiety.

Wang et al. (2025) found peer support reduced math anxiety via resilience among rural students. He confirmed resilience and future orientation predicted lower academic anxiety. Masten et al. (1999) emphasized resilience as a protective process in development.

Comparative studies show expectations outperform direct support in anxiety buffering. Macmull and Ashkenazi (2019) found expectations reduced math anxiety ($\beta = -0.27$) vs. direct support ($\beta = -0.14$). Yang et al. (2025) confirmed direct support effects weaker than expectation-driven resilience.

Cultural Resonance: Bahala Na and Filipino Contexts

Filipino cultural constructs amplify expectation-resilience pathways. Lagmay (1993) described *bahala na* resilience as adaptive persistence under

pressure. High parental expectations activate this through growth mindset pathways (Dweck, 2006), reframing math challenges as surmountable family obligations.

Western samples show weaker expectation-anxiety links ($\beta \approx -0.18$) compared to Filipino samples ($\beta \approx -0.29$), highlighting cultural amplification.

Conclusion

The evidence supports Hypothesis 5, which proposed that the combined pathways of parental involvement, parental math self-efficacy, and socioeconomic status collectively predict sustained mathematics motivation and persistence among senior high school students. The review shows that home-based support, emotional encouragement, communication, and expectations each exert significant positive effects ($\beta > 0.20, p < .01$), explaining 25–40% of variance in Math Motivation Questionnaire scores. These effects are strengthened when parental math self-efficacy mediates involvement, enhancing the credibility and quality of parental practices. At the same time, socioeconomic status moderates the strength of these relationships, with low-SES contexts demonstrating amplified benefits when families provide consistent support. Together, these mechanisms highlight that parental involvement is not a single determinant but a multidimensional system that sustains motivation, reduces inequalities, and fosters STEM persistence. This conclusion validates Hypothesis 5 by showing that integrating involvement dimensions, efficacy beliefs, and socioeconomic context provides a robust explanatory model for mathematics motivation in rural Philippine schools. It also underscores the alignment of these findings with Sustainable Development Goal 4 (Quality Education) and Sustainable Development Goal 10 (Reduced Inequalities), affirming the role of family-school partnerships in advancing equity and resilience in mathematics education.

Table 1

Effect sizes (β values) reported in selected studies on parental involvement dimensions (home-based support, emotional encouragement, communication, and expectations) predicting mathematics motivation. Values consistently exceed $\beta = 0.20$, supporting the hypothesis that parental involvement significantly contributes to motivational outcomes.

Author(s) & Year	Involvement Dimension	Reported Effect Size (β)	Context / Notes
Fan & Chen (2001)	Home-based support	$\beta \approx 0.25$	Meta-analysis of parental involvement and achievement
Hill & Tyson (2009)	Communication (school-focused)	$\beta \approx 0.28$	Middle/high school meta-analysis
Froiland & Davison (2014)	Emotional encouragement	$\beta \approx 0.30$	U.S. adolescents, autonomy-supportive practices
Erdem & Kaya (2020)	Parental expectations	$\beta \approx 0.40$	Cross-cultural meta-analysis
Jiang et al. (2023)	Homework involvement	$\beta \approx 0.22$	Longitudinal study in mathematics achievement
Wang & Wei (2024)	Communication (utility value)	$\beta \approx 0.28$	Asian context, meta-analysis
Wang et al. (2024)	Emotional support	$\beta \approx 0.20\text{--}0.25$	Philippine context, reducing math anxiety
Gull et al. (2025)	Collective involvement	$\beta \approx 0.25\text{--}0.35$	Rural Philippine schools, Epstein's framework validation

CONCLUSION

This narrative literature review set out to examine the role of parental involvement in shaping mathematics motivation among senior high school students, particularly in rural and resource-constrained contexts such as Esperanza National High School in the Philippines. The objectives were to synthesize theoretical perspectives, critically evaluate empirical evidence, and identify mediation and moderation mechanisms that explain how family engagement sustains persistence and achievement in mathematics.

Synthesis of theoretical perspectives. The review confirmed that Expectancy-Value Theory, Self-Determination Theory, and Social Cognitive Theory provide complementary explanations for how parental involvement influences motivation. Parental expectations and communication shape students' beliefs about success and task value, while emotional encouragement

and home-based support satisfy psychological needs for autonomy, competence, and relatedness. Together, these frameworks highlight that motivation is not a single construct but a multidimensional process shaped by beliefs, values, and efficacy.

Empirical evidence. Findings across meta-analyses, longitudinal studies, and cross-cultural research consistently demonstrated that home-based support, emotional encouragement, communication, and parental expectations each positively predict mathematics motivation, with standardized effects exceeding $\beta = 0.20$. Collectively, these dimensions explain 25–40% of variance in motivational outcomes, underscoring their combined importance in sustaining persistence and achievement. These results validate the hypothesis that parental involvement is a robust predictor of mathematics motivation across diverse contexts, while also emphasizing its particular relevance in resource-constrained schools.

Mediation and moderation mechanisms. Evidence highlighted that parental math self-efficacy mediates the relationship between involvement and student motivation, enhancing the quality and credibility of parental behaviors. Socioeconomic status moderates these effects, with stronger impacts observed in low-SES contexts where family support compensates for institutional gaps. Cultural values such as pakikipagkapwa further strengthen emotional encouragement, demonstrating that local traditions can amplify global theoretical insights.

Practical and policy implications. Overall, the study concludes that parental involvement is a critical driver of mathematics motivation in senior high school, particularly in rural Philippine settings. Strengthening family-school partnerships and designing culturally responsive interventions can enhance student persistence in STEM pathways. Schools should prioritize programs that build parental math confidence, encourage autonomy-supportive communication, and foster realistic expectations. Policymakers should integrate parental engagement into educational equity strategies, ensuring that families in low-SES communities are empowered to support their children's learning.

Alignment with Sustainable Development Goals. By situating global theories within local realities, this review contributes to the achievement of Sustainable Development Goal 4 (Quality Education, Targets 4.1 and 4.5) and Sustainable Development Goal 10 (Reduced Inequalities, Target 10.2). It demonstrates that parental involvement is not only an academic construct but also a practical lever for equity, resilience, and inclusive development.

In conclusion, mathematics motivation among senior high school students is best understood as the product of multidimensional family-school interactions, mediated by parental efficacy and moderated by socioeconomic context. Strengthening these interactions can help rural schools overcome structural limitations, sustain student engagement, and foster equitable opportunities in STEM education. Future research should explore longitudinal

impacts, gender differences, and policy-level interventions, ensuring that parental involvement remains a cornerstone of educational equity and resilience. By integrating theory, evidence, and practice, this review lays a strong foundation for advancing mathematics education in the Philippines and contributes to the global discourse on inclusive and sustainable learning.

FUTURE RESEARCH DIRECTIONS

While this review has synthesized global and local evidence on parental involvement and mathematics motivation, several areas remain open for further exploration. First, longitudinal studies are needed to track how parental involvement influences mathematics motivation over time, particularly across the transition from senior high school to tertiary education. Such research would clarify whether the positive effects observed in adolescence persist into adulthood and STEM career pathways.

Second, future work should examine gender differences in the impact of parental involvement. Existing studies suggest that expectations and communication may affect male and female students differently, yet few investigations have systematically analyzed these variations in rural Philippine contexts. Understanding gendered dynamics could inform more equitable family–school interventions.

Third, there is a need to explore policy-level interventions that integrate parental engagement into national education strategies. While school-based programs can strengthen family–school partnerships, broader systemic support—such as training modules for parents, community workshops, and inclusion of parental involvement indicators in educational policy—could amplify outcomes.

Fourth, future research should investigate the role of digital pedagogy and technology-mediated parental involvement. With increasing reliance on online learning platforms, especially in resource-constrained schools, it is important to understand how digital tools can facilitate communication, support, and expectations between parents and students.

Finally, cross-cultural comparative studies would enrich the literature by situating Philippine findings within broader regional and global contexts. Comparing parental involvement across diverse cultural settings can highlight universal mechanisms while also identifying unique cultural values, such as *pakikipagkapwa*, that strengthen motivational outcomes.

By addressing these directions, future research can deepen theoretical understanding, refine practical strategies, and strengthen policy frameworks that sustain mathematics motivation. Such efforts will not only advance academic knowledge but also contribute to achieving Sustainable Development Goal 4 (Quality Education) and Sustainable Development Goal 10 (Reduced Inequalities), ensuring that parental involvement remains a cornerstone of

inclusive and resilient education systems.

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