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Family Factors and Children's Academic Performance: The Mediating Role of Anxiety and the Moderating Role of Student Type

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ABSTRACT: Family-related factors have been consistently linked to children's academic performance and may also be associated with academic outcomes through psychological processes. Based on this perspective, the present study investigated the association between different family factors (parental involvement, parenting styles, and family functioning) and academic performance among Chinese primary school children. In addition, the potential mediating role of anxiety was examined, as well as whether the associations between these family factors and anxiety differed by student type (students with low versus typical school performance). Data were collected through a cross-sectional survey of 1083 students in Grades 3–5 and their parents from three primary schools in China, with parental involvement, parenting styles, family functioning, and children's anxiety assessed via parent-reported questionnaires, along with measures of academic performance. The results showed that parental involvement, parenting styles, and family functioning were each significantly associated with children's academic performance, and that anxiety played an indirect role in these relationships. Student type did not significantly moderate the relationship between these family factors and anxiety. Overall, the findings highlight the relevance of both the family environment and children's anxiety in understanding variations in academic performance, and they suggest the importance of considering family- and child-related factors in educational research.

Keywords: Anxiety; Family functioning; Parental involvement; Parenting style

1. Introduction

The family is not only the basic unit of society but also a critical environment for an individual's physical and mental growth. A growing body of research has documented associations between various family-related factors, including parental involvement (PI), parenting styles (PS), and family functioning



(FF), and children's academic performance, such as reading and mathematics outcomes [1–3]. Prior studies suggest that a higher level of PI is generally associated with better academic performance, whereas different PS are linked to distinct patterns of learning outcomes. In addition, FF has been shown to be related to children's educational outcomes through both direct and indirect pathways [4,5].

Beyond family-related factors, children's mental health, particularly anxiety, has received increasing attention in developmental and educational research. Anxiety is one of the primary components among psychological variables evaluated in the study of children's mental health. Existing evidence indicates that anxiety experienced in childhood is associated with anxiety in adulthood, accompanied by other mood and externalizing disorders [6]. However, relatively few studies have focused on anxiety among elementary school children, and even fewer have examined its potential role as a mediator linking family-related factors to children's academic performance. Moreover, it remains unclear whether the associations between family factors and children's anxiety vary across different student groups. In particular, students with low school performance (LP) may experience family environments and emotional challenges differently from students with typical school performance (TP).

Thus, the present study examines the mediating role of anxiety and the moderating role of student type in the relationships among family-related factors (PI, PS, and FF), children's anxiety, and academic performance in a sample of Chinese primary school students. Specifically, we investigate whether anxiety mediates the relationships between these family factors and academic performance, and whether these associations differ by student type (LP vs. TP). By addressing these questions, this study aims to contribute to a more nuanced understanding of the roles of family context and children's anxiety in academic performance.

2. Theoretical Context

The present study focuses on three key family factors, including PI, PS, and FF, selected based on two theoretical perspectives: the family investment model and the family process model.

The family investment model emphasizes that families with greater resources tend to provide more educational materials, cognitively stimulating activities, and parental engagement, which are generally associated with children's academic performance [7]. In this context, PI represents a key behavioral investment, reflecting parents' active participation in children's learning, such as assisting with homework and attending school events [8]. Moreover, the family process model posits that patterns of interaction among family members, communication and conflict resolution strategies, and overall family functioning, all of which have been linked to children's developmental outcomes [9,10]. Within this framework, PS and FF capture relational and emotional aspects of the family environment that influence children's cognitive, emotional, and academic development. Authoritative parenting has been associated with higher children's academic engagement, whereas authoritarian parenting may reduce children's learning motivation. Similarly, well-functioning families provide children with resources to cope with stress and pursue adaptive behaviors, which in turn support academic achievement [11].

Developing a child as a complex system in which multiple internal (e.g., learning anxiety, learning engagement) and external (e.g., parenting) factors interact continuously [12]. It provides an integrative framework to explain how family factors, through children's emotional states (e.g., anxiety), are associated with academic achievement. Previous research also suggests that these family factors may be related to children's academic performance both directly and indirectly through other variables, such as anxiety [7,13]. For example, authoritative parenting, characterized by responsiveness and emotional support, has been associated with higher levels of academic engagement and better learning outcomes, whereas long-term authoritarian parenting, marked by harshness and low responsiveness, may lead to emotional problems such as anxiety and depression, which in turn can negatively affect children's learning outcomes and overall psychological development [10].

Taken together, these three family factors (PI, PS, and FF) reflect complementary dimensions of the family context, each potentially shaping children's academic outcomes and anxiety levels.

3. Family Factors and Children's Academic Performance

3.1. Parental Involvement

PI refers to the active participation of parents in all aspects of their children's social, emotional, and academic development, including expectations for their academic future, control over homework, assistance with school assignments, and physical presence at school [14]. Research has consistently shown that PI is associated with children's educational outcomes, including student behavior, student motivation, self-esteem, attitudes to school, school attendance, and drop-out rates [15,16]. Meta-analysis evidence also supports a significant positive relationship between PI and academic achievement (including reading, mathematics, and GPA) for adolescents [17].

In addition, several studies have examined which specific aspects of PI are most strongly associated with children's academic performance. For example, general supervision of children's learning activities has been consistently linked to higher achievement [14]. Associations appear particularly strong in families that set high academic expectations, maintain open communication regarding school-related matters, and foster reading habits. A meta-analysis by Boonk et al. [18] differentiated between home-based and school-based PI and found that indicators of home-based involvement were more consistently associated with children's academic outcomes.

In China, research examining the relationship between PI and children's academic performance generally aligns with findings from Western contexts. A meta-analysis reported a moderate association between PI and academic performance among Chinese primary school students ($r = 0.19$) [19]. For example, Zheng and Liu [20] studied 316 5th and 6th-grade students and found that both home-based involvement and home-school collaboration were associated with higher academic performance, whereas school-based involvement showed no significant association. Similarly, Liu et al. [21] examined maternal and paternal involvement and found that engagement from both parents was linked to children's academic outcomes.

3.2. Parenting Styles

PS refers to a set of attitudes and behaviors toward children that create an emotional climate in which parental behaviors are expressed [22]. Several studies have examined the associations between PS and children's academic performance. For example, Carreiro et al. [23] investigated PS and reading achievement among 110 Portuguese primary school students, and results from multiple hierarchical linear analyses indicated that PS were associated with higher-level reading processes (syntactic and semantic), but not with lexical processes. Masud et al. [24] reviewed 35 studies on the association of PS with academic outcomes, results showed that PS are consistently associated with academic outcomes.

According to Baumrind [25], three types of PS are commonly distinguished, namely authoritative, authoritarian, and permissive. Evidence suggests that authoritative PS are associated with better academic performance in both concurrent and longitudinal studies. In contrast, authoritarian and permissive PS tend to be linked to lower academic achievement [5]. Children of authoritative parents often show higher academic engagement, as these parents combine high expectations with substantial emotional support, reflecting greater responsiveness to children's learning needs compared to authoritarian parents [26,27]. Overall PS characterized by both responsiveness and control have been associated with children's academic outcomes.

However, findings have not been entirely consistent, indicating that PS may not be strongly associated with academic outcomes in all contexts. For instance, Mantzicopoulos [28] found that PS were not significantly associated with any outcome measures among low-income, predominantly white children in Head Start. Likewise, Hindman and Morrison [29] reported that among predominantly white, middle-class preschool children, parents' autonomy support or discipline practices were unrelated to literacy and language skills, though they were associated with measures of self-control.

In China, research examining PS and academic performance among primary school students is relatively limited. Most studies have focused on adolescents rather than younger children [30,31], and only a few have investigated PS among primary school students [32]. A recent meta-analysis of Chinese primary school students found that positive PS, characterized by emotional warmth and understanding, was associated with higher academic performance, whereas negative PS, including punishment, harshness, excessive interference, favoritism, rejection, and denial, was linked to lower academic [33]. These findings underscore the relevance of both supportive and controlling dimensions of parenting for children's academic outcomes in the Chinese context.

3.3. Family Functioning

FF refers to the quality of family life at both systemic and dyadic levels, encompassing the well-being, competence, strengths, and weaknesses of a family [34]. Higher-quality FF is generally characterized by family members' willingness to solve problems collaboratively, mutual concern, and relatively low levels of conflicts [35].

Research on elementary-aged children is relatively limited but indicates associations between FF and children's academic performance [3]. For example, in a study of African American families, children whose parents were actively engaged in their academic activities tended to show higher overall GPAs, as well as better performance in math, science, and verbal tasks [4]. Similarly, Scott [36] reported that children who come from "intact" homes are more likely to demonstrate higher academic achievement. Most research has focused on adolescents and college students, rather than primary school students. Among adolescents, positive interactions with parents have been associated with higher academic performance [37], whereas research among African American and Caucasian college students suggests that family effects on academic outcomes appear to be smaller at the college level [38].

In China, studies on FF and academic performance have also primarily targeted adolescents. For instance, a questionnaire survey of 406 junior high school students and their parents indicated that FF is associated with academic outcomes through the quality of parent-child communication [39]. Furthermore, a recent study found that FF plays a mediating role in the relationship between PS and academic achievement, highlighting FF as an important factor in children's academic development. [40].

3.4. The Mediating Role of Children's Anxiety

Previous studies indicate that several family factors are associated with children's academic performance and may also be linked indirectly through mediating variables. For example, motivation mediates the association between PS and children's reading performance [7,11] while metacognitive strategies mediate the relationship between PI and children's academic achievement [41]. PI is also indirectly associated with academic outcomes through student attitudes and behaviors [42].

Despite these findings, few studies have examined children's mental health, such as anxiety, as a potential mediator between family factors and academic outcomes during primary school and adolescence [43,44]. In the limited literature, a study conducted in Romania reported that test anxiety partially mediates the negative association between poor parental supervision and academic performance among primary school students [13]. Similarly, Vukovic et al. [45] investigated 78 low-income, ethnic minority families and found that parental home support and expectations were associated with children's mathematics performance on word problems and algebraic reasoning via reductions in mathematics anxiety. Although no studies have directly examined the mediating role of anxiety between FF and academic performance, evidence suggests that lower-quality FF is associated with higher levels of anxiety symptoms, which in turn relate to poorer academic and psychological outcomes [46].

Overall, while prior research has explored the role of children's anxiety in the links between family factors and academic performance, these studies rarely consider a comprehensive set of family variables or focus specifically on general anxiety. The present study addresses this gap by examining whether children's anxiety mediates the relationship between family environments and academic outcomes.

3.5. *The Moderating Role of Student Type*

Previous research indicates that family factors are closely associated with children's negative emotional outcomes, such as anxiety and depression [43,47]. However, these associations may vary as a function of individual characteristics, including student type [48].

On one hand, compared with high-achieving peers, LP children tend to exhibit poorer academic performance. They also report lower levels of self-efficacy and experience difficulties in emotion regulation, making them more prone to anxiety [49]. Moreover, their parents are more likely to attribute academic difficulties to motivational deficits or ineffective learning habits [10], which may lead to more authoritarian parenting and a tense family atmosphere [50]. These vulnerabilities could render LP children more sensitive to adverse family environments, thereby strengthening the positive association between negative family factors and anxiety. For those positive family factors, however, LP children might benefit less if their cognitive or emotional limitations hinder the absorption of family resources, or more if family support serves as a compensatory buffer [51].

On the other hand, an alternative perspective suggests that student type may not moderate these associations. Previous studies found that family factors have a stable relationship with child mental health [52,53]. This suggests that the influence of family processes may operate as a relatively persistent contextual force in shaping children's psychological factors. Certainly, families of LP children may face more stress; however, research has shown that their families experience the same levels of family cohesion, family system maintenance, and emphasis on personal growth as families of TP children [54,55]. Similarly, evidence also indicates that parental involvement behaviors operate similarly across LD children and TD children [56].

Given the scarcity of prior studies examining the moderating effect of student type and the mixed results reported, the present study aims to empirically test whether student type (LP vs. TP) moderates the relationships between multiple family factors and child anxiety.

3.6. *The Present Study*

The present study addresses the following research questions:

1. Do family factors (PI, PS, and FF) separately have direct and indirect associations with children's academic performance?
2. Do children's anxiety mediate the relationship between these family factors and academic performance?
3. Does student type (LP vs. TP) moderate the association between family factors and children's anxiety?

Based on prior research, we hypothesize that:

- a. PI, PS, and FF would all be directly associated with academic performance.
- b. children's anxiety would mediate the relationships between these three family factors and children's academic performance, such that more positive family factors are associated with lower anxiety, which in turn is associated with better academic outcomes.
- c. Given inconsistent evidence regarding the moderating role of student type, we explored whether the associations between family factors and children's anxiety differ between LP and TP children without specifying a directional hypothesis.

4. Methods

4.1. Participants

Participants were recruited using a cluster convenience sampling method from three public primary schools in a medium-sized city in China. The schools were selected because they were under the same administrative authority, used identical textbooks, and served students from families with broadly similar socioeconomic backgrounds. All students in Grades 3 to 5 from the three selected schools were included in the study, yielding a total sample of 1110 participants. Because all participants were under 16 years of age, written informed consent was obtained from their parents or legal guardians prior to participation. Parents or legal guardians also provided consent for their own participation, and students provided assent when appropriate.

Data for the variables included in this study were primarily collected via questionnaires. Questionnaires were distributed to the parents of all 1110 students, with one parent (either the mother or the father) completing the questionnaire for each student. A total of 1083 valid questionnaires were collected, yielding a response rate of 96.23%. Of these students, 426 students were in grade 3 (39.34%), 449 students were in grade 4 (41.46%), and 208 students were in grade 5 (19.21%). Among them, 570 were boys (52.91%), and 513 were girls (47.59%).

Students were classified into LP and TP groups based on their most recent academic exam scores [50]. Specifically, each student's Chinese and mathematics scores were first converted into z-scores, and the mean of these two z-scores was calculated to create a composite school performance score. Students with composite scores at or above the sample mean were assigned to the TP group, while those with scores below the mean were assigned to the LP group. Based on this, 389 students were classified as the LP group and 694 students as the TP group.

4.2. Measures

Parent Involvement Questionnaire. It was adapted from Kohl et al. [57] to assess various facets of parent–school partnerships. This questionnaire has both parent- and teacher-report versions. The parent version was used in this study. This questionnaire consists of 10 items and is completed online by one of the child's parents. Responses are rated on a five-point Likert-type scale. The Cronbach's α for the current sample is 0.95.

Parenting Styles Questionnaire. This questionnaire was adapted from Frick et al. [58]. It consists of 25 items and measures three dimensions, which include involvement (9 items), positive parenting (6 items), and poor monitoring/supervision (10 items). The questionnaire was completed online by one of the child's parents. This questionnaire employs a four-point Likert-type scale. Items for the poor monitoring/supervision dimension were reverse scored so that higher values reflect better parenting quality. The Cronbach's α for the current sample is 0.93.

Family Functioning Questionnaire. It was adapted from the McMaster Family Assessment Device [35]. This questionnaire includes 12 items selected from the general functioning dimension in the McMaster Family Assessment Device. It is completed online by one of the child's parents. Responses are rated on a four-point Likert-type scale. The Cronbach's α for the current sample is 0.83.

Anxiety. It is from the Multidimensional Anxiety Scale for Children-2nd edition [59]. It is one of the most common measures of anxiety. It includes both self-report and parent-report of anxiety, covering separation anxiety, generalized anxiety disorder, social anxiety, humiliation/rejection, performance fears, obsession and compulsions, physical symptoms, and harm avoidance. In this study, the parent-report version was used. Responses are rated on a four-point Likert-type scale. The Cronbach's α for the current sample is 0.92.

Academic Performance Test. Children's academic performance was assessed by the Chinese reading achievement test and the mathematics achievement test. The Chinese achievement test is a subtest of a

standardized academic achievement test designed by the National Panel on Chinese Child and Youth Psychological Development Characteristics [60]. This Chinese reading achievement test includes levels of grade 2, grades 3 and 4, grades 5 and 6, and grades 7–9. We used levels of grades 3 and 4 and grades 5 and 6 for the current sample. They consisted of four parts: (1) word knowledge; (2) sentence comprehension; (3) literature; and (4) reading comprehension. The Cronbach's α for the current sample was 0.79 for grade 3, 0.84 for grade 4, and 0.90 for grade 5.

The mathematics achievement test was developed for the present study based on a previous study [61]. It comprises four sections: (1) fill-in-the-blank items, (2) computational problems, (3) graphing tasks, and (4) applied word problems. The items were designed based on curriculum standards and the grade level of the participating students. The Cronbach's α for the present sample was 0.80 for Grade 3, 0.86 for Grade 4, and 0.84 for Grade 5.

4.3. Data Analysis

In this study, we used SPSS 23.0 to perform common method bias (CMB), descriptive statistics, and correlation analysis. Mathematics and reading performance scores were standardized into z scores and averaged to form a composite academic performance score.

Subsequently, to examine the direct and indirect effects of family factors on academic performance through anxiety, structural equation modeling (SEM) was conducted using the lavaan package in R. Model fit was evaluated using multiple indices: Chi-square test, Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Square Residual (SRMR). Indirect effects were tested using bootstrapping with 5000 resamples.

5. Results

5.1. Common Method Bias, Descriptive Statistics, and Correlation Analysis

In this study, PI, PS, and FF were all self-rated by one of the parents. Although we conducted multiple procedural methods to mitigate CMB, its potential influence could not be entirely ruled out. Therefore, we employed Harman's single factor test to examine the CMB [62]. Results showed that the first factor explained 32.87% of the total variance, below the threshold of 40%, suggesting no significant CMB issues in this study.

Means, standard deviations (*SD*), and correlations of variables are presented in Table 1. Results showed that PI, PS, and FF were positively correlated with children's reading and mathematics performance ($p < 0.05$). Anxiety was significantly negatively correlated with reading performance ($p < 0.01$), but its correlation with mathematics performance was not significant. In addition, anxiety was negatively correlated with PI, PS, and FF ($p < 0.01$).

Table 1. Correlation analysis of Family Factors, Academic Performance, and Anxiety.

| Variables | <i>M</i> | <i>SD</i> | 1 | 2 | 3 | 4 | 5 | 6 |
|----------------------------|----------|-----------|----------|----------|----------|---------|---------|---|
| 1. Parental involvement | 39.77 | 8.10 | 1 | | | | | |
| 2. Parenting styles | 89.68 | 9.89 | 0.53 ** | 1 | | | | |
| 3. Family functioning | 45.14 | 7.28 | 0.43 ** | 0.48 ** | 1 | | | |
| 4. Mathematics performance | 60.08 | 17.32 | 0.07 * | 0.12 * | 0.09 ** | 1 | | |
| 5. Reading performance | 22.65 | 5.55 | 0.20 ** | 0.23 ** | 0.22 ** | 0.17 ** | 1 | |
| 6. Anxiety | 49.39 | 9.16 | -0.10 ** | -0.20 ** | -0.17 ** | -0.06 | -0.1 ** | 1 |

Note. * $p < 0.05$, ** $p < 0.01$.

5.2. Family Factors and Academic Performance

To further examine the specific contributions of family factors, we decomposed this construct into three components (*i.e.*, PI, PS, and FF) and conducted additional SEM analyses by entering each component into the model separately. All three SEM models showed excellent fit, with χ^2 values ranging from 5.40 to 10.32 (all $ps > 0.05$), $0.98 < CFI < 1.00$, $0.98 < TLI < 1.00$, $RMSEA = 0.00$, and SRMR ranging from 0.015 to 0.02.

After controlling for grade and gender, the results showed that PI ($\beta = 0.16$, $SE = 0.002$, $p < 0.001$), PS ($\beta = 0.17$, $SE = 0.002$, $p < 0.001$), and FF ($\beta = 0.15$, $SE = 0.002$, $p < 0.001$) significantly predicted academic performance, demonstrating that all family factors were positive predictors of academic performance for Chinese primary school students.

5.3. Mediation Analysis of Anxiety

After controlling for grade and gender, results indicated that PI significantly predicted children's anxiety ($\beta = -0.09$, $SE = 0.04$, $p < 0.01$), and anxiety, in turn, negatively predicted academic performance ($\beta = -0.08$, $SE = 0.002$, $p < 0.01$). The indirect effect via anxiety was small but significant ($\beta = 0.007$, $SE = 0.001$, $p < 0.05$). PS also significantly predicted children's anxiety ($\beta = -0.19$, $SE = 0.04$, $p < 0.001$), and anxiety, in turn, negatively predicted academic performance ($\beta = -0.06$, $SE = 0.002$, $p < 0.05$). The indirect effect via anxiety was small but significant ($\beta = 0.01$, $SE = 0.00$, $p < 0.05$). Similarly, results indicated that FF significantly predicted children's anxiety ($\beta = -0.17$, $SE = 0.04$, $p < 0.001$), and anxiety, in turn, negatively predicted academic performance ($\beta = -0.07$, $SE = 0.002$, $p < 0.05$). The indirect effect via anxiety was small but significant ($\beta = 0.01$, $SE = 0.000$, $p < 0.05$).

Figures 1–3 present the mediation models, with anxiety mediating the relationships between PI, PS, and FF, respectively, and academic performance. Table 2 shows the decomposition of total, direct, and indirect effects.

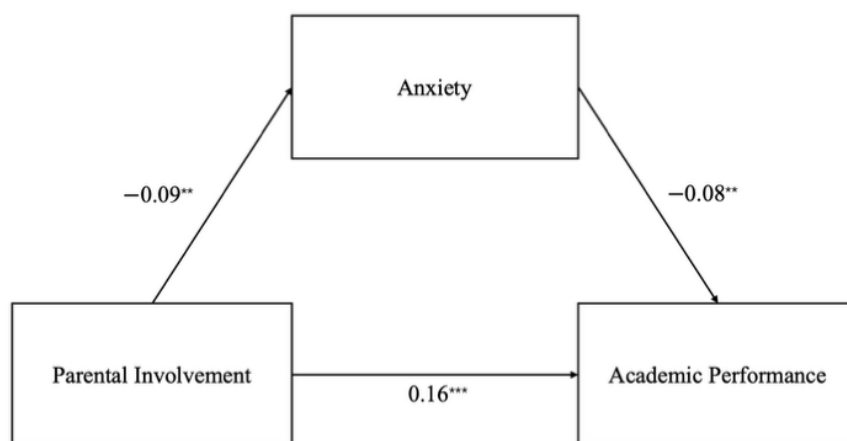


Figure 1. Tested mediating model. Shown is the mediating effect of anxiety on PI and academic performance, *i.e.*, PI predicted academic performance mediated by anxiety. Note. ** $p < 0.01$, *** $p < 0.001$.

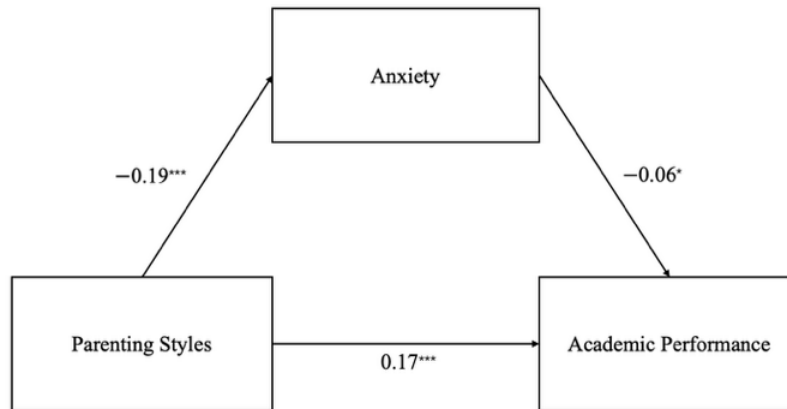


Figure 2. Tested mediating model. Shown is the mediating effect of anxiety on PS and academic performance, *i.e.*, PS predicted academic performance mediated by anxiety. Note. * $p < 0.05$, *** $p < 0.001$.

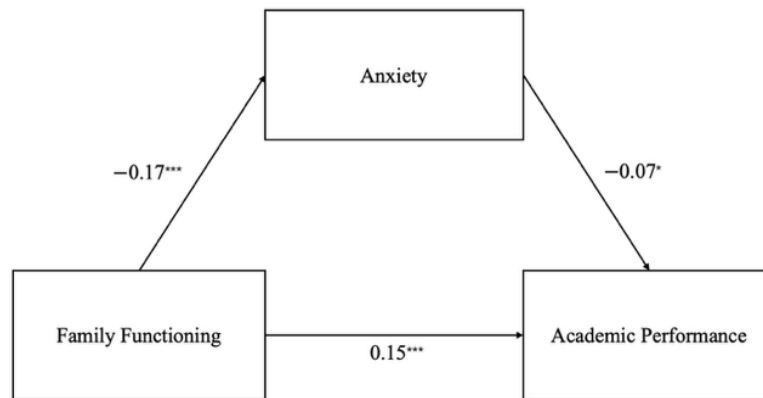


Figure 3. Tested mediating model. Shown is the mediating effect of anxiety on FF and academic performance, *i.e.*, FF predicted academic performance mediated by anxiety. Note. * $p < 0.05$, *** $p < 0.001$.

Table 2. Decomposition of Total, Direct, and Indirect Effects.

| | Estimate | Boot SE | Boot LLCI | Boot ULCI | Relative Effect |
|----------------------|----------|---------|-----------|-----------|-----------------|
| Total effect c | 0.17 | 0.02 | 0.009 | 0.02 | |
| Direct effect c' | 0.16 | 0.002 | 0.008 | 0.02 | 95.7% |
| Indirect effect ab | 0.007 | 0.000 | 0.000 | 0.001 | 4.3% |
| Total effect c | 0.19 | 0.002 | 0.009 | 0.02 | |
| Direct effect c' | 0.17 | 0.002 | 0.008 | 0.02 | 93.6% |
| Indirect effect ab | 0.01 | 0.000 | 0.000 | 0.002 | 6.4% |
| Total effect c | 0.17 | 0.002 | 0.01 | 0.02 | |
| Direct effect c' | 0.15 | 0.002 | 0.008 | 0.02 | 92.8% |
| Indirect effect ab | 0.01 | 0.000 | 0.000 | 0.002 | 7.2% |

Note. Boot SE = bootstrap standard error; Boot LLCI/Boot ULCI = lower/upper limits of the 95% bootstrap confidence interval based on 5000 resamples.

5.4. Moderation Analysis of Student Type

Multi-group analysis across student types (LP vs. TP) indicated that the effect of PI on anxiety was not significantly moderated by student type. The path from PI to anxiety was similar in TP ($\beta = -0.08$, $SE = 0.04$, $p < 0.05$) and LP ($\beta = -0.19$, $SE = 0.06$, $p < 0.05$) groups. The effect of PS on anxiety was also not significantly moderated by student type. The path from PS to anxiety was similar in TP ($\beta = -0.19$, $SE = 0.04$, $p < 0.001$) and LP ($\beta = -0.20$, $SE = 0.04$, $p < 0.001$) groups. Similarly, the effect of FF on anxiety

was not significantly moderated by student type. The path from FF to anxiety was similar in TP ($\beta = -0.17$, $SE = 0.04$, $p < 0.05$) and LP ($\beta = -0.16$, $SE = 0.04$, $p < 0.05$) groups.

See Table 3 for the results of the moderated mediation analysis.

Table 3. Results of the Moderated Mediation Analysis of Student Type ($N = 1083$).

| Path | Student Type | β | SE | 95%CI |
|------------------------------|--------------|-----------|-------|---------------|
| Parental involvement→Anxiety | TP | -0.08 * | 0.04 | -0.17, -0.03 |
| | LP | -0.19 * | 0.06 | -0.35, -0.15 |
| Index of moderated mediation | | 0.001 | 0.001 | -0.001, 0.003 |
| Parenting styles→Anxiety | TP | -0.19 *** | 0.04 | -0.25, -0.11 |
| | LP | -0.20 *** | 0.04 | -0.25, -0.11 |
| Index of moderated mediation | | 0.02 | 0.05 | -0.08, 0.11 |
| Family functioning→Anxiety | TP | -0.17 * | 0.04 | -0.28, -0.14 |
| | LP | -0.16 * | 0.04 | -0.28, -0.14 |
| Index of moderated mediation | | -0.006 | 0.05 | -0.1, 0.1 |

Note. SE = standard error. CI = confidence interval. The index of moderated mediation is not statistically significant. * $p < 0.05$, *** $p < 0.001$.

6. Discussion

The results of this study suggested that PI, PS, and FF were each positively associated with children's academic performance. In addition, anxiety played a partial mediating role in the relationships between each of these three factors and Chinese primary children's academic performance. However, the results did not support a moderating role of student type in the relationship between PI, PS, or FF and children's anxiety. These findings highlighted the importance of different aspects of the family environment in relation to children's academic achievement. Specifically, PI, PS, and FF each had not only a direct relationship with children's academic performance, but also were indirectly associated with it through children's anxiety.

6.1. Direct Effects of PI, PS, and FF on Children's Academic Performance

This study found that PI, PS, and FF were related to children's academic performance, which is consistent with our hypothesis. As the primary context for children's daily life and learning, the family plays a crucial role in educational outcomes, with parenting behaviors serving as key factors in children's academic development [63]. This finding aligns with previous research, indicating that higher PI, supportive and responsive PS, and well-functioning families collectively provide an environment that is associated with children's cognitive development and academic success [4,14,23].

These findings provide empirical support for both the family investment model and the family process model. Specifically, the significant role of PI supports the family investment perspective, which emphasizes that parents' behavioral investments, such as engaging in educational activities and providing learning-related support, facilitate children's cognitive development and academic achievement [7]. At the same time, the associations of PS and FF with academic performance are consistent with the family process model, which highlights the importance of relational and emotional dynamics within the family, including parenting styles, communication patterns, and emotional support [11].

Taken together, these results suggest that children's academic performance is predicted not only by the availability of parental investments but also by the quality of family interactions and emotional climate. This integrated perspective helps to explain how both behavioral and relational aspects of the family environment are jointly associated with children's academic development.

6.2. Indirect Effects of Family Factors on Children's Academic Performance via Anxiety

Previous studies have primarily focused on how family factors may influence children's academic performance through the mediating effects of motivation and self-efficacy beliefs, with relatively little attention given to the role of children's anxiety [64]. The results of the present study indicate that children's anxiety can mediate the relationship between each of the three family factors and academic performance, which is consistent with our hypothesis.

Theoretically, individual development is a complex process in which behavioral, cognitive, and other factors result from the joint influence of internal mechanisms and external factors [65]. Previous research has shown that children's emotions, such as anxiety, constitute an important component of internal factors, often serving as a mediator between external factors (e.g., parenting styles) and children's achievement [66]. The results of the present study are consistent with this view, suggesting that external factors (including PI, PS, and FF) are associated with changes in children's emotional states, which in turn are associated with their academic performance [67].

These findings are also consistent with some previous empirical research. For example, Albulescu et al. [13] found that primary school students' test anxiety partially mediates the negative association between poor parental supervision and children's academic performance. Similarly, evidence from research with Chinese adolescents indicates that higher parental authoritarianism is associated with greater academic burnout, and this relationship is significantly mediated by adolescents' mental health symptoms, including anxiety and depression [68]. Together, these findings suggest that certain family environments are associated with children's emotional distress, thereby indirectly undermining their academic functioning.

In addition, the results of the present study underscore the negative association between children's anxiety and academic performance. This finding is consistent with previous research showing that children's mental health symptoms are linked to poorer academic outcomes [69]. For example, anxious children are more likely to hesitate or avoid problem-solving and have difficulty maintaining attention, which further undermines their problem-solving abilities [70]. Anxious children also tend to have difficulty accepting the emotional states they are experiencing and often rely on inappropriate or ineffective emotion regulation strategies to cope with academic stress [68].

Our findings strongly support the idea that anxiety is an important indicator of children's mental health and plays a significant role in the relationship between various family factors and children's academic performance. This not only suggests that the quality of the family is related to the development of children's mental health, but also further emphasizes the critical role of the family environment in children's academic achievement.

6.3. Student Type Fail to Moderate the Relation Between Family Factors and Anxiety

The present study did not find that student type (LP vs. TP) moderates the association between family factors and children's anxiety. That is, the negative association between positive family factors (e.g., PI, authoritative parenting, healthy family functioning) and child anxiety was similar in magnitude for both LP and TP students. This finding is partly consistent with previous studies reporting that family factors may exert a universal rather than conditional influence on children's anxiety [52,53].

According to the family investment process and family process theory, in family life, parents actively participate in child development through various forms of investment and build a positive family climate, thereby ensuring children's progress in physical, emotional, and academic domains [7,10]. Our research further emphasizes that such investment does not change as a function of children's academic performance. That is, regardless of whether children's current academic performance is high or low, the relationship between family factors and children's anxiety remains stable. A positive family environment, characterized by warm and supportive parenting, reasonable expectations rather than excessive control, can provide children with a sense of psychological safety, which tends to co-occur with lower anxiety, and this

protective effect is independent of children's academic performance [71]. Regardless of whether children are high-achieving or academically struggling, emotional support and understanding from the family can effectively be associated with lower levels of anxiety. In other words, the foundational role of family in children's emotional development is relatively independent and is not easily moderated by children's achieved academic success. Previous studies also found that although families of children with LP may experience greater stress, factors such as PI and family climate remain largely unchanged [55,56].

Thus, the protective or risk patterns of family factors on anxiety may operate similarly for LP and TP students, without being amplified or attenuated by academic performance.

6.4. Limitations and Future Directions

Despite the contributions of the present study, several limitations should be acknowledged. First, this study employed a cross-sectional design, which limits the ability to draw causal inferences from the observed relationships. While mediation analyses can provide insights into potential mechanisms, they are better suited for longitudinal data that capture unfolding developmental processes over time [72]. Therefore, the mediating role of anxiety identified in this study should be interpreted with caution. Future research employing a longitudinal to examine causal relationships among family factors, anxiety, and academic performance. Second, children's anxiety in the present study was reported by parents, which may differ from children's self-reports or evaluations provided by other informants. Future research would benefit from incorporating multi-informant assessments, such as reports from teachers and children themselves, to provide a more comprehensive and accurate evaluation of children's anxiety. Third, while previous research has primarily focused on test anxiety, the present study examined general anxiety as a mediator between family factors and academic performance. Although this broadens the current literature, the precise mechanisms through which general anxiety operates, and how it may differ from or interact with test anxiety, remain unexplored. Future research could compare general and test anxiety within the same design to better understand whether family factors influence academic outcomes through distinct anxiety pathways.

6.5. Implications

Our findings support the view that family factors are closely associated with primary school children's academic performance in China. These results emphasize that children's learning and development are shaped by multiple, interacting environmental contexts [11]. When parents demonstrate interest in their children's education, provide encouragement, and offer stable support, they help establish a solid foundation for academic success. In addition, effective and open communication between families and schools may further promote children's sense of responsibility and autonomy in the learning process.

Moreover, the study emphasizes the necessity of recognizing and addressing the anxiety of children. Overly stressful or high-pressure family situations can contribute to feelings of anxiety, which may hinder their academic performance and overall development. Children need to feel emotionally supported and understood by their parents, especially when facing challenges. This creates an environment where they can take risks, make mistakes, and grow without the fear of failure.

7. Conclusions

This study examined the associations among family factors, anxiety, and academic performance, as well as the moderating role of student type. The findings indicate that anxiety serves as a significant mediator in the relationship between family factors and children's academic performance. Family factors were associated with academic performance both directly and indirectly through their association with children's anxiety. In contrast, no evidence was found to support a moderating effect of student type on the relationship between family factors and anxiety.

Statement of the Use of Generative AI and AI-Assisted Technologies in the Writing Process

During the preparation of this manuscript, the authors used ChatGPT and Grammarly for language editing, grammatical refinement, and improvement of clarity. After using these tools, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

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Author Contributions

Conceptualization and design: Z.Z., M.L. (Mengmeng Liu), W.Z., M.L. (Miao Li) and S.Z. Data Collection: Z.Z. and M.L. (Mengmeng Liu). Data Analysis: Z.Z., M.L. (Miao Li) and W.Z. Initial draft preparation: Z.Z. and M.L. (Mengmeng Liu). Editing and review: W.Z., M.L. (Miao Li) and S.Z. All authors read and approved the final manuscript.

Ethics Statement

All procedures in studies involving human subjects were conducted in accordance with the ethical standards of the institutional and/or national research committee and with the Helsinki Declaration of 1964 and its subsequent amendments or comparable ethical standards. The Research Ethics Committee of Beijing Normal University approved the research presented in this article (protocol codes: BNU202203100018; date of approval: [04/02/2022]).

Informed Consent Statement

As all students were under the age of 16, participation in the study was permitted only after informed consent had been obtained from their parents or legal guardians. The parents or legal guardians also provided their own informed consent to participate. Students provided assent when appropriate.

Data Availability Statement

The datasets generated and/or analyzed during the current study are not publicly available due to concerns regarding participant privacy, but are available from the corresponding author on reasonable request.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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