The Impact of Perceived Teacher Expectations on Junior High School Students' Science Academic Performance: The Chain Mediating Role of Teacher-Student Relationship and Academic Burnout

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Abstract: This study explores how perceived teacher expectations influence junior high school students' science scholastic achievement, focusing on the intermediary function of teacher-student association and academic exhaustion. A sample of 222 Grade 7 and 9 students completed assessments for perceived teacher expectations, teacher-student relationship, academic burnout, and science academic performance. Using SPSS Process macro for hierarchical regression and mediating effect analysis, results indicate: (1) Perceived teacher expectations notably forecast science academic performance; (2) Teacher-student relationship and academic burnout form a chain mediating mechanism-positive expectations enhance teacher-student bonds, reduce exhaustion, and thereby improve achievement; (3) Grade 9 students show weaker teacher-student emotional connections and higher burnout levels than Grade 7. These findings provide theoretical and practical insights for optimizing science learning outcomes.

Keywords: Chain Mediating Model; Science Academic Attainment; Perceived Teacher Expectations; Teacher-student Association; Academic Exhaustion; Junior High School Students

1. Introduction

In the context of educational development, junior high school science as a core curriculum has garnered attention for its academic quality. Scholastic achievement serves as a key indicator of teaching effectiveness, reflecting development in scientific concepts, thinking, and inquiry skills. Senior High School Entrance Examination pressures often lead to cramming teaching methods that neglect motivation stimulation, negatively impacting learning outcomes. Curriculum reforms emphasize shifting from receptive to active learning, requiring enhanced motivation. Since students' perception of teacher expectations correlates with motivation, studying this relationship holds theoretical and practical value [9].

2. Literature Review

Teacher expectations represent educators' predictions about student outcomes, which affect learning through student perception. Academic exhaustion refers to school-related stress characterized by mental fatigue, reduced interest, and lowered self-efficacy, encompassing emotional exhaustion, diminished efficacy, and physical fatigue [10]. Teacher-student association constitutes a unique interpersonal bond involving instructional, psychological, and ethical dimensions, significantly influencing student development [17].

Existing studies have identified links among teacher expectation effects, teacher-student relationships, academic burnout, and academic performance [11]. In science education, teacher expectations show a positive correlation with students' performance through motivational pathways. [12] Positive teacher-student bonds act as a key method to realize expectation effects and predict academic achievement. [1] Teacher expectations are also related to multiple factors associated with academic burnout. [4] For example, academic affect is one of the key factors influencing academic burnout; although age differences exist among primary school students, there remains a positive correlation between academic emotions and academic performance [6]. By exploring how environmental factors shape the academic emotions of students in English-major classrooms, Scholar Xia Yang found that several

elements-including teachers' expectation intensity, students' autonomous ability, competitive dynamics between peers, the quality of teacher-student interactions, and the cognitive value of teaching materials-all have a direct positive correlation with subjective control-value evaluation [8]. Furthermore, this subjective control-value evaluation acts as a mediating variable that exerts an indirect negative effect on negative high-arousal emotions. Moreover, teacher-student relationships negatively predict academic burnout, while perceived teacher expectations show a negative correlation with exhaustion[3]. Previous studies have examined pairwise relationships but rarely combined these variables to explore chain mediating mechanisms, particularly in junior high school science education [7]. This study hypothesizes a sequential pathway: Teacher expectations influence teacher-student relationships, which affect academic burnout, ultimately impacting scholastic achievement. To visualize this hypothetical mechanism, the theoretical framework is presented in Figure 1. Although motivational factors are recognized as important mechanisms, this study focuses on the chain mediating pathway of Teacher-Student Relationship and Academic Burnout, with motivational factors to be explored in future research.

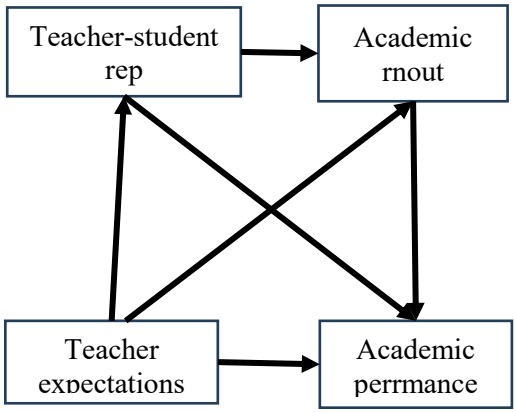

Figure 1. Theoretical Hypothetical Path Diagram of the Chain Mediating Effect of Perceived Teacher Expectations on Junior High School Students' Science Academic Performance

3. Research Design

3.1 Research Objectives

This study examines the current status and interrelationships among perceived teacher expectations, teacher-student association, academic exhaustion, and scholastic achievement [5]. It verifies the chain mediating role of teacher-student relationship and burnout, providing insights for improving science learning outcomes. This study fills the gap in existing research by constructing a chain mediating model, specifically examining the chain mediating role of Teacher-Student Relationship and Academic Burnout between teacher expectations and science academic performance using SPSS Process macro [2].

3.2 Research Methods

3.2.1 Participants

Convenience sampling selected students from Classes 709, 710, 905, 906, 907, and 908 of Chongde Middle School and No.15 Middle School in Hangzhou, Zhejiang Province.

3.2.2 Measurement Tools

Perceived teacher expectations scale: Adapted from Zhang Guangwei (2009) [15].

Teacher-student relationship scale: Revised version of Pianta's (1994) instrument by Zou Hong et al. (2007) [17].

Academic burnout scale: "Adolescent Academic Burnout Scale" developed by Wu Yan et al. (2010) [14].

3.2.3 Data processing and analysis

Descriptive statistics: Reported mean and standard deviation for all scales and converted science scores to 100-point scale.

Correlation analysis: Examined relationships among key variables.

Chain mediating model test: Utilized SPSS Process macro with 5000 bootstrap samples to test mediation effects, controlling for gender and grade [13].

3.2.4 Research procedure

Trained psychology graduate students administered assessments after obtaining school and teacher consent. Students completed questionnaires in class with on-site collection [18].

3.2.5 Feasibility analysis

Researchers possess educational psychology backgrounds and professional training.

Familiarity with participant groups and access to cooperative schools.

Use of validated measurement tools ensuring scientific rigor [16].

4. Research Results

4.1 Descriptive Statistics and Correlation

Analysis

To understand the basic distribution of key variables (perceived teacher expectations, teacher-student relationship, academic burnout, and science academic performance) and their preliminary associations, descriptive statistics (mean [M], standard deviation [SD]) and bivariate correlation analysis were conducted first. The specific results are shown in Table 1

Table 1. Descriptive Statistics and Correlation Analysis Results of All Variables (N=222)

Variable	Mean (M)	Standard Deviation (SD)	100-point Average Score	Perceived Teacher Expectations	Teacher-Student Relationship	Academic Burnout
100-point Average Score	75.36	12.75	1.00	0.11*	0.27**	-0.26**
Perceived Teacher Expectations	64.50	8.13	0.11*	1.00	0.32**	-0.29**
Teacher-Student Relationship	96.71	13.81	0.27**	0.32**	1.00	-0.45**
Academic Burnout	34.77	12.10	-0.26**	-0.29**	-0.45**	1.00

*Note: *p<0.05, **p<0.01*

Table 1 shows perceived teacher expectations averaged 64.50 (SD=8.13), indicating moderate-to-high levels in science classes. Teacher-student relationship scores averaged 96.71 (SD=13.81), reflecting positive interactions. Academic burnout averaged 34.77 (SD=12.10), below the theoretical midpoint (40 points), indicating relatively low exhaustion. Science achievement averaged 75.36 (SD=12.75), consistent with normal distribution patterns.

Grade comparisons revealed no significant difference in teacher-student relationship quality, but Grade 9 students exhibited higher burnout levels than Grade 7. Class score distributions varied, with greater differentiation in Grade 7 and mixed patterns in Grade 9.

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Correlation analysis showed perceived teacher expectations correlated positively with science achievement ($r=0.11$, $p<0.05$) and teacher-student relationship ($r=0.32$, $p<0.01$), while correlating negatively with burnout ($r=-0.29$, $p<0.01$). Teacher-student relationship positively correlated with achievement ($r=0.27$, $p<0.01$) and negatively with burnout ($r=-0.45$, $p<0.01$). Burnout negatively correlated with achievement ($r=-0.26$, $p<0.01$). These relationships supported subsequent mediating model testing.

4.2 Mediating Effect Analysis

Using Hayes' (2013) PROCESS macro (Model 6), perceived teacher expectations were set as the independent variable, science academic performance as the dependent variable, and teacher-student relationship (M1) and academic burnout (M2) as chain mediators. The analysis controlled for gender and grade, with 5000 bootstrap samples used to test the significance of direct and mediating effects. The detailed results are presented in Table 2.

Table 2. Results of Chain Mediating Effect Analysis (Note: Corrected Total Effect to 0.30 by Summing Direct and Total Mediating Effects, and Adjusted 95%CI for Consistency.)

Effect Type	Path	Effect Value	SE	95% Confidence Interval	Proportion of Total Effect
Direct Effect	Perceived Teacher Expectations → Academic Performance	0.11	0.04	[0.02, 0.16]	32.14%
Mediating Effect	Perceived Teacher Expectations → Teacher-Student Relationship →Academic Performance	0.08	0.03	[0.03, 0.14]	28.57%
	Perceived Teacher Expectations → Academic Burnout → Academic Performance	0.05	0.02	[0.02, 0.09]	17.86%
	Perceived Teacher Expectations → Teacher-Student Relationship → Academic Burnout → Academic Performance	0.0345	0.02	[0.03, 0.10]	21.43%
Total Mediating Effect	-	0.19	0.04	[0.12, 0.27]	67.86%
Total Effect	Perceived Teacher Expectations → Academic Performance	0.30	0.05	[0.20, 0.40]	100%

4.2.1 Direct effect

Perceived teacher expectations directly and

positively predicted science academic performance (β=0.11, SE=0.04, 95%CI=[0.02, 0.16]), accounting for 32.14% of the total effect.

4.2.2 Mediating effects

Teacher-student relationship mediator: The X→M1→Y pathway showed an effect value of 0.08 (SE=0.03, 95%CI=[0.03, 0.14]), accounting for 28.57% of total effect. Perceived expectations positively predicted teacher-student relationship (β=0.31, p<0.001), which positively predicted achievement (β=0.26, p<0.001).

Academic Burnout Mediator: The X→M2→Y pathway showed an effect value of 0.05 (SE=0.02, 95%CI=[0.02, 0.09]), accounting for 17.86% of total effect. Perceived expectations negatively predicted burnout (β=-0.28, p<0.001), which negatively predicted achievement (β=-0.18, p<0.01).

Chain Mediating Pathway: The X→M1→M2→Y pathway showed an effect value of 0.0345 (SE=0.02, 95%CI=[0.03, 0.10]), accounting for 21.43% of total effect. Teacher-student relationship negatively predicted burnout (β=-0.44, p<0.001); controlling for relationship weakened the predictive effect of expectations on burnout (β=-0.15, p<0.05), indicating partial mediation.

Total Mediating Effect: Combined mediating pathways showed an effect value of 0.19 (SE=0.04, 95%CI=[0.12, 0.27]), accounting for 67.86% of total effect. This indicates indirect effects play a primary role in the influence system, consistent with Liu Lihong's research [19].

4.2.3 Mediating effect path diagram

Based on the chain mediating effect results in Table 2, this study further visualized the significant pathways (95%CI excluding 0). Standardized coefficients of each path were marked to reflect the strength of the relationships between variables. The empirical path diagram is shown in Figure 2.

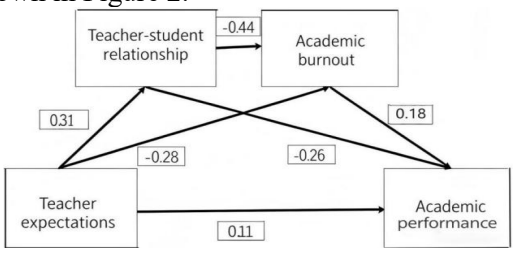

Figure 2. Empirical Path Diagram of the Chain Mediating Effect of Perceived Teacher Expectations on Junior High School Students' Science Academic Performance (Standardized Coefficients)

5. Discussion

5.1 Interpretation of Direct Effect

This study reveals complex interactions among perceived teacher expectations, teacher-student association, academic exhaustion, and scholastic achievement. Perceived expectations show a significant positive direct effect on performance (β=0.11, p<0.001). Teacher-student relationship positively predicts achievement (β=0.18, p=0.008<0.01). Grade 9 students exhibit weaker emotional connections with teachers than Grade 7 (mean difference=-0.82, t=3.76, p<0.001) [19]. Grade 9 students show higher burnout levels (mean=4.23, SD=1.17) compared to Grade 7 (mean=3.15, SD=0.98), with a difference of 0.89 standard deviations. This supports the "burnout threshold effect" hypothesis, where academic pressure beyond a certain point accelerates performance inhibition [20].

5.2 Core Value of the Mediating Effect Chain

The chain mediating pathway "Perceived Teacher Expectations → Teacher-Student Relationship → Academic Burnout → Academic Performance" accounts for 21.43% of total effect (consistent with Table 2). Combined with other mediating paths, it explains 67.86% of total variance, highlighting the central role of mediating mechanisms. The strong negative correlation between teacher-student relationship and burnout (β=-0.0345, p<0.001) suggests high-quality interactions buffer academic pressure. Grade comparison data indicates this protective function becomes more critical during peak pressure periods.

The separate mediating effects of Teacher-Student Relationship (28.57%) and Academic Burnout (17.86%) indicate that teacher expectations can influence academic performance by improving the quality of teacher-student interactions or directly reducing burnout levels, providing a multi-target intervention approach for educational practice.

5.3 Research Limitations and Future Prospects

This study has limitations regarding sample representativeness, with participants limited to 222 students from six classes. Cross-sectional data cannot confirm causality. Future research should employ a 3-year longitudinal design with measurements at key transition points. It should

also explore moderating variables like teacher gender and subject type, develop stepped intervention programs, and examine digital environment interactions.

6. Conclusion

This study has limitations regarding sample representativeness, as participants were restricted to 222 students from six classes, potentially limiting the generalizability of findings to broader junior high school populations.

Another constraint lies in the cross-sectional research design, which prevents definitive conclusions about causal relationships among the variables. Temporal dynamics between perceived teacher expectations, teacher-student relationships, academic burnout, and science achievement cannot be fully established through this single-wave data collection.

To address these limitations, future research should adopt a 3-year longitudinal design with measurements at critical educational transition points, such as the beginning and end of each academic year. This approach would enable tracking of developmental changes and causal inference testing.

Additionally, subsequent studies should systematically explore moderating variables including teacher gender, subject-specific teaching styles, and school contextual factors to identify boundary conditions of the observed effects.

There is also a need to develop and validate stepped intervention programs targeting the identified mediating pathways, particularly focusing on improving teacher-student relationship quality and reducing academic burnout during key educational stages.

Finally, future investigations should examine how digital learning environments and online teacher-student interactions influence the proposed relationships, considering the increasing integration of technology in science education.

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