

The Relationship Between Physical Exercise and Prosocial Behavior of Junior Middle School Students in Post-Epidemic Period: The Chain Mediating Effect of Emotional Intelligence and Sports Learning Motivation and Gender Differences

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Purpose: This study examined the relationship between physical exercise (PE) and prosocial behavior (PSB) and constructed a chain mediation model through the mediating effect of physical education learning motivation (PELM) and emotional intelligence (EI).

Methods: Through the stratified random sampling, 1053 students (average age = 14 years, SD = 0.96 years) that complied with the requirements were surveyed from Henan Province in China. PE, EI, PELM, and PSB were assessed using standard scales. For data analysis, Pearson's correlation analysis, structural equation model test, and bias-corrected percentile Bootstrap method were carried out in turn.

Results: (1) There was a significant positive correlation between PE and PSB ($r = 0.137$), and the direct path between PE and PSB was significant ($\beta = 0.09, t = 4.73, p < 0.01$); (2) PE can positively predict EI ($\beta = 0.08, t = 5.27, p < 0.01$) and PELM ($\beta = 0.04, t = 2.07, p < 0.05$), EI can significantly and positively PSB ($\beta = 0.67, t = 22.12, p < 0.01$), PELM can significantly and positively predict PSB ($\beta = 0.05, t = 2.20, p < 0.05$); (3) EI and physical learning motivation play a significant intermediary role between PE and PSB. The mediating effect consists of three indirect effects: PE \rightarrow EI \rightarrow PSB (the mediating effect value is 0.055), PE \rightarrow PELM \rightarrow PSB (the mediating effect value is 0.002), PE \rightarrow EI \rightarrow PELM \rightarrow PSB (the mediating effect value is 0.002); (4) The chain mediation effect is significant in girls, but not in boys.

Conclusion: (1) PE can positively predict PSB. (2) EI and PELM had significant mediating effects between PE and PSB, including single mediating effects of EI and PELM and chain mediating effects of EI-PELM; (3) There are gender differences in the chain mediation effect.

Keywords: physical exercise, emotional intelligence, physical education learning motivation, prosocial behavior, junior school students, COVID-19

Introduction

The so-called post epidemic era does not mean that the epidemic situation has completely disappeared and everything has recovered as before. It is an era in which the epidemic situation rises and falls from time to time, small-scale outbreaks may occur at any time, return from foreign countries and seasonal outbreaks, and delays for a long time, which has a profound impact on all aspects. At present, China is in a "post epidemic" period, and the number of new patients has been strictly controlled. However, no one can predict whether the epidemic will break out again. Therefore, this period is the key moment in the fight against the epidemic. Affected by the COVID-19, many people are in anxiety and panic. This not only does this have negative effects on the body and mind, but prolonged, focused psychological panic can have

negative effects on the entire social organism. Studies have shown that individuals are prone to negative emotions when confronted with threats, especially junior middle school students who are in the psychological lactation stage and seldom experience major life events,¹ and are more likely to produce negative psychological and behavioral resonance phenomena.² Therefore, the psychological and behavioral performance of junior high school students after COVID-19 cannot be ignored. As one of the positive indicators of individual social development, PSB refers to the sum of a series of behaviors that are beneficial to others and society and conform to social norms and expectations.⁴ The close relationship between PSB and mental health has been confirmed in previous studies. For example, individuals with more prosocial behaviors have higher life satisfaction and sense of life meaning, and less negative emotional experiences such as anxiety and depression.⁵ Junior high school students are in adolescence, during which children's emotions are rich, intense and changeable. Improving their PSB level will help them build harmonious interpersonal network, ensure their physical and mental health and promote all-round development. Therefore, with the advent of post-epidemic period, it is of great significance to pay attention to the influencing factors of PSB of junior high school students in this period. At present, studies on the influencing factors of PSB mainly focus on certain psychological qualities of individuals, such as moral cognition, emotional arousal and personality characteristics, and few studies comprehensively examine the influence of PE environment and individual psychological qualities on PSB. Therefore, this study aims to explore the effects of PE, EI and PELM on PSB.

PE and PSB

In the discussion on influencing factors of PSB of junior high school students in the post-epidemic period, PE is a positive factor that cannot be ignored. PE is a regular and structured physical activity with physical activity as the basic means to promote health.⁶ As a form of activity in human society, PE can not only enrich teenagers' after-school cultural life, meet the needs of PE, but also enhance their psychosocial adaptability.^{7,8} PSB is the external manifestation of positive social adaptation, which reflects the individual's social adaptation from different aspects. Researchers (Wan et al, 2021)⁹⁻¹¹ provided direct evidence of the impact of PE on PSB through empirical research, which showed that PE has a significant positive impact on individual PSB. Based on this, this study proposed hypothesis 1: PE is significantly correlated with PSB. Although some studies have proved that PE can positively predict PSB, and preliminarily revealed the correlation between the two, there is still a lack of necessary empirical research on how PE affects PSB, that is, the mechanism of the two.

Mediating Effect of EI

In recent years, some studies have shown a close relationship between EI and PSB.¹² The competency orientation of EI believes that EI is a comprehensive ability integrating various abilities such as perception, expression, management and use of emotions.¹³ The ability to perceive and evaluate the emotions of others may provide information related to PSB. Research shows that individual EI is significantly positively correlated with PSB.^{14,15} Mayer et al¹⁶ also found that individuals with high EI had more positive social behaviors. For example, those who can accurately perceive the level of fear of others also show more positive prosocial behaviors in social interactions.¹⁷ Individuals with high EI showed more prosocial behaviors, better empathy, and fewer negative behaviors in their interactions with peers.¹⁸ Therefore, we conclude that EI can enhance PSB in junior high school students. In addition, PE was found to be a significantly positive predictor of EI. Studies have shown that exercise engagement is significantly positively correlated with EI.¹⁹ Silvia et al²⁰ found that the more individuals engage in beneficial physical activity, the greater their resilience and emotional management, and the lower their rates of psychological distress. Regularly engaging in physical activity is considered a healthy habit and a protective factor against diseases and harmful risk behaviors. It provides multiple benefits such as improving self-esteem and body image, decreasing stress and nervous tension, improving motor balance, and favoring social relatedness.²¹ Stephane et al,²² regarded emotional intelligence as a mixture of abilities and traits, including self-confidence, initiative, optimism and motivation in addition to abilities such as infectivity, stress management and impulse control. Therefore, for the purpose of obtaining physical and mental health, people who regularly participate in PE are more likely to make positive regulation on their own and others' emotions, so as to maintain their good physical and mental state. Therefore, we propose hypothesis 2: EI plays a mediating role in the relationship between PE and PSB.

Mediating Effect of PELM

Learning motivation can be regarded as the internal cause of individual behavior, which is the internal psychological process that induces and maintains students' learning activities, and leads learning activities to the goals set by teachers.²³ Students' intrinsic learning motivation is the driving force of high-level learning participation, and improving intrinsic learning motivation will promote the effectiveness of students' learning participation.²⁴ PELM is the internal psychological motivation which is triggered by sports goals and impels students to participate in physical education learning and physical exercise activities.²⁵ Previous studies have shown that motivation is an important antecedent variable for effectively predicting PSB.²⁶ Most of the early studies on the relationship between motivation and PSB were carried out from the perspective of Achievement Goal Theory.²⁷ For example, Maria²⁸ investigated the relationship between athletes' goal orientation and sports prosocial behavior based on the Achievement Goal Theory, and found that task orientation could positively predict PSB, while self-orientation could negatively predict PSB.

Edward et al²⁹ believe that motivation is not a simple binary division like the Achievement Goal Theory, and advocates that motivation is regarded as a continuum and can be divided into autonomous motivation, controlled motivation and no motivation according to the "quality" of motivation. Autonomic motivation can positively predict sports PSB, and the higher the autonomic motivation, the higher the probability of sports PSB.³⁰ Students with strong PELM will show a positive attitude, produce perseverance to overcome difficulties, achieve better learning results, and help improve their PSB level. Therefore, we conclude that PELM can improve PSB of junior high school students. In addition, empirical studies show that exercise time, exercise intensity, exercise frequency and amount of exercise are significantly positively correlated with internal motivation of physical education learning, and PE can improve the level of PELM.³¹ The intrinsic motivation and extrinsic motivation of participating in PE directly affect students' mental health. Intrinsic motivation is the fundamental factor leading to changes in mental health. The main way to improve students' mental health through PE is to strengthen students' intrinsic motivation in physical education learning.³² Based on this, this study proposed hypothesis 3: PELM plays a mediating role between PE and PSB.

Chain Mediating Effect of EI and PELM

In recent years, the research on learning motivation in the field of psychology and education has mainly focused on individual factors (such as gender, self-esteem, self-efficacy, positive psychological capital, etc.) and their relationships. Studies have shown a significant positive correlation between EI and learning motivation,^{33–35} indicating that they may play a chain mediating effect between PE and PSB. The higher the EI, the more effectively you can manage and use your emotions, generate positive emotions and relieve negative emotions. When making career decisions, it can avoid wrong judgments caused by emotional problems, so as to make more reasonable and accurate plans. Based on such plans and goals, students will have high-level learning motivation to achieve better academic performance and gradually achieve their goals. This can explain the mechanism of EI influencing learning motivation to a certain extent. Saulius et al³⁶ found that significant correlations between total EI and intrinsic, integrated, identified, and introjected regulation. Higher EI was negatively related to athletes' motivation. More specifically, the self-reported abilities to perceive emotion and manage others' emotions were significantly related to intrinsic, integrated, and identified regulation. Therefore, this study further proposed hypothesis 4: EI and PELM play a chain mediating role between PE and PSB.

In addition, previous studies have also found significant gender differences in the developmental levels and interactions of PE, EI, PELM, and PSB. For example, girls' PE,³⁷ PSB,³⁸ EI,³⁹ and PELM⁴⁰ are significantly higher than boys. Due to the existence of these gender differences, the chain mediation model that PE influences PSB through EI and PELM may be moderated by gender. Based on this, this study proposed hypothesis 5: there may be gender differences in the chain mediating effect of EI and PELM; The mediating effects of EI and PELM may be valid in both male and female groups, and the effect size may be larger in girls than in boys.

In conclusion, individuals with higher levels of PE tend to be more optimistic, recover more quickly from negative emotions, and experience more positive emotions. Positive emotions can help individuals adopt an optimistic cognitive way, get more social support, eliminate psychological barriers, and get protection from them, and promote the generation and maintenance of positive mental health state. Good mental health is directly reflected in more PSB. Accordingly,

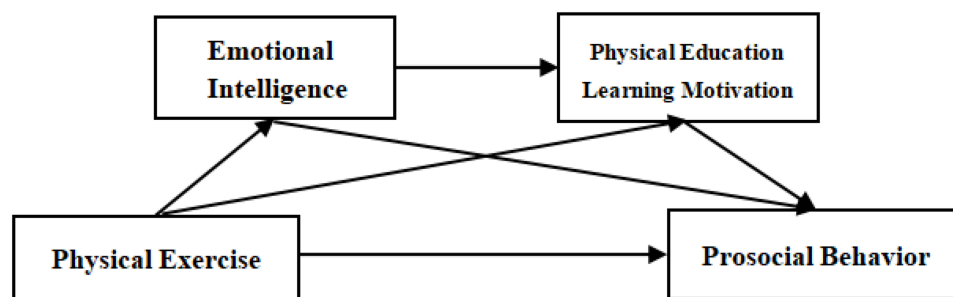


Figure 1 Chain mediation model.

hypothesis 1 is put forward: there is a significant correlation between PE and PSB, that is, PE may significantly and positively predict PSB. Regular participation in PE will be more likely to actively regulate their own and others' emotions, so as to maintain their good physical and mental state. Therefore, hypothesis 2 is put forward: EI plays an intermediary role between PE and PSB, that is, PE may improve PSB by improving EI. PELM is an internal psychological motivation that is triggered by sports goals and can promote students to participate in physical learning and physical exercise activities. Individuals with high levels of PE and positive emotions are more likely to show high levels of PELM. When individuals have a high level of PELM, they will be more willing to interact with others in a friendly way, which may help others improve their PSB. Accordingly, hypothesis 3 is put forward: PELM plays an intermediary role between PE and PSB, that is, PE may also improve PSB by improving PELM. As a powerful driving force of motivation, EI may promote the development of junior middle school students' PELM, and further promote the development of junior middle school students' psychosocial adaptability. Accordingly, Hypothesis 4 is put forward: EI and PELM play a chain intermediary role between PE and PSB, that is, PE may improve PELM and PSB by improving emotional intelligence. Therefore, in this study, PE was used as the independent variable, PSB was used as the dependent variable, and PELM and EI were used as mediating variables to construct a chain mediation model (Figure 1), in order to provide some theoretical guidance for the mental health intervention of junior middle school students in the post epidemic period.

Materials and Methods

Procedure and Participants

In order to facilitate the organization of sampling and survey, simplify the workload of sample survey and save time and money; At the same time, in order to ensure that the sample contains sampling units with various characteristics, to ensure that the sample structure is close to the overall structure, effectively improve the accuracy of sample estimation. Using stratified random sampling, 1 junior high school was selected from urban and rural areas in the three regions of eastern, central and western Henan Province, and 2 classes were randomly selected from each junior high school and each grade. A total of 1159 people from 36 classes were distributed questionnaires. After the questionnaire was collected, 106 invalid questionnaires due to regular answers and data missing were excluded, and 1053 valid questionnaires were collected (recovery rate was 90.8%). Each questionnaire takes about 10 minutes to complete. The average age of the subjects was 14.08 ± 0.956 , including 534 boys and 519 girls. 353 in grade one, 347 in grade two and 353 in grade three.

The principal test subjects were all professionally trained students majoring in sports psychology, with the consent of school leaders, teachers and the subjects themselves. The collective test was adopted, and the principles of voluntary filling, data confidentiality and anonymous filling were emphasized, and variables such as gender and grade of the subjects were controlled. The study design passed the ethical review process of the Human Research Ethics Committee. In this process, all invited participants are voluntary and confidentiality is guaranteed.

Measures and Instruments

In this study, qualitative and quantitative methods were used to study the relationship between PE and PSB, the theoretical model was constructed by literature method, the research hypothesis was proposed, and the research results were further discussed. The data were collected by questionnaire survey, and the data were analyzed by mathematical statistics, and the hypothesis was verified.

Physical Exercise

PE was measured by Liang Deqing's Physical Activity Rating Scale-3 (PARS-3).⁴¹ The PARS-3 is a three-item self-reported scale, containing exercise time, exercise intensity and exercise frequency. Each item is rated from 1 to 5, and the total score of physical activity is computed by the following equation: intensity \times (time-1) \times frequency, with a range of 0 to 100.

The higher the score, the higher the physical activity of the individual. A total score equal to or less than 19 is considered a small amount of exercise, 20 to 42 is considered a moderate amount of exercise, and a score equal to or greater than 43 is considered a large amount of exercise. According to previous experience,⁴² this study divided the small amount of physical exercise into two parts: no physical exercise and small amount of exercise. No physical exercise is equal to or less than 4 points, and a small amount of exercise is 5 to 19 points. Therefore, PE in this study is divided into four levels, from "1= no PE" to "4= large amount of PE". The internal consistency coefficient ($\alpha = 0.639$) and retest reliability ($r = 0.82$) of PARS-3 are quite reasonable. In addition, a previous study proved that the scale has good applicability in junior high school students.³⁷ In this study, the total score of the PARS-3 was used to represent the physical exercise level of junior high school students, and Cronbach's α coefficient of the scale was 0.622.

Emotional Intelligence

EI was measured using the Emotional Intelligence Scale [Chinese version] revised by Nicolae et al⁴³ and revised by Caikang et al.⁴⁴ Studies have shown that this scale is suitable for measuring emotional intelligence of Chinese junior high school students⁴⁵ (Xia Ximei et al).⁴⁶ The scale contains 33 items (eg, "I am acutely aware of the emotions I am experiencing"), of which 5, 28 and 33 are entitled reverse scoring. This scale contains 4 dimensions: self-emotion regulation (eg: "When I'm in a good mood, I know how to prolong it."), emotional perception (eg: "I think it is difficult for me to understand other people's body language."), regulation of other people's emotions (eg, "I try to do my best to impress others."), and emotional use (eg, "I can control my emotions."). Each item is scored from 1 (completely inconsistent) to 5 (completely consistent). A higher score indicates a higher level of EI. In this study, the average score of the Emotional Intelligence Scale represents the level of emotional intelligence, and the internal consistency coefficient α of the scale was 0.81, and the confirmatory factor analysis fitting index was $\chi^2/df= 4.35$, RMSEA= 0.068, GFI= 0.915, CFI =0.923.

Physical Education Learning Motivation

PELM was measured using the Physical Education Learning Motivation Scale (Chinese version) compiled by Frederic et al⁴⁷ and revised by Yu Su.⁴⁸ Studies have proved that the scale is widely applicable to the measurement of PELM of Junior high school students in China.⁴⁹ The scale has 14 items (eg, "Because I find it interesting to attend physical education class"), and contains four dimensions: internal motivation (eg, "Because I am willing to do it."), discriminating adjustments (eg, "Because I think physical education class will bring me happiness"), external adjustments (eg "For some reason I had to take physical education class") and lack of motivation (eg "I take physical education class, but I am not sure it's a good thing to do it"). The scale has good reliability and validity, and both retest reliability and internal consistency coefficient meet statistical requirements.⁵⁰ Each item is scored from 1 (completely inconsistent) to 5 (completely consistent). The higher the score, the stronger the PELM. In this study, the average score of the Physical Education Learning Motivation Scale represents the level of PELM, the internal consistency coefficient α coefficient of the scale was 0.71, and the results of confirmatory factor analysis were $\chi^2/df= 4.135$, RMSEA= 0.088, GFI= 0.935, CFI =0.912.

Prosocial Behavior

The PSB was measured by the Prosocial Behavior Tendency Scale [Chinese version) compiled by Gustavo et al⁵¹ and revised by WenJun.⁵² Studies have proved that the scale is widely applicable to the measurement of PSB of Junior high school students in China⁵³ (Jinping and Daohan et al, 2019).³ The scale has 23 items (eg, “I never hesitate when someone asks for help”), It includes six dimensions, which are: public (eg, “I will try my best to help others when the public is watching.” Anonymous (eg “I prefer to donate anonymously”), altruistic (eg “I tend to help people, especially when they are emotionally distressed”), compliant (eg “I want to help those in need when I am emotionally affected”), emotional (eg “I respond best to helping others in situations of high emotion”) and urgent (eg, “I am willing to give help to those in need or in need”). Each item is scored from 1 (completely inconsistent) to 5 (completely consistent). The higher the score, the more pronounced the PSB. The scale has good reliability and validity, and both retest reliability and internal consistency coefficient meet statistical requirements⁵³ (Jinping and Daohan et al, 2019).³ In this study, the average score of the Prosocial Behavior Tendency Scale represents the level of prosocial behavior, the internal consistency coefficient α of the scale was 0.85, and the results of confirmatory factor analysis were $\chi^2/df=4.238$, RMSEA= 0.038, GFI= 0.915, CFI =0.922.

Statistical Analyses

After the questionnaire data were collected, Amos21.0 was used to conduct confirmatory factor analysis on all the questionnaires, and common method deviation test was performed on the data.

Pearson correlation analysis was performed on the data using IBM SPSS23.0, and the relationships among PE, EI, PELM, and PSB were calculated. The continuous variables of normal distribution were expressed as mean \pm standard deviation (SD). Mplus8.1 was used to test the relationship model, mediation effect and multi-group analysis of PE, EI, PELM, and PSB. According to previous experience, goodness of fit index χ^2/df less than 3, RMSEA less than 0.08, NNFI and CFI greater than 0.9, and SRMR less than 0.05 are acceptable. In this study, significance level was set as $p < 0.05$.

Results

Common Method Deviation Test

Because this study collected data through self-reporting methods, it was possible that there could be an issue with common method variance (CMV). To reduce this possible deviation, according to the suggestion by Zhou and Long (2004), in the data collection stage, the participants were told that the results would be kept anonymous and that some items were reverse coded.⁵⁴ In order to further improve the rigor of the study, Harman's one-factor test was used for statistical control before data analysis, that is, unrotated principal component factor analysis is performed on all variables. The results show that the variance explained by the first factor is 30.25%, which is less than the critical value of 40%. Confirmatory factor analysis was used to extract a common factor from multiple variables involved in the study, and all items were loaded on this factor. The results showed that the model had poor fitting effect on data: $\chi^2/df = 12.75$, CFI = 0.62, TLI = 0.54, RMSEA = 0.18, SRMR = 0.16. This indicates that there are no factors in this study that can explain most of the variation. Consequently, there was no significant CMV in this study.

Descriptive Statistics and Correlation Analysis

As shown in Table 1, The correlation coefficients of PE, EI, PELM and PSB were statistically significant. Correlation analysis showed that PE was positively correlated with PSB, PELM and EI. The relationship between variables supports subsequent hypothesis testing.

Demographic Characteristics of the Study Sample

As shown in Table 2, of the total sample, 50.71% (534) were boys, and 49.29% (519) were girls. The PE level of boys was significantly higher than that of girls, and there was no significant difference between boys and girls in PSB, EI and PELM.

Table 1 Means, Standard Deviations, and Correlations Among Variables

Variable	M	SD	Gender	1	2	3	4
Gender			1				
1 Physical Exercise	20.064	7.714	0.182**	1			
2 Emotional Intelligence	3.784	0.385	0.080**	0.152**	1		
3 Physical Education Learning Motivation	3.724	0.549	0.025	0.107**	0.334**	1	
4 Prosocial Behavior	3.761	0.463	-0.040	0.137**	0.584**	0.247**	1

Notes: N = 1053; ** $p < 0.01$. The same below.

Table 2 Differences in Gender

Variable	Gender	Number (%)	M	SD	t	p
PE	Male	534(50.71)	21.20	7.72	6.367	0.000
	Female	519(49.29)	19.94	7.67		
PSB	Male	534(50.71)	3.78	0.46	1.375	0.169
	Female	519(49.29)	3.74	0.46		
EI	Male	534(50.71)	3.82	0.39	2.756	0.006
	Female	519(49.29)	3.75	0.37		
PELM	Male	534(50.71)	3.71	0.54	-0.873	0.383
	Female	519(49.29)	3.74	0.55		

Table 3 Differences in Grade

Variable	Grade	Number (%)	M	SD	F	p
PE	One	353(33.52)	18.96	6.76	9.121	0.000
	Two	347(32.95)	20.06	7.67		
	Three	353(33.52)	22.17	7.69		
PSB	One	353(33.52)	3.68	0.47	11.765	0.000
	Two	347(32.95)	3.84	0.46		
	Three	353(33.52)	3.76	0.45		
EI	One	353(33.52)	3.75	0.40	3.758	0.024
	Two	347(32.95)	3.82	0.37		
	Three	353(33.52)	3.78	0.38		
PELM	One	353(33.52)	3.54	0.49	38.203	0.000
	Two	347(32.95)	3.85	0.51		
	Three	353(33.52)	3.79	0.58		

As shown in Table 3, of the total sample, 33.52% (353) were grade one students, 32.95% (347) were grade two students, and 33.52% (353) were grade three student. There are significant differences in PE among different grades. Grade 1 is significantly lower than grade 2 and grade 3, and grade 2 is significantly lower than grade 3. There are significant differences in PSB among different grades. Grade 1 is significantly lower than grade 2 and grade 3, and grade 3 is significantly lower than grade 2. There are significant differences in EI among grades. Grade 1 is significantly lower than grade 2 and grade 3, and grade 3 is significantly lower than grade 2. There are significant differences in pelm among different grades. Grade 1 is significantly lower than grade 2 and grade 3, and grade 3 is significantly lower than grade 2.

Table 4 Mediating Effect and Effect Size

Path	Effect Size	The Proportion of the Mediation Effect to the Total Effect	95% Confidence Interval	
			Lower Limit	Upper Limit
PE→EI→ PSB	0.055	0.055/0.058=0.948	0.0340	0.079
PE→PELM→ PSB	0.002	0.002/0.058=0.034	0.0001	0.0064
PE→EI→PELM→ PSB	0.002	0.005/0.058=0.034	0.0001	0.0042
Total effect	0.058			

Note: N = 1053.

A Chain Mediation Test of EI and PELM

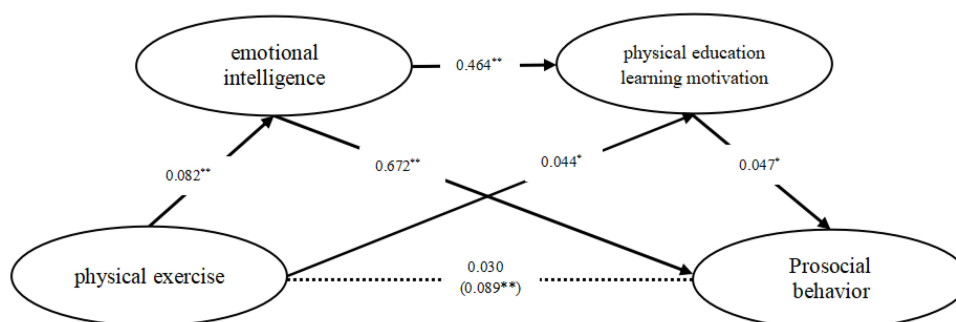
First, controlling for demographic variables (gender and grade), the direct pathway of PE on PSB was examined. The results show that the model fits well: $\chi^2/df=2.31$, RMSEA=0.06, CFI=0.94, TLI=0.92. Before adding mediator variables, the direct path of physical exercise on prosocial behavior of junior high school students was significant ($\beta=0.09$, $t=4.73$, $p<0.01$).

Then, we examine the chain mediating effect of EI and PELM on the relationship between PE and PSB. The results show: $\chi^2/df=2.11$, RMSEA=0.06, CFI=0.95, TLI=0.93, indicating that the model fits well. The relationship analysis of main variables showed that, with the addition of mediating variables, the direct path of PE on PSB was not significant ($\beta=0.03$, $T=1.92$, $p=0.055 > 0.05$), and the other direct paths reached the significant level. PE could affect PSB through three indirect paths: (1) PE → EI → PSB; (2) PE → PELM → PSB; (3) PE → EI → PELM → PSB. The direct path of PE to EI is significant ($\beta=0.08$, $t=5.27$, $p<0.01$), the direct path of EI to PSB was significant ($\beta=0.67$, $t=22.12$, $p<0.01$); the direct path of PE to PELM is significant ($\beta=0.04$, $t=2.07$, $p<0.05$), the direct path of PELM to PSB is significant ($\beta=0.05$, $t=2.20$, $p<0.05$); the direct path of EI to PELM is significant ($\beta=0.46$, $t=11.73$, $p<0.01$). The results showed that EI and PELM were the chain mediators between physical exercise and prosocial activities.

Tests were performed using the bias-corrected percentile Bootstrap method (5000 replicates). It can be seen from Table 4 that the Bootstrap 95% confidence interval results of the mediating effect show that: the confidence interval of PE → EI → PSB is [0.034, 0.079], and the mediating effect size is 0.055; PE → PELM → PSB. The confidence interval is [0.0001, 0.0064], the mediating effect size is 0.0021; the confidence interval of PE → EI → PELM → PSB is [0.0001, 0.0042], the mediating effect size is 0.0018, and the confidence interval does not include 0, indicating significant mediating effect.

Gender Multigroup Analysis of a Chained Mediation Model

To explore whether the chain mediating effect of EI and PELM between PE and PSB is consistent across genders. Figure 2 shows that, according to the fitting index of the model M1 (morphological equivalent model), it can be seen that the chain-mediated transgender outcome invariance is established. The factor load and structure path limit were set equal, model M2 was established, and the path was estimated freely. Since the M2 model is nested in the M1 model, the

**Figure 2** Chain mediation Model (M1).

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

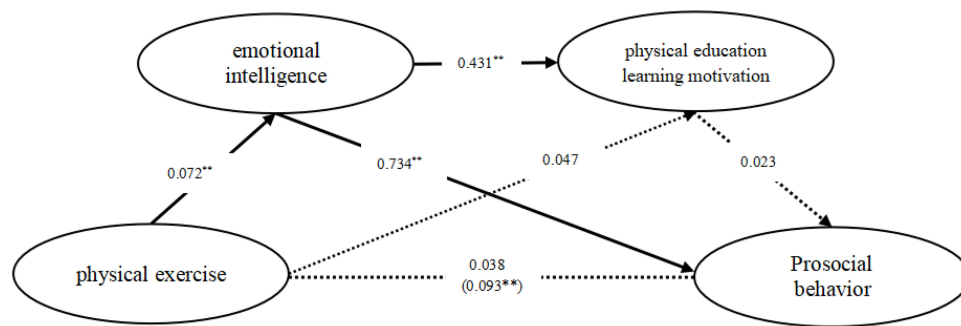


Figure 3 Chain mediation Model (M2 Male group).

Note: ** $p < 0.01$.

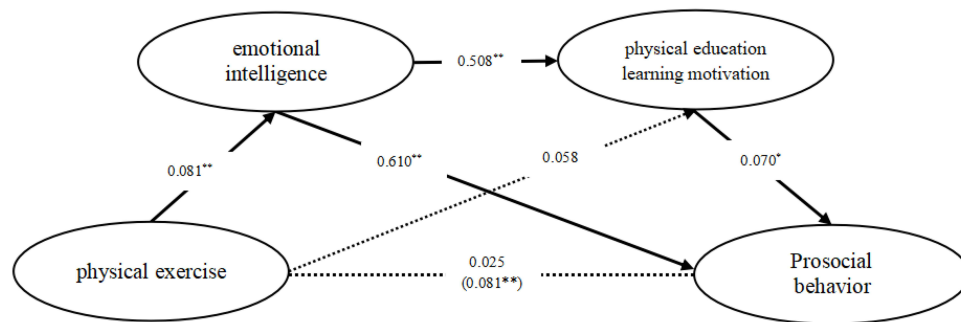


Figure 4 Chain mediation Model (M3 Female group).

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

comparison method of nested models is used.⁵⁵ $\Delta\chi^2=18.37$, $\Delta df=4.98$, $p < 0.01$, chi-square difference was significant, that is, there was a significant gender difference in the chain mediation effect.

Figures 3 and 4 show that, comparing male and female models, the results showed that: (1) the direct effect of PE on PSB was not significant; (2) Only EI had a significant mediating effect in the male group; (3) The independent mediating effect of EI and the chain mediating effect of EI and PELM were significant in the female group. The results showed that PE had no direct influence on PSB of both boys and girls. PE has an indirect effect on PSB of girls through the chain mediating effect of EI and PELM and the independent mediating effect of EI, while PE has an indirect effect on PSB of boys through the independent mediating effect of EI. This suggests that PE and its associated changes in EI and PELM may have a much higher effect on PSB in girls than in boys.

Discussion

In this study, we found that PE has a significant positive predictive effect on PSB, and EI and PELM have a chain mediation effect between them. The higher the level of PE of junior high school students, the easier it is to develop their EI, the more conducive to cultivate and stimulate their PELM, and then lead to their easy to make PSB. This explains the mechanism of the influence of PE on PSB to a certain extent.

PE and PSB

This study shows that there is a significant positive correlation between PE and PSB, which is consistent with the results of previous related studies,^{56–58} which verifies Hypothesis 1. O'Donnell et al⁵⁹ explored the impact of PE on children's PSB through comparative experiments and found that the group that participated in PE improved their PSB. Shu et al¹⁰ conducted a 6-month sports intervention on 100 rural left-behind children and found that the average score of the PSB dimension increased significantly after the intervention. Therefore, PE plays an important role in promoting PSB of junior high school students. The World Health Organization recommends that adolescents get more than 60 minutes of physical

activity per day.⁶⁰ Students who regularly participate in PE can significantly reduce depression, increase well-being, and produce positive psychological factors that have a positive impact on PSB.⁶¹ At the same time, participating in PE can increase empathy, promote collective participation, and increase interpersonal trust, thereby enhancing individual PSB.⁶²

In addition, this study found that the direct relationship between PE and PSB was not significant after the addition of mediation variables, which may indicate that this relationship does not exist completely and may need the help of other conditions.

Independent Mediating Effect of EI and PELM

This study found that EI plays an intermediary role between PE and PSB, which verified hypothesis 2. This is consistent with the previous research evidence that PE plays a positive role in EI⁶³ and EI is conducive to PSB.⁶⁴ In this study, three variables were included simultaneously, revealing that PE is an important factor in improving EI and promoting PSB. This may be because PE is not only an important means to enhance physical fitness, but also provides students with the most direct social scene experience to participate in social practice. The constant reproduction of situations such as the awareness of rules, failure and victory, and interpersonal interaction between teams in PE, make the students' emotional control, will quality, frustrated, thinking ability, etc under subtly improved and improve,⁶⁵ so that when they encounter various negative events, they always maintain a state of positive energy, keep themselves in balance with the external environment, and show more prosocial behaviors such as sharing behaviors, cooperative behaviors, and adjustment behaviors (Wenhua, 2021).³⁸ It is worth noting that, as a potential positive psychological capital, EI can enable individuals to view their own negative situations in a relevant way and make positive adjustments, so as to maintain their good physical and mental state, and it is easier to establish prosocial behaviors. This is not only good for self-esteem and optimism, but also good for their overall health. Studies have proved that individuals with high EI traits are more willing to help others after experiencing social stress. When stress is not too threatening, high EI can regulate stress and promote PSB.

This study also found that PELM played a mediating role between PE and PSB, which verified hypothesis 3. This is related to PE promoting PELM,^{66,67} PELM is conducive to PSB^{30,68} showed consistent results. This study also explores the relationship between these three variables, and confirmed that PE is an important factor in promoting PELM and an important factor in increasing PSB. The possible reason lies in that students get sports fun, sense of belonging, sense of competence and satisfaction from PE. In addition, the positive feedback, guidance and care from teachers and classmates also improved students' sense of achievement. The sports characteristics and exercise forms of some sports events are conducive to improving students' internal learning motivation such as knowledge seeking, achievement and stimulation.³¹ Obviously, for individuals with a high level of sports learning motivation, the main reason for individuals to engage in certain behaviors is to obtain happiness, interest or satisfy their own psychological needs (such as social affinity needs, etc).³⁰ Therefore, students with higher level of autonomic motivation are more likely to respect the rules of competition and engage in prosocial behaviors. In fact, the impact of PELM on junior high school students not only lies in school learning, but even after entering the society still has a great impact. PELM is of great significance to junior high school students, not only for the healthy development of individual students, but also for the development of the whole society.

At the same time, this study also found that the mediating effect of EI is higher than that of PELM, and improving EI is easier to promote the PSB of junior high school students. This may be because the direct situational experience brought to students by PE can help them maintain a good physical and mental state, as well as a positive attitude towards exercise. This state will also be imperceptible to their peers who participate in exercise together, and naturally tend to show PSB such as sharing behavior and cooperation behavior. For junior high school students, since there is no need to consider the interference of external environment, it is more direct to acquire PSB in the above ways.⁶⁹ However, if students want to generate PELM, they first need to get a happy experience through PE, and the generation of happiness needs to rely on the guidance, love, encouragement and other positive feedback of others (teachers, classmates, parents).⁷⁰ This is why the mediating effect of EI is higher than that of PELM. Therefore, the effect of PE on PSB through EI is better than that of PE on PSB through PELM. Therefore, EI should be considered in promoting PSB.

Chain Mediating Effect of EI and PELM

In addition, the results of the study further found that EI and PELM play a chain mediating role between PE and PSB, and hypothesis 4 is established. This is similar to previous findings that EI is beneficial to PELM.³⁶ Studies have shown that EI can significantly positively predict deep learning motivation of high school students, that is, the higher the level of EI, the higher the level of learning motivation.⁷¹ Students with high EI are more inclined to bring positive emotions into the process of physical education learning. Using high-level PELM can make them feel happy in learning, focus more on learning, and improve their academic performance. At the same time, avoid bringing negative emotions into the learning process and prevent academic performance from deteriorating. At the same time, in order to make themselves and others such as teachers and parents have positive emotions, they often require themselves to get good grades, which is why students with higher EI have higher learning motivation. Through the chain mediation effect test, this study found that regular PE can promote the development of students' EI toward a healthier development, which will be conducive to cultivating and stimulating students' PELM, and then conducive to promoting their PSB. Accordingly, the chain mediation of EI → PELM in this study is feasible, and it can play a partial mediating effect in the impact of PE on PSB. To some extent, the mediation effect model has revealed the influence mechanism of PE on junior high school students' PSB, which has certain guiding value for improving junior high school students' PSB. The chain mediation effect suggests that physical education educators can effectively improve the PSB of junior high school students by improving students' EI and PELM on the premise of improving students' PE level.

Sex Differences in Mediating Models

Neither girls nor boys' PE directly predicted PSB. But girls' PE can positively predict PSB through EI and PELM, and the chain effect is established. However, boys' PE can only positively predict PSB through emotional intelligence. The transition from primary to secondary school is an important and decisive stage for many students, with both positive and negative effects on their physical and mental health. Middle school is a period of rapid physical, social, and emotional development for students, which may increase loneliness, stress, depression, and anxiety.⁷² On the one hand, girls are easier than boys to adapt to the social relationship between the class and peers,⁷³ and are more sympathetic, friendly, caring for others and other prosocial psychological characteristics, so they are easier to interact with friends and obtain close friendship. Furthermore, they have good interpersonal skills,³⁷ which promote PSB; On the other hand, it may also be because girls' judgment ability,⁷⁴ self-control ability⁷⁵ and emotion perception recognition⁷⁶ are significantly higher than boys', thus they have good emotional intelligence and promote their prosocial behaviors. Boys' emotional stoicism, emphasis on physical strength, avoidance of femininity and pursuit of status and achievement may have a negative impact on prosocial behaviors.⁷⁷

Observations of female student-athletes confirm that they have a higher pursuit of academic achievement, and more precisely, that female students are more interested in PE in a lower level of technical learning tasks and physical demands.⁷⁸ Boys with poor body shape, poor athletic ability and physical quality, and poor athletic performance are at higher risk of marginalization, ridicule and violence in traditional physical education learning.⁷⁹ Therefore, boys may be more afraid of participating in PE and cause a lack of PELM. Girls, on the other hand, are better at monitoring their own emotions and those of others, and do PE to enjoy the process of exercising, to gain physical attractiveness and stable peer relationships.⁸⁰ Therefore, physical exercise can promote girls' EI and PELM, and promote their good PSB development.

Practical Significance

This study investigated the influence of PE on PSB of junior high school students, which enriched the relevant research on PE and PSB in the post-epidemic period, and also had certain guiding significance for the intervention of PSB of junior high school students: First, physical exercise is an important predictor of prosocial behavior. The junior high school stage is a critical period of individual development and the period with the most changes in the life cycle. They are growing up physically and psychologically, and their personal mentality and social relations are constantly changing. In addition, due to COVID-19, a public health emergency and other reasons, they are prone to adverse psychological and

behavioral problems. Extensive evidence, especially meta-analysis, supports the cardio-health benefits of PE, including the treatment and control of depression and anxiety.⁸¹ At the same time, PE is also an effective process to accelerate, guide, and regulate individual socialization. Therefore, improving the level of PE of junior high school students should become an important part of school education.

From the perspective of students' overall physical and mental development, teachers, especially physical education teachers, should create conditions for students to take good physical education classes and extracurricular physical exercise according to the characteristics of students' physical and mental development, and ensure that exercise time, exercise venues and exercise equipment are guaranteed. It will be more directly helpful to the development of students' sports habits, and even for teenagers' life sports habit to lay a solid foundation. Secondly, PELM and EI are important factors affecting PSB of junior high school students. According to this study, two variables of PELM and EI have more unique effects on PSB. Therefore, schools should take practical and effective measures to cultivate EI: within the scope of the first classroom, establish a new teacher-student relationship, build an emotional classroom teaching model, set EI education content in standardized courses, and adopt a scientific teaching evaluation system. Within the scope of the second classroom, humanistic education, social practice activities, quality development training and professional school psychological counseling are carried out. In addition, schools should also organize a variety of extracurricular sports activities and sports competitions. Teachers can use a variety of teaching content, teaching methods, teaching organization and teaching evaluation to improve the endogenous motivation of physical education classes, and improve students' PELM.

Limitations and Prospects

This study explored the relationship between PE and PSB, built a chain mediation model, it reveals the internal mechanism of the influence of PE on PSB, which has important theoretical and practical value for understanding the causes of PSB of junior high school students, and also provides a preliminary basis for studying the causal relationship between the variables. However, this study has not been able to draw inferences about causal relationships between variables. Longitudinal tracking or experimental intervention designs may be used in the future to more effectively explain the effects of PE on PSB. In addition, this study only considered the mediating effect of EI and PELM, and in fact there may be other mediating variables such as personality, rumination, and learning interest, which need to be further explored in the future. Meanwhile, the survey object of this study is junior high school students in Mainland China, and the survey results may only be applicable to junior high school students in mainland China. In the future, the survey scope should be expanded to extend the study results to junior high school students in more countries and regions. In the future, we will adhere to the education concept of "health first" and follow the important requirements of "strengthening physical education classes and extracurricular exercises to promote physical and mental health and physical fitness of teenagers", and explore the multiple mechanisms of the influence of exercise on the physical and mental health of teenagers.

Conclusions

(1) PE is significantly positively correlated with PSB; (2) PE can positively predict EI and PELM, EI can significantly positively predict PSB, and PELM can significantly positively predict PSB. (3) EI and PELM had significant mediating effects between PE and PSB, and the mediating effects included three paths: EI alone mediating effect, PELM alone mediating effect, and EI- PELM chain mediating effect; (4) Boys' EI plays a complete mediating role, but PELM has no mediating role, and EI and PELM fail to play a chain mediating role; girls' EI and PELM play a complete mediating role between PE and PSB, and EI and PELM play a chain mediating role. (5) Through this study, it can be found that the PSB of junior middle school students in the post epidemic period is affected by their own EI and PELM to a certain extent. Therefore, in the post epidemic period, when improving the PSB of junior middle school students, we should start from strengthening the PE of junior middle school students, pay attention to the level of junior middle school students' EI and PELM (especially the level of EI), so as to promote the improvement of junior middle school students' PSB.

Data Sharing Statement

The data used to support the findings of this study are available from the corresponding author upon request. Our study complies with the Declaration of Helsinki.

Ethical Approval Statement

The study was approved by the Ethical Review Board of Zhaoqing University. The procedures performed were in accordance with the Declaration of Helsinki. Parents or guardians of all participants signed informed consent. The informed consent described the purpose and process of the study, the method used and publication plans. It also included confidentiality assurance, the principles for voluntary participation and included contact information to the researcher and organization behind the study.

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Disclosure

The authors report no conflicts of interest in this work.

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