Journal of International Education and Development
2025, VOL. 9, NO. 3, 19-23
DOI: 10.47297/wspiedWSP2516-250004.20250903

The Influence of Learning Motivation on Self-Efficacy in Fifth Grade Students: The Moderating Role of Mathematics Anxiety

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ABSTRACT

This study investigates the impact of learning motivation on self-efficacy among fifth-grade students, focusing on the moderating role of mathematics anxiety. A total of 272 students participated, completing the Mathematics Anxiety Scale for Children (MASC), a Learning Motivation Questionnaire, and a Self-Efficacy Scale. Results indicate a significant positive correlation between learning motivation and self-efficacy, and a significant negative correlation between these variables and mathematics anxiety. Mathematics anxiety was found to moderate the relationship between learning motivation and self-efficacy, with high levels of anxiety weakening this relationship. These findings underscore the importance of addressing mathematics anxiety to enhance learning motivation and self-efficacy during elementary education.

KEYWORDS

Learning Motivation; Self-Efficacy; Mathematics Anxiety; Fifth Grade Elementary Students; Moderating Role

1 Introduction

Mathematics anxiety is a widely recognized emotional challenge that adversely affects students' academic performance and psychological well-being. This condition, characterized by feelings of unease and fear towards mathematical tasks, has been shown to impede learning motivation and self-efficacy (Ashcraft & Krause, 2007; Hill, Mammarella, & Caviola, 2016). For elementary school students, the emergence of mathematics anxiety can have profound implications, as it coincides with the foundational development of critical cognitive and emotional skills (Hembree, 1990).

Learning motivation and self-efficacy are pivotal constructs in understanding academic performance. Learning motivation refers to the drive or willingness to engage in academic activities, shaped by both intrinsic and extrinsic factors (Pintrich & Schunk, 2002). Self-efficacy, a key component of Bandura's (1997) Social Cognitive Theory, encompasses students' belief in their ability to complete tasks successfully, influencing their persistence and approach to challenges. Previous studies have consistently demonstrated a positive correlation between learning motivation and self-efficacy, whereby higher motivation fosters greater self-belief and academic success (Schunk, Pintrich, & Meece, 2008; Zhao & Zhu, 2020). Mathematics anxiety complicates this relationship. Negative emotions associated with mathematics can reduce students' confidence and willingness to engage, diminishing the benefits of motivation and self-efficacy (Pajares & Graham, 1999). Moreover, research has shown that high levels of mathematics anxiety consume cognitive resources, thereby limiting students' ability to perform effectively in academic tasks (Sweller, 1988; Gross, 2002). Although prior studies have explored the effects of mathematics anxiety on motivation and self-efficacy, limited research has investigated its role as a moderator. Understanding this moderating effect is essential for designing interventions that address the dual challenges of enhancing motivation and mitigating anxiety.

Based on prior research and theoretical frameworks such as Social Cognitive Theory (Bandura, 1997) and Emotion Regulation Theory (Gross, 2002), this study aims to investigate the following hypotheses:

Hypothesis 1: Learning motivation positively predicts self-efficacy, such that higher levels of learning motivation lead to greater self-efficacy.

Hypothesis 2: Mathematics anxiety is negatively correlated with both learning motivation and self-efficacy.

Hypothesis 3: Mathematics anxiety moderates the relationship between learning motivation and self-efficacy, such that the positive effect of learning motivation on self-efficacy is weakened under higher levels of mathematics anxiety.

2 Method

2.1 Participants

This study recruited 272 fifth-grade elementary students from diverse backgrounds to ensure representativeness. Among the participants, 150 were boys (55%) and 122 were girls (45%). A majority of the students were from urban areas (71%), with the remaining 29% from rural areas. Additionally, 67 students (25%) were only children, while 205 students (75%) had siblings. This sample captured a broad spectrum of gender, residential, and familial contexts, making it suitable

for examining the research questions.

2.2 Instruments

2.2.1 Mathematics Anxiety Scale for Children (MASC)

Mathematics anxiety was measured using the revised Mathematics Anxiety Scale for Children (MASC) developed by Geng et al. (2005), based on Chiu and Henry's (1990) adaptation of the Mathematics Anxiety Rating Scale (Plake, 1982). The scale consisted of 22 items across four dimensions: mathematics evaluation anxiety, mathematics learning anxiety, mathematics problem-solving anxiety, and mathematics teacher anxiety. Responses were recorded on a four-point Likert scale (1 = Not anxious at all, 4 = Extremely anxious), with higher scores indicating greater levels of anxiety. The scale showed excellent reliability, with a Cronbach ' s α coefficient of 0.93 in this study.

2.2.2 Learning Motivation Questionnaire

The Learning Motivation Questionnaire, developed by Yu and Yang (1988) and revised in 2018, assessed intrinsic and extrinsic learning motivation. It included 13 items, with 6 items measuring intrinsic motivation (e. g., personal achievement) and 7 items assessing extrinsic motivation (e. g., social recognition). Students responded on a five-point Likert scale (1 = Strongly disagree, 5 = Strongly agree). Higher scores reflected greater overall learning motivation. The questionnaire demonstrated good reliability, with a Cronbach ' s α coefficient of 0.81 in this study.

2.2.3 Self-Efficacy Scale

Self-efficacy was evaluated using the General Self-Efficacy Scale developed by Schwarzer and Jerusalem (1995) and adapted for Chinese populations by Wang (1998). This unidimensional scale contained 10 items rated on a five-point Likert scale (1 = Completely untrue, 5 = Completely true). Higher scores indicated greater self-efficacy. The Cronbach ' s α coefficient for this scale in the current study was 0.94, indicating excellent internal consistency.

2.3 Data Analysis

The collected data were analyzed using SPSS 29.0 software. Descriptive statistical analysis was first conducted to understand the basic characteristics of each variable. Subsequently, correlation analysis was performed to explore the relationships among learning motivation, self-efficacy, and mathematics anxiety. Finally, multiple linear regression analysis and moderation effect analysis were employed to examine the moderating role of mathematics anxiety in the relationship between learning motivation and self-efficacy.

3 Results

3.1 Descriptive Statistics and Correlation Analysis

Descriptive statistics and correlation analysis were conducted to examine the relationships among learning motivation, self-efficacy, and mathematics anxiety. The means, standard deviations, and correlations are presented in Table 1.

Table 1 Descriptive Statistics and Correlation Matrix for Learning Motivation, Self-Efficacy, and Mathematics Anxiety among Fifth Grade Students

Variable	Mean	SD	Min	Max	1	2	3
Learning Motivation	55.86	7.07	28	66	1		
Self-Efficacy	35.45	8.68	13	49	0.616**	1	
Mathematics Anxiety	33.27	8.81	23	68	-0.460**	-0.447**	1

*Note: **p < 0.01.

The results revealed significant positive correlations between learning motivation and self-efficacy ($r = 0.616$, $p < 0.01$) and significant negative correlations between mathematics anxiety and both learning motivation ($r = -0.460$, $p < 0.01$) and self-efficacy ($r = -0.447$, $p < 0.01$). These findings provide initial evidence supporting the study's hypotheses.

3.2 Main Effect Test: The Impact of Learning Motivation on Self-Efficacy

To further investigate the relationship between learning motivation and self-efficacy, multiple linear regression analysis was performed. Learning motivation significantly predicted self-efficacy ($\beta = 0.757$, $p < 0.001$), explaining 38.0%

of the variance in self-efficacy scores ($R^2 = 0.380$, $p < 0.001$). These results support Hypothesis 1, suggesting that higher learning motivation is associated with stronger self-efficacy.

Table 2 Regression Analysis Results of Learning Motivation on Self-Efficacy

Model	β	SE	t	p	R^2	Adjusted R^2
Learning Motivation → Self-Efficacy	0.757	0.059	12.856	<0.001	0.38	0.377

3.3 Moderation Effect Test: The Moderating Role of Mathematics Anxiety

The moderating effect of mathematics anxiety on the relationship between learning motivation and self-efficacy was tested using interaction terms in regression models. The interaction between learning motivation and mathematics anxiety was significant ($\beta = -0.02$, $p < 0.001$). Adding the interaction term significantly improved the model's explanatory power ($\Delta R^2 = 0.073$, $p < 0.001$), confirming that mathematics anxiety moderates the relationship between learning motivation and self-efficacy.

Table 3 Regression Analysis Results of the Moderating Effect of Mathematics Anxiety

Variable	β	SE	t	p	95% Confidence Interval
Intercept	-30.31	11.2	-2.71	0.0073	[-52.37, -8.25]
Learning Motivation	1.34	0.2	6.63	< 0.001	[0.94, 1.74]
Mathematics Anxiety	0.8	0.28	2.86	0.0046	[0.25, 1.34]
Interaction Term (Learning Motivation × Mathematics Anxiety)	-0.02	0.005	-3.65	< 0.001	[-0.03, -0.01]

**p < 0.01 indicates significant correlation, p < 0.05 indicates marginal significance.

3.4 Simple Slope Analysis of the Moderating Effect

To further explore the moderation effect, simple slope analysis was conducted by categorizing participants into low, medium, and high mathematics anxiety groups. Results showed that the positive effect of learning motivation on self-efficacy was strongest in the low mathematics anxiety group ($\beta = 0.712$, $p < 0.05$) and weakest in the high mathematics anxiety group ($\beta = 0.504$, $p < 0.001$). Figure 1 illustrates the interaction effect.

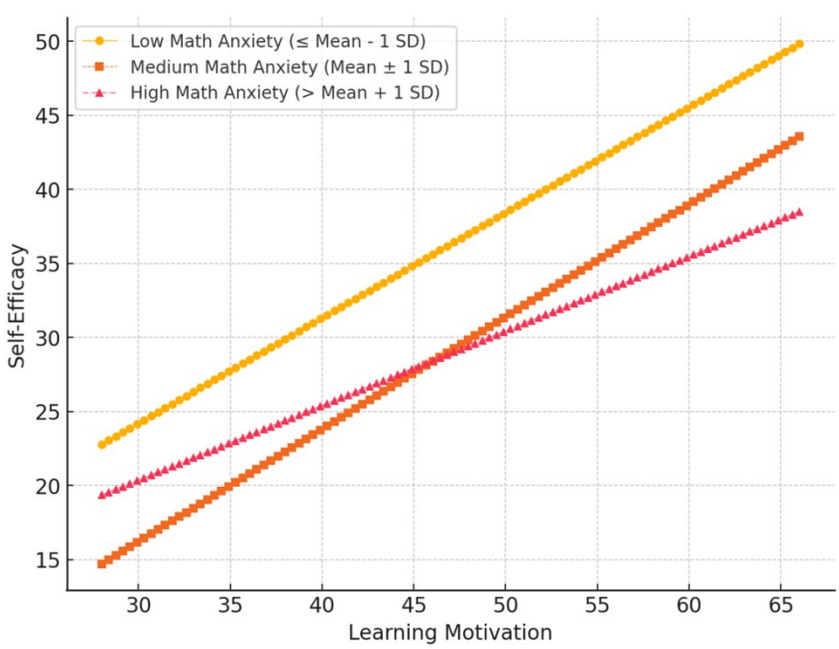

Figure 1 Moderating Role of Mathematics Anxiety in the Relationship Between Learning Motivation and Self-Efficacy

4 Discussion

4.1 Relationship Between Learning Motivation and Self-Efficacy

This study found that learning motivation significantly predicts self-efficacy, supporting Hypothesis 1. Students with higher levels of learning motivation tend to exhibit greater confidence in their ability to complete academic tasks successfully. These findings align with Social Cognitive Theory (Bandura, 1997), which posits that individuals' motivation levels influence their beliefs in their capabilities and, subsequently, their performance. Prior studies have similarly

highlighted the positive impact of motivation on self-efficacy and academic performance (Schunk, Pintrich, & Meece, 2008; Zhao & Zhu, 2020).

For fifth-grade students, this relationship is particularly critical, as their academic self-efficacy is still in development. Enhancing both intrinsic and extrinsic motivation can positively influence their confidence and persistence in learning. For instance, incorporating student-centered teaching strategies and offering immediate feedback could strengthen students' motivation and self-efficacy.

4.2 Moderating Role of Mathematics Anxiety

The study also confirmed Hypotheses 2 and 3, showing that mathematics anxiety not only negatively correlates with learning motivation and self-efficacy but also moderates their relationship. Specifically, the positive effect of learning motivation on self-efficacy was weakened at higher levels of mathematics anxiety. This aligns with Emotion Regulation Theory (Gross, 2002), which explains how negative emotions, such as anxiety, impair cognitive and motivational processes.

The moderation analysis revealed that students with lower levels of mathematics anxiety benefit more from high learning motivation, whereas those with higher anxiety levels experience a diminished effect. This suggests that while motivation plays a critical role in enhancing self-efficacy, its impact is contingent upon students' emotional states. Similar findings in prior research have emphasized the disruptive effects of anxiety on academic confidence and performance (Sweller, 1988; Hill et al., 2016).

From a practical perspective, these results highlight the importance of addressing mathematics anxiety in the classroom. Implementing emotion regulation strategies, such as mindfulness exercises, and creating a supportive learning environment may help mitigate the negative impact of anxiety and allow students to fully benefit from their motivation.

4.3 Limitations and Future Directions

This study has several limitations. First, the sample was limited to fifth-grade students from specific regions, which restricts the generalizability of the findings. Future research should expand the sample to include students from diverse regions and grade levels. Second, the study employed a cross-sectional design, which does not allow for the determination of causal relationships between variables. Longitudinal studies are recommended to better elucidate the dynamic relationships among learning motivation, self-efficacy, and mathematics anxiety. Additionally, the data primarily relied on self-reported questionnaires, which may be subject to social desirability bias. Future research could incorporate behavioral observations or third-party assessments to enhance data accuracy.

Subsequent studies could further explore other potential moderating variables, such as family support and teacher feedback, and their influence on the relationship between learning motivation and self-efficacy. Moreover, designing and implementing interventions targeting mathematics anxiety could assess their effectiveness in enhancing students' learning motivation and self-efficacy, thereby providing more targeted recommendations for educational practice.

5 Conclusion

There exists a significant positive correlation between learning motivation and self-efficacy, indicating that higher learning motivation is associated with stronger self-efficacy among students.

There is a significant negative correlation between learning motivation and mathematics anxiety, suggesting that higher learning motivation corresponds to lower levels of mathematics anxiety.

Mathematics anxiety plays a significant moderating role in the relationship between learning motivation and self-efficacy, with high levels of mathematics anxiety weakening the positive impact of learning motivation on self-efficacy.

Funding

This work was supported by grants from the China Association for Non-Government Education (CANFZG23233) and Guangzhou Huashang College (2022HSXS047, HS2021KCSZ48)

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