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ARTICLE

The Relationships among Exercise Participation, Self-Compassion and Academic Stress in Classroom Contexts: Based on Latent Profiles and Mediation Analyses

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ABSTRACT: Background: Physical exercise is recognized as an effective means of alleviating academic stress, and physical education (PE) classes constitute a primary source of such activity for middle school students. This study aimed to delve into the diversity of PE class participation patterns among these students, examine their relationship with academic stress, and specifically investigate the mediating role of self-compassion in this process. **Methods:** A cross-sectional survey was conducted among 849 Chinese middle school students. Data were collected via online questionnaires using validated measurement instruments, which included the degree of participation in PE classes, academic stress, and the self-compassion scale. SPSS 27.0 was used to perform correlation and mediation analyses, and Mplus 8.3 was utilized for latent profile analysis (LPA). **Results:** The study identified four distinct patterns of participation: the avoidant group (13.31%), the moderate participation group (10.75%), the interest-driven group (29.71%), and the active participation group (46.23%). Additionally, compared to the "Avoidant group", students in the other three groups showed significantly higher levels of self-compassion and reported significantly lower levels of academic stress. Specifically, the relative indirect effects for the Moderately Engaged group, Interest-Driven Engagers group, and Actively Engaged group were −0.060 (95% CI: [−0.180, 0.055]), −0.123 (95% CI: [−0.220, −0.021]), and −0.234 (95% CI: [−0.333, −0.137]), respectively. **Conclusion:** These results underscore the importance of PE participation patterns and highlight that optimizing PE class design to stimulate students' intrinsic interest, thereby enhancing their engagement, represents an effective strategy for promoting the overall psychosocial well-being of middle school students.

KEYWORDS: Physical education class; sports participation; self-compassion; academic stress; adolescents

1 Introduction

Academic stress refers to a variety of pressures felt by students during the learning process [1]. Heavy assignments, large amounts of reading materials, and the need to master knowledge points and exams may cause great stress to students [2,3]. A report published by the World Economy and the Organization for Cooperation and Development (OECD, 2017) states that with rising academic expectations, students around the world are facing pressure from both academic and social experiences [4]. In China, the phenomenon of

high school students facing academic pressure is more prevalent due to the pressure of promotion in the middle and high school entrance exams; according to a survey, as many as 58.9% of high school students in China suffer from academic pressure for a long period of time [5].

This widespread academic stress has a particularly profound impact on secondary school students who are currently in adolescence. Secondary school students are in the midst of adolescence and young adulthood, which is a critical transitional stage from childhood to adulthood. Along with significant physical, cognitive, and emotional changes [6], they are psychologically relatively vulnerable and more likely to experience negative emotions such as anxiety, depression, and stress [7]. Research has found that moderate stress can actually have positive effects, such as improving students' attention and memory, which can facilitate learning [8]. This is because stress activates areas of the brain, such as the prefrontal cortex, which are closely related to cognitive control and decision-making. However, too much stress can not only impair these important cognitive functions [9] but also exacerbate adolescents' already existing psychological vulnerabilities, leading to a variety of mental health problems such as depression, anxiety, and academic burnout [10,11]. An empirical study from China also confirms that higher levels of academic stress are associated with poorer psychological status afterward [12]. On the contrary, lower levels of negative stressful experiences can help to improve teacher-student relationships, increase school engagement, and promote academic achievement [13]. Therefore, paying attention to and managing students' academic stress not only helps to improve their academic performance but also protects their psychological well-being.

It is crucial to find effective coping strategies to address the negative impacts of the aforementioned academic stress. Physical activity is often regarded as a protective factor for adolescent mental health [14]. Research confirms that moderate physical activity is effective in reducing academic stress and positively affecting the mental health of adolescents [15,16]. Emotion regulation theories support the rationale for this behavior, as exercise promotes the brain's release of endorphins, the "happy hormones" that elevate mood and alleviate negative emotions such as anxiety and depression [17]. In addition, exercise can help students temporarily detach themselves from academic stress by diverting their attention, thus reducing stress [18]. However, in China, parents and schools generally worry that extracurricular sports activities will impact academics, and this concern limits students' opportunities to participate in extracurricular sports to some extent [19]. Therefore, the nationally regulated physical education (PE) classes have become an important way for secondary school students to obtain stable exercise time, directly influencing their overall physical activity levels. However, physical activity exhibits a "dose effect", meaning that specific intensity and frequency are required to achieve benefits [20]. Consequently, the degree of student engagement in PE classes is directly related to the effectiveness of physical activity in alleviating academic stress.

In exploring the mechanisms by which physical activity alleviates stress, self-compassion has attracted researchers' attention as a significant psychological variable. Self-compassion refers to the ability to treat oneself with kindness and understanding during times of pain or failure, recognizing that these difficulties are shared human experiences, and maintaining a positive mindset and awareness of one's own thoughts and emotions [21]. It plays a key psychological protective role for adolescents, helping them face their deficiencies and dilemmas with an objective and friendly attitude, thereby managing academic stress more effectively [22]. It is important to note that self-empathy is not inherent by nature but is a trait that can be cultivated [23]. Research suggests that elevated feelings of self-compassion can mitigate psychological factors that impede willingness to be physically active, which in turn drives individuals to engage in physical activity [24]. In turn, physical activity is also beneficial in fostering self-compassion. A meta-analysis by Wong et al. confirms that various forms of physical activity, such as aerobic exercise, yoga, and strength training, can enhance individuals' levels of self-compassion [25]. In addition, as an important

component of self-compassion, positive thought-based interventions have also been recognized as effective stress reducers [26,27]. Therefore, self-compassion may mediate the association between secondary school students' sports participation in PE classes and academic stress.

However, secondary school students' participation in PE classes varies significantly, directly affecting class effectiveness. While previous studies have linked sports participation, self-compassion, and academic stress, most have focused on general physical activity rather than the specific context of PE classes. Therefore, this study uses latent profile analysis (LPA) to classify students based on their specific participation behaviors, avoiding subjective categorization [28]. On this basis, we will further explore the relationship between different types of engagement and academic stress and examine the possible role of self-compassion in the relationship.

In summary, the present study attempted to identify different profiles of secondary school students' sports participation in PE classes by means of potential profile analysis, to explore the relationship between different profiles and academic stress, and to examine whether self-compassion plays a mediating role between potential profiles of sports participation in PE classes and academic stress. In order to provide empirical evidence to alleviate students' academic stress and promote healthy development. Accordingly, the following hypotheses were formulated:

Hypothesis 1: *Secondary school students present different potential profiles on sports participation in physical education classes.*

Hypothesis 2: *Different potential profiles differ in self-compassion and academic stress.*

Hypothesis 3: *Self-compassion mediates the relationship between physical education participation and academic stress.*

2 Methodology

2.1 Participants and Procedures

This study was conducted in June 2025 as a cross-sectional survey in a middle school in Xinjiang, using a stratified random sampling method to recruit participants across different grades. The study strictly adhered to the Declaration of Helsinki and related laws, regulations, and ethical codes to ensure the morality and legitimacy of the study. The study was approved by the Ethics Committee of the Faculty of Psychology at Beijing Normal University (IRB No.: BNU202506160166).

After identifying the research topic, we integrated the PE Class Exercise Participation, Self-Compassion, and Academic Stress Scales into the Questionnaire Star platform. Before the questionnaire was distributed, we trained the participants in the study. After obtaining informed consent from the participants and their guardians, they filled out the questionnaire online through an exclusive link. The entire study process was executed based on the STROBE checklist for cross-sectional studies to ensure transparency of the study and completeness of reporting (Supplementary Material S1) [29]. Through these rigorous measures, we sought to enhance the reliability and validity of the study. A total of 872 data sets were collected in this study. After screening and excluding 23 data sets with homogeneous responses or excessively short completion times, 849 valid data sets were obtained, resulting in a validity rate of 97.1%. In the sample, females accounted for 48.6% and males for 51.4%, with a mean age of 14.9 ± 1.63 years. Regarding grade distribution, there were 237 students in Grade 7 (28%), 218 in Grade 8 (26%), 167 in Grade 10 (20%), and 227 in Grade 11 (27%), with a total sample size of 849.

2.2 Measurement

2.2.1 Sports Participation in Physical Education Classes

This study used the Measurement of Students' Sports Participation in PE Scale developed by Agbuga et al. to assess students' participation in PE classes [30]. The scale consists of three dimensions: behavioral participation, effective participation, and cognitive participation, with a total of 13 questions, each of which is scored on a 5-point Likert scale, ranging from 1 to 5 on a scale from "very inconsistent" to "very consistent". The total score of the scale ranges from 13 to 65, with higher scores indicating more active participation in PE classes. The Chinese version was revised by Zhang and has been well-validated with secondary school students [31]. The Cronbach's alpha of the scale in this study was 0.952.

2.2.2 Self-Compassion

This study used the short version of the Self-Compassion Scale (SCS-SF) to assess the level of self-compassion of the subjects [32]. Its Chinese version was revised by Gong et al. [33]. The scale contains 12 items based on a three-dimensional six-factor model, measuring self-kindness, common humanity, and positive thinking. The scale is scored on a 5-point scale, with higher scores indicating higher levels of self-compassion. The Cronbach's alpha coefficient for this scale in this study was 0.755.

2.2.3 Academic Stress

In this study, the Academic Stress Scale for Secondary School Students, developed by Xu et al., was used to assess students' academic stress [34]. The scale is based on Likert's 5-point self-rating scale, with scores ranging from 1 to 5, from "very inconsistent" to "fully consistent". The scale consists of 21 items, and the total score ranges from 21 to 105, with higher scores indicating higher levels of academic stress among secondary school students. The Cronbach's alpha coefficient of the total scale in the original study was 0.81, and the Cronbach's alpha of the scale in this study was 0.908.

2.3 Statistics and Analysis

After completing the initial cleaning and organizing of the data, we first used Mplus 8.3 software (Muthén & Muthén, Los Angeles, CA, USA) to perform an LPA, which aims to identify potential categories formed in the student population based on the characteristics of sports participation in PE classes. In accordance with the recommendations of Weller et al., we reported the corresponding fit indices, entropy, posterior probabilities, and the smallest class proportion [35]. Next, correlation analysis was performed using SPSS 27.0 software (IBM Corp., Armonk, NY, USA) in order to examine the degree of association among the variables. Also, based on the different participation types identified by the LPA, we further executed a one-way analysis of variance to compare the differences in the distribution of each type of student on the other variables. Finally, still using SPSS 27.0 and its PROCESS 4.2 plug-in, a mediated-effects model was constructed with potential profile categories of sports participation as the independent variable, academic stress as the dependent variable, and self-control as the mediator, and controlling for the effects of gender and age. The analysis was conducted using Bootstrap methods with 5000 resampling iterations to construct 95% confidence intervals (CIs). We assessed the significance of the mediating effect by determining whether the CI contained zero: if the CI did not contain zero, the corresponding mediating effect was considered significant.

3 Results

3.1 Potential Profiles of Secondary School Students' Sport Participation in PE Classes

The results show (Table 1) that the values of the information criterion indicators Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and Adjusted Bayesian Information Criterion (ABIC) exhibit a decreasing trend with the increase in the number of potential categories, indicating that the model's goodness-of-fit to the data is gradually improving.

Further combining the results of Lo-Mendell-Rubin adjusted Likelihood Ratio Test (LMR-LRT) and Bootstrap Likelihood Ratio Test (BLRT), the p-values of each test reached the significance level ($p < 0.05$) from the dichotomous model to the quaternary model, implying that the subsequent models (i.e., those containing more categories) significantly outperform their predecessor models. In addition, the Entropy index of each categorical model remained above 0.9, indicating a high categorization accuracy of over 90%.

However, when the models were extended to five classifications, the p-value of the LMR-LRT test was greater than 0.05, failing to reach the significance level of 0.05. This suggests that the five-classification model did not provide a significant improvement in fit compared to the four-classification model. Therefore, the four-category model is the best choice. It not only has an entropy greater than 0.9 but also has a lower information criterion value and a reasonable distribution of categories. The average posterior probabilities for each class were: The Avoiders (0.994), The Moderately Engaged (0.908), Interest-Driven Engagers (0.924), and The Actively Engaged (0.959). With the exception of minimal overlap between the Moderately Engaged and Interest-Driven Engagers, the samples in each category demonstrated extremely high classification accuracy.

Fig. 1 visually shows the mean scores of these four identified potential categories on the 13 entries of sports participation in PE class. The horizontal coordinates in the figure represent the 13 entries of the sport participation assessment, and the vertical coordinates represent the mean scores of the different categories on these entries. Based on the differences in students' sports participation in PE classes, we categorized them into four types: active participants, interest-driven participants, moderate participants, and avoidant participants.

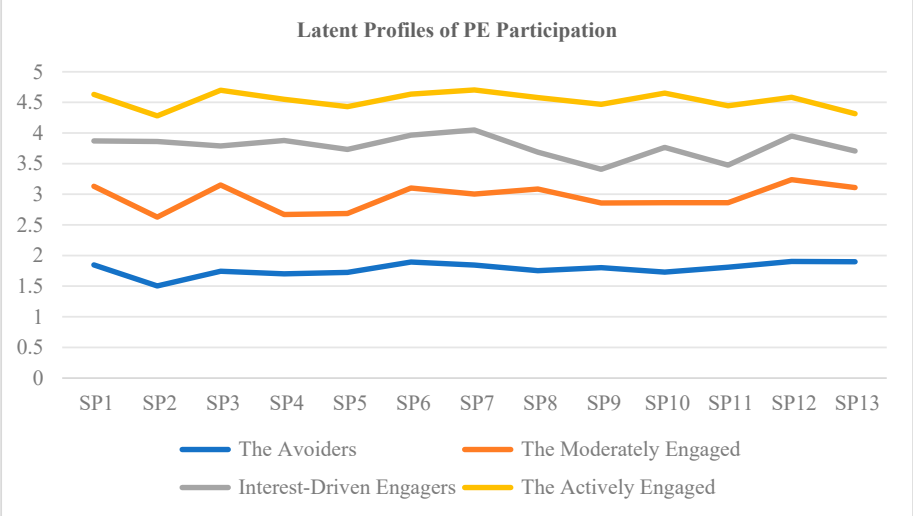

Figure 1: Mean scores of middle school students on each item based on different profiles of physical education class participation.

Table 1: Latent profile model of physical activity participation in middle school physical education classes and its indicators.

Class	LL	AIC	BIC	ABIC	Entropy	LMR	BLRT	Type (%)
1	−17,809.27	35,670.54	35,793.88	35,711.31	-	-	-	100
2	−14,689.14	29,458.28	29,648.04	29,521.01	0.98	<0.01	<0.01	20.98/79.02
3	−13,930.11	27,968.21	28,224.39	28,052.90	0.92	<0.01	<0.01	16.15/52.0/31.84
4	**−13,709.76**	**27,555.53**	**27,878.12**	**27,662.17**	**0.91**	**0.04**	**<0.01**	**13.31/10.75/29.71/46.23**
5	−13,618.54	27,401.07	27,790.08	27,529.68	0.90	0.71	<0.01	13.25/7.59/25.50/8.37/45.29

Note: LL, Log-Likelihood; AIC, Akaike Information Criterion; BIC, Bayesian Information Criterion; ABIC, Sample-Size Adjusted Bayesian Information Criterion; LMR, Lo-Mendell-Rubin Adjusted Likelihood Ratio Test (p-Value); BLRT, Bootstrap Likelihood Ratio Test (p-Value); Entropy, Classification Quality (Values Closer to 1 Indicate Better Classification); Bold values indicate the optimal number of latent classes.

3.2 Results of Correlation Analysis

According to the results of the correlation analysis presented in Table 2, academic stress is significantly and negatively correlated with participation in PE class sports ($r = -0.315$, $p < 0.01$) and self-compassion ($r = -0.425$, $p < 0.01$). Meanwhile, a notable positive association exists between self-compassion and attendance in PE sessions ($r = 0.239$, $p < 0.01$). The research indicated a negative correlation between age and academic stress, although gender exhibited no significant link with any other variable.

Table 2: Analysis of bivariate correlations among various variables.

Variable	Grade	Gender	Age	AS	SP	SCS
Grade	-					
Gender	−0.033	-				
Age	0.948**	−0.005	-			
AS	−0.126**	0.033	−0.133**	-		
SP	0.072*	−0.001	0.062	−0.315**	-	
SC	0.033	0.005	0.031	−0.425**	0.239**	-

Note: **$p < 0.01$, *$p < 0.05$. AS, Academic stress; SP, Physical education class sports participation; SC, Self-compassion.

3.3 Results of Univariate Analysis

Univariate analysis was conducted based on the four categories of secondary school students' sports participation (LPA) in PE classes. From Table 3, it can be seen that there are significant differences in gender, age, grade, self-compassion score, and academic stress score across categories. Specifically, the higher the level of sports participation in PE classes, the higher the participants' self-compassion scores and the lower their perceived academic stress. Female students had a higher percentage in the active participation group, but also had a much higher percentage in the avoidance group than male students.

Table 3: Statistical characteristics of different categories.

Characteristic	Overall (N = 849)	The Avoiders (N = 1)	The Moderately Engaged (N = 92)	Interest-Driven Engagers (N = 249)	The Actively Engaged (N = 397)	p-Value
Gender, n (%)						<0.001
Male	413 (48.6%)	39 (35.1%)	61 (66.3%)	137 (55.0%)	176 (44.3%)	
Women	436 (51.4%)	72 (64.9%)	31 (33.7%)	112 (45.0%)	221 (55.7%)	
Grade, n (%)						<0.001
Grade 7	237 (27.9%)	35 (31.5%)	30 (32.6%)	94 (37.8%)	78 (19.6%)	
Grade 8	218 (25.7%)	26 (23.4%)	26 (28.3%)	53 (21.3%)	113 (28.5%)	

Table 3: *Cont.*

Characteristic	Overall (N = 849)	The Avoiders (N = 1)	The Moderately Engaged (N = 92)	Interest-Driven Engagers (N = 249)	The Actively Engaged (N = 397)	*p*-Value
Grade 10	167 (19.7%)	13 (11.7%)	9 (9.8%)	36 (14.5%)	109 (27.5%)	
Grade 11	227 (26.7%)	37 (33.3%)	27 (29.3%)	66 (26.5%)	97 (24.4%)	
Age, Mean (SD)	14.90 (1.63)	14.97 (1.68)	14.64 (1.69)	14.69 (1.67)	15.06 (1.56)	0.023
SC, Mean (SD)	42 (7)	39 (9)	40 (7)	41 (6)	43 (6)	<0.001
AS, Mean (SD)	52 (16)	62 (20)	56 (15)	53 (13)	48 (14)	<0.001

Note: SC, Self-compassion; AS, Academic stress.

3.4 Mediating Effects of Self-Compassion

This study draws on the suggestion of Fang et al. to use relative mediation analysis for independent variables containing three or more categories ($k \geq 3$) [36]. First, considering the possible interference of demographic factors, we included gender and age as control variables in the model. Second, for the categorization process, we set "avoidance" as the reference group. Then, we coded dummies for the potential profile categories of the independent variable "self-compassion" and generated three dummy variables: D1 (vs. passive involvement vs. avoidance), D2 (vs. interest-driven vs. avoidance), and D3 (vs. active involvement vs. avoidance). See Table 4 for the mediating effect pathways of self-compassion and their specific effect sizes.

Fig. 2 illustrates the modeling of the mediating role of self-compassion between potential profiles of sports participation in PE classes and academic performance. The results of the analysis showed that the relative direct effect reached significant levels in the passive participation, interest-driven, and active participation groups compared to the avoidance group. In addition, the relative indirect effect showed a significant effect only in the interest-driven and active participation groups, while no significant difference was observed in the passive participation group.

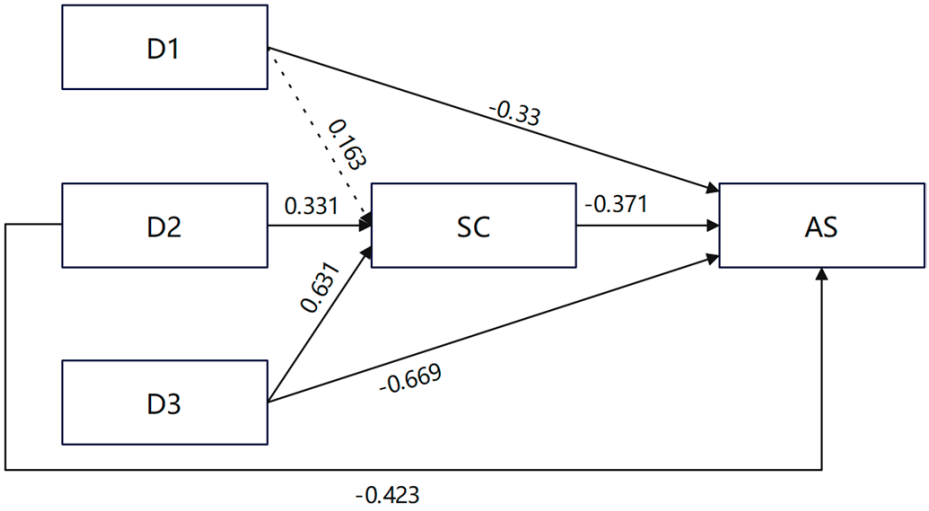

Figure 2: The mediating pathway diagram of self-compassion between physical activity participation in physical education classes and academic stress. Note: SC: Self-compassion; AS: Academic stress. Solid lines represent significant paths, while dashed lines indicate non-significant paths.

Table 4: Self-compassion mediating effect test.

Types	β	SE	95% CI
Relative Direct Effect			
The Moderately Engaged	−0.330	0.125	−0.575, −0.085
Interest-Driven Engagers	−0.423	0.101	−0.622, −0.225
The Actively Engaged	−0.669	0.096	−0.857, −0.481
Relative Indirect Effect			
The Moderately Engaged	−0.060	−0.060	−0.180, 0.055
Interest-Driven Engagers	−0.123	0.051	−0.220, −0.021
The Actively Engaged	−0.234	0.050	−0.333, −0.137

4 Discussion

This study examined the physical activity participation patterns of secondary school students in PE classes, utilizing LPA grounded in emotion regulation theory. The results of the analysis showed that the student population could be categorized into four different participation profiles: the avoidance group (13.31%), moderate participation group (10.75%), the interest-driven group (29.71%), and the active participation group (46.23%). This finding confirms research **Hypothesis 1**. Additionally, the study examined the differences in self-compassion and academic stress levels among secondary school students across various participation profiles. Students in the passive, interest-driven, and active participation groups exhibited higher levels of self-compassion and lower perceptions of academic stress compared to those in the "avoidance group", confirming **Hypothesis 2**. This finding further revealed that sports participation was positively associated with self-compassion and negatively associated with academic stress, which is consistent with the findings of previous studies by August et al. and Wunsch et al., and collectively emphasizes the positive effects of physical activity participation on adolescents' physical and mental health [37,38].

The results indicated that both the interest-driven and active involvement groups were effective in forecasting people's levels of self-compassion, in contrast to the exercise-avoidance group. The prognostic effect of the passive participation group was insignificant. This disparity may arise from variations in motivational characteristics. The exercise avoidance and passive participation groups had a comparable characteristic: an absence of drive for physical activity. Despite students in the passive participation group engaging to a degree in their PE lessons, this involvement failed to provide substantial beneficial consequences owing to insufficient intrinsic desire. According to self-determination theory, individuals are more likely to experience positive emotions, such as joy, vigor, and pride, when they participate in sports based on intrinsic motivation (e.g., enjoyment, sense of accomplishment, or excitement) [39]. On the contrary, in the passive participation group, due to insufficient motivation, they struggled to achieve full psychological benefits from exercise, which may explain the non-significant predictive effect of their self-compassion.

However, in the analysis of variance, the self-compassion score of the passive participation group was higher than that of the exercise avoidance group. This may indicate that even limited participation in exercise may still result in a marginally positive impact compared to complete exercise avoidance. Further comparing the interest-driven and active participation groups with the exercise avoidance group, we found that the first two groups were significant predictors of self-compassion, with relative direct effects of $\beta = 0.331$ ($p < 0.01$) and $\beta = 0.631$ ($p < 0.01$), respectively. de Bruin et al. conducted a five-week intervention demonstrating that physical activity could effectively improve attentional control, executive functioning, awareness of positive thoughts, self-compassion, and worry [40]. A randomized controlled trial (RCT)

by Mothes et al. showed that regular physical activity also improves positive self-perceptions, such as dispositional positive thoughts, in healthy men [41]. Similarly, tai chi has been shown to significantly increase individuals' levels of self-compassion in an RCT [42], which is an important component of Chinese PE classes.

Research indicates that individuals who are passively involved, motivated by interest, or actively participating in physical activity exhibit markedly lower levels of academic stress compared to those who opt to forgo exercise within the college demographic, underscoring the significance of physical activity as a viable strategy for stress management [43]. In terms of physiological mechanisms, physical activity can reduce the stress response by reducing stress-induced cortisol release or relieving tension [44], while systematic evaluations by De Nys et al. and Beserra et al. have also confirmed the positive effects of exercise on reducing cortisol levels [45,46]. However, it is worth noting that exercise modulates the hypothalamic-pituitary-adrenal axis (HPA axis) and influences the cortisol arousal response (CAR), which may require reaching a specific exercise threshold [47]. This is particularly important for middle school students: they tend to be more likely to reach this threshold if they are more actively engaged in PE classes, which can lead to more effective academic stress relief. In addition, active participation in PE, whether performing aerobic exercises or participating in team sports such as basketball and soccer, often creates a more positive learning atmosphere and a stronger sense of social support. This positive atmosphere facilitates the acquisition of motor skills and effectively relieves stress [48,49], and social support itself has been suggested to buffer the HPA axis and the cardiovascular system from stress responses [50]. As a result, even students who are less willing to participate are susceptible to the enthusiastic atmosphere and thus get enough exercise to reach the exercise threshold needed to lower cortisol levels. In the process, they can harvest the social support and psychological resources necessary to cope with stress. This suggests that measures to motivate students to actually engage in exercise in the PE classroom are critical to their healthy development.

The results of this study also support the mediating role of self-compassion between the potential profiles of exercise participation in PE class and academic stress, thus confirming **Hypothesis 3**. The mediating effect of self-compassion was more significant in the remaining groups compared to the exercise avoidance group. Specifically, sports participation in PE classes contributed to adolescents' development of self-compassion, which in turn significantly influenced individuals' stress responses [51–53]. Compared with adolescents with lower levels of self-compassion, adolescents with higher levels of self-compassion exhibit more moderate physiological stress responses when facing stress (e.g., lower cortisol secretion, greater heart rate variability, complete recovery from stress, and smaller elevations in heart rate and blood pressure) [54]. In addition, interventions targeting self-compassion and positive thinking have been shown to be effective in reducing adolescents' perceived stress levels [23]. In conjunction with our previous discussion, it is clear that incorporating aerobic exercise, strength training, and tai chi programs into PE classes is an effective way to develop self-compassion. Therefore, increased exercise participation in PE classes by secondary school students can be considered as an intervention to promote self-compassion, which in turn can help to regulate their academic stress response and maintain their physical and mental health.

Research Limitations and Future Perspectives

This study has some methodological limitations. First, the cross-sectional research design adopted is essentially correlational, making it difficult to draw strong inferences regarding the causal relationships between physical activity participation, self-compassion, and academic stress, allowing only for a preliminary exploration of their directional relationships. A design such as a longitudinal study or a

RCT would be a better choice in the future. Second, over-reliance on subjective reports may introduce measurement errors when measuring exercise participation in PE classes. In the future, physiological indicators (e.g., heart rate monitoring) or wearable devices (e.g., accelerometers) can be introduced for objective measurements, which will significantly improve the reliability and validity of the data. Finally, the present study only included self-compassion and failed to adequately consider other moderators or mediators that may influence the relationship between variables, such as self-efficacy and mental toughness. Future research could be conducted on these variables.

5 Conclusions

This study revealed that the participation of secondary school students in sports during PE class does not follow a single pattern but rather shows significant heterogeneity, which can be categorized into four types: avoidance group, passive participation group, interest-driven group, and active participation group. Further analysis revealed statistically significant differences among these four groups in terms of gender, age, grade level, level of self-compassion, and perceived academic stress. Of particular importance, this study confirms that self-compassion plays a significant mediating role between the type of sports participation in PE class and academic stress: students' sports participation patterns influence their academic stress by affecting their level of self-compassion. Consequently, we advise PE instructors to refine the structure of their curriculum to augment student involvement in PE classes and foster their physical and mental health growth.

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Availability of Data and Materials: Data supporting this study can be obtained from the corresponding authors.

Ethics Approval: The study was approved by the Ethics Committee of the Faculty of Psychology at Beijing Normal University (IRB No.: BNU202506160166). Informed consent was obtained from all participants and their guardians.

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