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ORIGINAL RESEARCH

Mediating effect of class flow on the relationship between physical education class climate and health promotion behaviors among Korean male middle school students

Ji-Heum Park[1], Wi-Young So[2,*,†], Ho-Hyun Song[1,*,†]

[1]Department of Physical Education, College of Fourth, Korea National University of Education, 28173 Cheongju, Republic of Korea
[2]Department of Sports Medicine, College of Humanities, Korea National University of Transportation, 27469 Chungju, Republic of Korea

***Correspondence**
wowso@ut.ac.kr
(Wi-Young So);
hohyunss@jbedu.kr
(Ho-Hyun Song)

† These authors contributed equally.

Abstract

Background: This study analyzed the effects of physical education (PE) class climate and class flow on health promotion behaviors (HPBs) among male middle school students and verified the mediating effect of class flow. **Methods**: During May 2025, we collected and examined the responses of 335 male middle school students from Sejong City, Republic of Korea. The collected data were rigorously examined via descriptive statistics, Pearson's correlation analysis, confirmatory factor analysis, and structural equation modeling to ensure the validity and reliability of the findings. **Results**: The class climate exerted a significant positive effect on class flow ($p < 0.05$). Class flow positively influenced HPBs ($p < 0.05$). The class climate did not exert a significant direct effect on HPBs ($p > 0.05$). Furthermore, the class flow mediated the relationship between class climate and HPBs ($p < 0.05$). **Conclusions**: Improving the climate and flow in PE classes may help boost HPBs in middle school boys.

Keywords

Class flow; Health promotion behaviors; Middle school students; Physical education class climate; Structural equation model

1. Introduction

Healthy behaviors—for example, regular exercise—play a vital role in a healthy life and have various benefits [1–3]. During adolescence, regular exercise promotes physical development and strengthens the immune system. In addition, it fosters improvements in mental health outcomes—such as reductions in stress, anxiety, and depression [2]—thereby offering particular value for adolescents who are emotionally overwhelmed. Furthermore, it contributes to disease prevention and, in the long term, reduces medical expenses as well as the demand for medical services [1]. Health promotion behaviors (HPBs) refer to activities that help an individual lead a healthy life and contribute to well-being, self-realization, and personal achievement [3]. Although chronic diseases primarily afflict middle-aged and older individuals, HPBs are equally important for adolescents, as they undergo continuous physical and mental growth. Although these behaviors contribute to a healthy life at any age, they are particularly beneficial when adopted early.

In Korean schools, physical education (PE) is a structured program that all students participate in, with classes primarily focusing on exercise, sports, and physical expression activities [4]. School PE classes can provide adolescents with an opportunity to develop healthy habits and lay the foundation for a healthy lifestyle. Therefore, such classes should not be limited to exercise but should also help adolescents form healthy habits. In-depth research on how school PE classes can promote HPBs among adolescents is required. This study was informed by the self-determination theory, which asserts that the persistence and volitional nature of human behavior can be understood through the satisfaction of three central psychological needs: autonomy, competence, and relatedness [5]. In PE classes, empowering students with task-related authority enhances autonomy, while tasks with a balance of challenge and mastery and specific feedback can enhance competence. Furthermore, a warm classroom environment that ensures mutual respect and emotional support among teachers, students, and peers can foster relatedness. Satisfying these needs can enhance intrinsic motivation, foster class engagement, and ultimately support the transition to health-promoting behaviors.

Research suggests that class climate and class flow can improve the efficacy of PE classes. The class climate pertains to the overall environment of a classroom, including the attitudes that teachers and students have toward one another [6]. Class flow refers to a mental state wherein students are completely absorbed in learning activities and experience the most enjoyment [7].

Studies have shown that a smooth relationship between teachers and students bolsters class flow, which results in greater academic achievements [8]. Similarly, a mastery-oriented climate and self-determined situational motivation promote class flow [9]. Furthermore, the flow state is created when the class climate is student-led and students engage in independent problem-solving. Class flow has a significant effect on the intention to continue exercising [10]. Fierro-Suero *et al*. [11] observed that experiencing a flow state in PE classes increases satisfaction with the class as well as students' intention to continue exercising. It also encourages students to form healthy habits.

The results of existing studies have indicated a significant correlation between academic achievement and class climate [12]. Regarding HPBs, class climate can reduce sedentary activities and increase physical activity [13]. Xu *et al*. [14] found decreased health-risk behaviors among students following an intervention aimed at promoting social inclusion in schools. Moreover, Wilkins *et al*. [15] observed that the bond between students and the school is inversely proportional to problem behaviors.

This study explored the relationships among class climate, class flow, and HPBs and investigated whether the climate and flow in PE classes foster HPBs among adolescents. With this objective, we aimed to provide practical recommendations for cultivating healthy habits through PE classes.

Middle school constitutes a critical phase of adolescence, characterized by the onset and progression of secondary sexual characteristics and significant physical and social changes in students. Therefore, research outcomes for middle school students may vary based on sex, necessitating studies that contribute to gender-appropriate education. However, most existing studies have examined mixed-gender groups without accounting for sex-based differences. Unlike previous studies, this study focused on only male middle school students and explored ways to optimize PE classes and promote male adolescents' HPBs. Fig. 1 demonstrates the research model and hypotheses.

H1: The climate of PE classes has a positive effect on class flow.

H2: Class flow in PE classes has a positive effect on HPBs.

H3: The climate of PE classes has a positive effect on HPBs.

H4: Class flow mediates the relationship between class climate and HPBs.

The results of this study are expected to guide PE teachers in improving class flow and students' HPBs, providing a clear direction for the future of PE.

2. Materials and methods

2.1 Participants and data collection

A survey was conducted from 09 May 2025, to 31 May 2025, among 400 male middle school students from Sejong City, Republic of Korea. The participants were determined using convenience sampling, as the characteristics of the target population were judged to be relatively homogeneous. The participants were given a small gift for their participation. Of the 355 responses received, 20 were excluded because of insincere answers. Consequently, 335 responses were used in data analysis. The study was approved by the Institutional Review Board of the Korea National University of Education (approval number: KNUE-202505-SB-0205-01, approval date: 08 May 2025). This study adhered to the ethical principles delineated in the Declaration of Helsinki. All participants as well as their legal guardians were provided with detailed information regarding the study's objectives, and written informed consent was secured prior to participation.

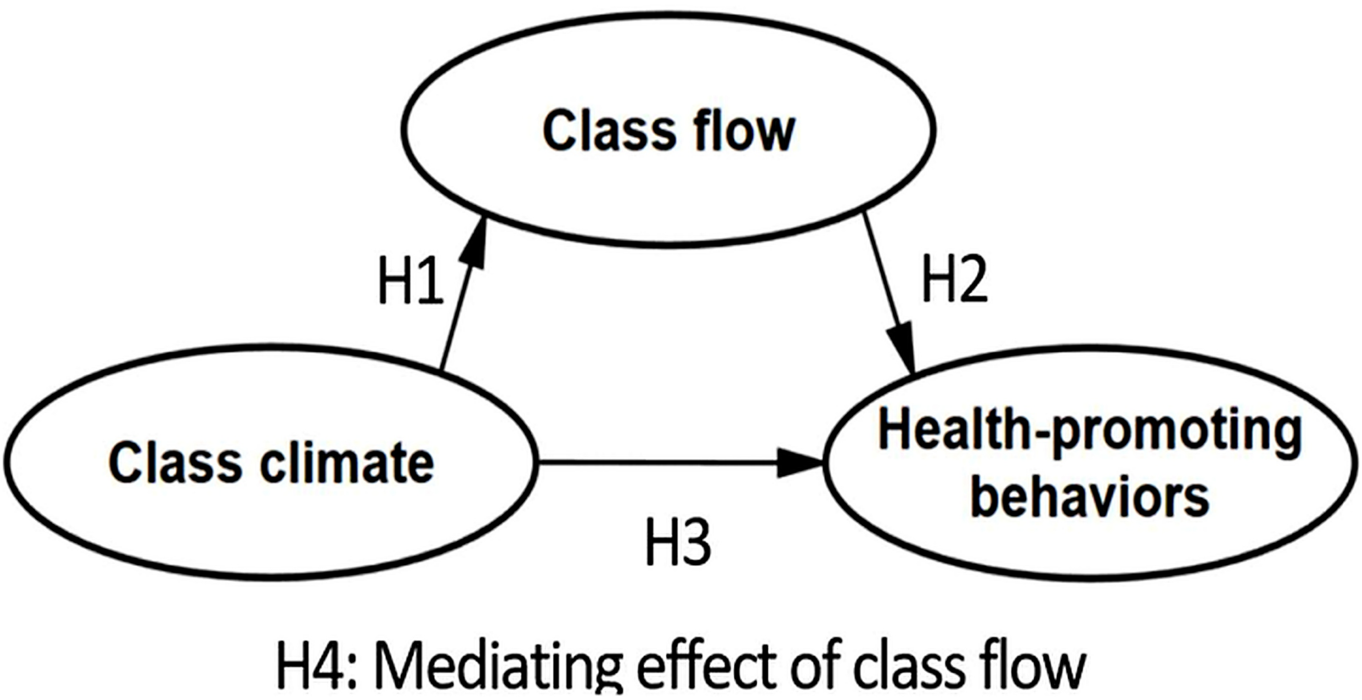

FIGURE 1. Research model.

2.2 Measurement of key variables

The survey collected data on participants' demographic characteristics: grade (7th, 8th, and 9th) and frequency of exercise (one, two, three, four, five, six, or seven times a week). Class climate was evaluated using Tuckman's [16] class climate observation questionnaire. Comprising 16 items, the questionnaire covers four dimensions of class climate: creativity (four items), vitality (four items), conscientiousness (four items), and agreeableness (four items). Class flow was assessed using the flow factor questionnaire designed by Csikszentmihalyi [17]. This questionnaire comprises 11 items across three dimensions: absorption in the class content (three items), action-awareness merging (five items), and challenge-skill balance (three items). HPBs were evaluated utilizing the questionnaire developed by Walker *et al*. [18]. The questionnaire comprises 21 items across three dimensions: self-actualization (10 items), health management (six items), and stress management (five items). All items were rated on a five-point Likert scale, with 1 denoting "not at all", 2 denoting "a little", 3 denoting "moderately", 4 denoting "quite a lot", and 5 denoting "very much". The questionnaires used in this study have been verified for reliability and validity in previous studies [16–18]. They were modified and supplemented to suit the purpose of the present study.

2.3 Data analysis

Regarding analysis of the collected data, first, descriptive statistics were obtained to assess the trends and normality of the data. Skewness and kurtosis values were calculated to examine the assumption of normality. If skewness values were ± 3.00 or less and kurtosis values were ± 8.00 or less, the data were considered to meet normality [19]. Second, we performed confirmatory factor analysis using the maximum likelihood estimation method, and the measurement tools' validity and reliability were confirmed using Cronbach's α coefficients. Normed χ^2 was considered acceptable at a strict level if it was 3.00 or lower and at a lenient level if it was 5.00 or lower [20]. The goodness-of-fit index (GFI) was considered sufficient if it was 0.900 or higher. The root mean square residual (RMR) was considered acceptable if it was 0.050 or lower. The root mean square error of approximation (RMSEA) was considered average if it was 0.100 or lower. The incremental fit index (IFI), the Tucker-Lewis index (TLI), and the comparative fit index (CFI) were considered acceptable if they were 0.900 or higher [20]. However, considering that fit indices are not absolute values, even a close value was considered acceptable. Cronbach's coefficients were considered to have secured internal consistency if they were 0.600 or higher. Third, we conducted a correlation analysis to assess multicollinearity between variables. Fourth, we performed a path analysis of a structural equation model to analyze the relationship of class climate, class flow, and HPBs. Fifth, bootstrapping was performed 2000 times at 95% confidence using a bias correction method to verify the effect. All statistical analyses were performed using SPSS and AMOS for Windows (version 29.0; IBM Corp., Armonk, NY, USA), with statistical significance set at $p < 0.05$.

3. Results

3.1 Characteristics of the study participants

Table 1 presents data on the participants' characteristics. The study sample comprised students in Grades 7–9, ranging in age from 12 to 15 years. Notably, about one-third of the participants reported exercising three times weekly, which constituted the highest frequency among the cohort.

3.2 Descriptive statistics for key study variables

Table 2 presents the descriptive statistics of key study variables. The means ranged from 3.278 to 3.894, and standard deviations ranged from 0.677 to 0.841. Skewness values ranged from −0.540 to −0.013, and kurtosis values ranged from −0.481 to 0.989, confirming that the distribution was normal.

3.3 Confirmatory factor analysis

Table 3 presents the results of the confirmatory factor analysis. In this study, one professor and two doctors specializing in sports pedagogy verified content validity before the survey was conducted. Regarding the validity and reliability of the measurement tool for class climate, the fit indices were $\chi^2 = 316.455$, GFI = 0.892, RMR = 0.042, RMSEA = 0.082, IFI = 0.925, TLI = 0.906, and CFI = 0.924. Confirming reliability, the Cronbach's α coefficient was 0.805 for creativity, 0.858 for vitality, 0.862 for conscientiousness, and 0.898 for agreeableness. Regarding the measurement tool for class flow, the fit indices were $\chi^2 = 135.528$, GFI = 0.931, RMR = 0.039, RMSEA = 0.096, IFI = 0.960, TLI = 0.933, and CFI = 0.960. The Cronbach's α coefficient was 0.804 for absorption in the class content, 0.928 for action-awareness merging, and 0.875 for challenge-skill balance, thereby confirming reliability. Regarding the HPBs measurement tool's validity and reliability, the fit indices were $\chi^2 = 455.047$, GFI = 0.891, RMR = 0.059, RMSEA = 0.065, IFI = 0.923, TLI = 0.910, and CFI = 0.922. The Cronbach's α coefficients were 0.910 for self-actualization, 0.745 for health management, and 0.804 for stress management, thus confirming reliability.

3.4 Correlation analysis

Table 4 presents the correlation analysis results, which showed a significant positive correlation among all subfactors. The highest correlation was found between absorption in the class content and challenge-skill balance (0.750), while the lowest correlation was between vitality and health management (0.212). Furthermore, all coefficients were less than 0.800, indicating an absence of multicollinearity.

3.5 Goodness-of-fit indices and parameter estimates

Goodness-of-fit indices were applied to determine the model's goodness of fit. Table 5 presents the results. All values indicated acceptable fit (normed $\chi^2 = 2.829$, GFI = 0.951, RMR = 0.019, RMSEA = 0.070, IFI = 0.973, TLI = 0.962, and CFI = 0.973). Therefore, the research model was adopted and used for the analysis. In addition, Table 6 shows that

TABLE 1. Characteristics of the study participants (n = 335).

Characteristic	Categories	Frequency (n)	Percentage (%)
Grade			
	7th	101	30.15
	8th	112	33.43
	9th	122	36.42
	Total	335	100.00
Frequency of exercise			
	1 time a week	27	8.06
	2 times a week	42	12.54
	3 times a week	91	27.16
	4 times a week	63	18.80
	5 times a week	70	20.90
	6 times a week	21	6.27
	7 times a week	21	6.27
	Total	335	100.00

TABLE 2. Descriptive statistics of key study variables.

Variable	Dimensions	Mean	Standard deviation	Skewness	Kurtosis
Class climate					
	Creativity	3.675	0.751	−0.284	0.989
	Vitality	3.669	0.722	−0.013	0.803
	Conscientiousness	3.718	0.677	−0.149	0.508
	Agreeableness	3.631	0.840	−0.540	−0.044
Class flow					
	Absorption in the class content	3.869	0.823	−0.334	−0.465
	Action-awareness merging	3.744	0.841	−0.206	−0.481
	Challenge-skill balance	3.894	0.755	−0.278	−0.312
Health promotion behaviors					
	Self-actualization	3.875	0.705	−0.284	0.026
	Health management	3.278	0.806	−0.013	0.266
	Stress management	3.688	0.789	−0.149	−0.064

TABLE 3. Results of confirmatory factor analysis.

Variable	Sub-variables	Estimate	β	Standard error	Critical ratio	α	Model fit
Class climate							
	Creativity 1	1.017	0.652	0.096	10.578***	0.805	
	Creativity 2	1.178	0.787	0.095	12.370***		
	Creativity 3	1.017	0.756	0.096	11.974***		
	Creativity 4	1.000	0.657	-	-		
	Vitality 1	1.057	0.554	0.125	8.472***		$\chi^2 = 316.455$ $df = 97$ GFI = 0.892 RMR = 0.042 RMSEA = 0.082 IFI = 0.925 TLI = 0.906 CFI = 0.924
	Vitality 2	1.071	0.616	0.117	9.121***		
	Vitality 3	1.698	0.773	0.161	10.530***		
	Vitality 4	1.000	0.558	-	-		
	Conscientiousness 1	1.920	0.755	0.259	6.459***	0.862	
	Conscientiousness 2	2.018	0.764	0.271	7.436***		
	Conscientiousness 3	1.525	0.529	0.236	7.407***		
	Conscientiousness 4	1.000	0.408	-	-		

TABLE 3. Continued.

Variable	Sub-variables	Estimate	β	Standard error	Critical ratio	α	Model fit
	Agreeableness 1	1.066	0.728	0.076	14.017***	0.898	
	Agreeableness 2	1.173	0.796	0.075	15.615***		
	Agreeableness 3	0.941	0.718	0.068	13.810***		
	Agreeableness 4	1.000	0.766	-	-		
Class flow							χ^2 = 135.528 *df* = 33 GFI = 0.931 RMR = 0.039 RMSEA = 0.096 IFI = 0.960 TLI = 0.933 CFI = 0.960
	Absorption in the class content 1	0.551	0.460	0.061	8.959***	0.804	
	Absorption in the class content 2	0.574	0.461	0.064	8.997***		
	Absorption in the class content 3	1.000	0.859	-	-		
	Action-awareness merging 1	1.060	0.831	0.059	13.430***	0.928	
	Action-awareness merging 2	0.784	0.639	0.061	12.943***		
	Action-awareness merging 3	0.787	0.754	0.056	18.943***		
	Action-awareness merging 4	1.000	0.708	-	-		
	Action-awareness merging 5	1.105	0.885	0.070	15.773***		
	Challenge-skill balance 1	1.167	0.762	0.120	12.068***	0.875	
	Challenge-skill balance 2	1.446	0.820	0.090	12.942***		
	Challenge-skill balance 3	1.000	0.608	-	-		
Health promotion behaviors							χ^2 = 455.04 *df* = 180 GFI = 0.891 RMR = 0.059 RMSEA = 0.065 IFI = 0.923 TLI = 0.910 CFI = 0.922
	Self-actualization 1	0.753	0.663	0.059	12.748***	0.910	
	Self-actualization 2	0.704	0.666	0.055	12.831***		
	Self-actualization 3	0.714	0.575	0.066	10.896***		
	Self-actualization 4	0.751	0.636	0.062	12.194***		
	Self-actualization 5	0.910	0.771	0.060	15.177***		
	Self-actualization 6	0.940	0.745	0.064	14.595***		
	Self-actualization 7	0.989	0.745	0.068	14.548***		
	Self-actualization 8	0.951	0.714	0.069	13.846***		
	Self-actualization 9	0.840	0.674	0.064	13.027***		
	Self-actualization 10	1.000	0.765	-	-		
	Health management 1	1.100	0.566	0.149	7.390***	0.745	
	Health management 2	1.266	0.652	0.156	8.094***		
	Health management 3	1.390	0.736	0.163	8.526***		
	Health management 4	0.898	0.419	0.148	6.054***		
	Health management 5	1.292	0.719	0.153	8.456***		
	Health management 6	1.000	0.499	-	-		
	Stress management 1	0.904	0.719	0.068	13.298***	0.804	
	Stress management 2	0.670	0.657	0.056	12.015***		
	Stress management 3	0.861	0.681	0.068	12.659***		
	Stress management 4	0.752	0.567	0.072	10.387***		
	Stress management 5	1.000	0.785	-	-		

****p < 0.001; assessed using confirmatory factor analysis. GFI: goodness-of-fit index; RMR: root mean square residual; RMSEA: root mean square error of approximation; IFI: incremental fit index; TLI: Tucker-Lewis index; CFI: comparative fit index; df: degrees of freedom.*

TABLE 4. Results of correlation analysis.

Varial	1	2	3	4	5	6	7	8	9	10
1	1.000									
2	0.608***	1.000								
3	0.666***	0.646***	1.000							
4	0.717***	0.592***	0.633***	1.000						
5	0.389***	0.409***	0.451***	0.356***	1.000					
6	0.376***	0.415***	0.408***	0.352***	0.692***	1.000				
7	0.474***	0.472***	0.443***	0.406***	0.750***	0.682***	1.000			
8	0.357***	0.373***	0.302***	0.327***	0.553***	0.490***	0.592***	1.000		
9	0.231***	0.212***	0.326***	0.230***	0.471***	0.435***	0.418***	0.620***	1.000	
10	0.302***	0.284***	0.301***	0.318***	0.502***	0.442***	0.446***	0.714***	0.581***	1.000

****$p < 0.001$; assessed using Pearson's correlation analysis.*

1: creativity; 2: vitality; 3: conscientiousness; 4: agreeableness; 5: absorption in the class content; 6: action-awareness merging; 7: challenge-skill balance; 8: self-actualization; 9: health management; 10: stress management.

TABLE 5. Goodness-of-fit indices of the research model.

Model	Normed χ^2	GFI	RMR	RMSEA	IFI	TLI	CFI
Goodness-of-fit index	2.829 (χ^2 = 90.527, df = 32)	0.951	0.019	0.070	0.973	0.962	0.973
Criterion of model fit	$<$3.000	$\geq$0.900	$\leq$0.050	$\leq$0.100	$\geq$0.900	$\geq$0.900	$\geq$0.900

GFI: goodness-of-fit index; RMR: root mean square residual; RMSEA: root mean square error of approximation; IFI: incremental fit index; TLI: Tucker-Lewis index; CFI: comparative fit index.

TABLE 6. Parameter estimates of the research model.

Variable	Dimensions	Estimate	β	Standard error	Critical ratio
Class climate					
	Creativity	0.802	0.840	0.046	17.478***
	Vitality	0.705	0.757	0.046	15.436***
	Conscientiousness	0.812	0.807	0.049	16.702***
	Agreeableness	1.000	0.807	-	-
Class flow					
	Absorption in the class content	1.000	0.864	-	-
	Action-awareness merging	1.221	0.791	0.068	17.879***
	Challenge-skill balance	0.961	0.870	0.047	20.355***
Health promotion behaviors					
	Self-actualization	1.000	0.891	-	-
	Health management	0.902	0.707	0.064	14.793***
	Stress management	0.999	0.799	0.058	17.159***

****$p < 0.001$; assessed using structural equation modeling.*

the standardized coefficient of each latent variable explaining the measured variable was 0.707 or higher. Therefore, the variables' explanatory power was satisfactory, and the research model was adopted and used for the analysis.

3.6 Verification of causal relationships

Table 7 presents the results of verifying causal relationships among class climate, class flow, and HPBs using the research model. The relationship between class climate and class flow was statistically significant ($p < 0.001$), with a standardized coefficient (β) of 0.606 and a critical ratio of 10.548. Moreover, the relationship between class flow and HPBs was statistically significant ($p < 0.001$), with a standardized coefficient (β) of 0.693 and a critical ratio of 10.308. However, the relationship between class climate and HPBs was not statistically significant (β = 0.045, critical ratio = 0.726, and significance level = 0.468).

Table 8 presents the results of verifying the indirect path. The indirect effect of class climate on HPBs through class flow

TABLE 7. Estimates of direct paths.

	Path	Estimate	β	Standard error	Critical ratio	Hypothesis
H1	Class climate → Class flow	0.516	0.606	0.049	10.548***	Supported
H2	Class flow → Health promotion behaviors	0.656	0.693	0.064	10.308***	Supported
H3	Class climate → Health promotion behaviors	0.036	0.045	0.050	0.726	Rejected

****$p < 0.001$; assessed using structural equation modeling.*

TABLE 8. Estimates of the indirect path.

	Path	Estimate	Standard error	95% Confidence interval		Hypothesis
				Lower	Upper	
H4	Class climate → Class flow → Health promotion behaviors	0.339**	0.052	0.246	0.454	Supported

***$p < 0.01$; assessed using structural equation model analysis.*

was statistically significant, with an unstandardized coefficient (β) of 0.339 ($p < 0.01$). Considering that class climate did not exhibit a direct effect on HPBs, we inferred that class flow exerts a complete mediating effect on the relationship between class climate and HPBs (Fig. 2).

4. Discussion

Recently, there has been a strong interest in health; nonetheless, research on the relationship between school PE classes and HPBs has been limited. Korean adolescents are increasingly engaging in detrimental health practices, such as unhealthy eating habits, excessive use of smart devices, and sedentary lifestyles due to schoolwork and entrance exam preparations [21, 22]. We explored HPBs in adolescence, a period during which lifelong habits are formed, and investigated the relationship between PE class climate, class flow, and HPBs among male middle school students. Our analyses revealed several insightful results.

First, the climate of PE classes exhibited a significant positive relationship with class flow. Consistent with our results, Cavinato *et al.* [23] stated that calling students by their names and providing a supportive climate can increase their participation. Shin and Bolkan [24] observed that classroom support, such as motivational support and relationship support, affects students' learning participation. Monteiro *et al.* [25] stated that a supportive class environment has a positive effect on students' behavioral participation. These results suggest that the climate of PE classes should be one in which teachers actively engage with students and support them. This means that PE teachers must put greater effort into creating a supportive class climate.

Second, class flow exhibited a significant positive relationship with HPBs. Tabrizi *et al.* [26] reported that individualized education programs foster adolescents' HPBs. Fierro *et al.* [11] reported that experiencing a flow state in PE classes boosts students' satisfaction with the class as well as their intention to continue exercising. Similarly, Ko and Kim [27] reported that experiencing a flow state increases Kendo participants' intention to continue exercising. These results suggest that creating a flow state in PE classes can prompt HPBs among students. The flow state can lead to students internalizing the class content and adopting healthy behaviors outside of school. Therefore, PE teachers should present tasks at an appropriate level to induce a flow state and teach students to challenge themselves and control risky behavior.

Third, the climate of PE classes did not exert a significant relationship on students' HPBs. This result aligns with those of Beck *et al.* [28], who found that health promotion schools do not demonstrate greater effectiveness in fostering health behaviors compared to regular schools. However, Wu *et al.* [29] found that a mastery-oriented climate boosts exercise continuance intentions, whereas a performance-oriented climate deters such intentions. These conflicting results suggest that enhancing students' HPBs solely through the PE class climate may be challenging. PE teachers should find ways to create a supportive class climate and enable students to focus and participate in the class.

Fourth, the flow state in the classroom mediated the relationship between class climate and HPBs. Aligning with our results, Chen *et al.* [30] reported that the social climate of the classroom influences the fulfillment of students' psychological needs, and the fulfillment of these needs strengthens their self-determination motivation. Ma and Wei [31] reported that student participation mediates the relationship between academic achievement and the emotional climate of the classroom. Other studies have also reported that student participation mediates the relationship between school climate and students' academic achievement [32, 33]. Our results corroborate the mediation effect of class flow on the relationship between class climate and HPBs. They suggest that creating a flow state in school PE classes can foster students' HPBs. PE teachers should therefore create a learner-centered climate in the classroom while providing assignments that allow students to immerse themselves in the class content.

In Korea, middle school is a compulsory part of education, and PE classes are held 2–3 times per week. We noted that almost all adolescents receive systematic PE through middle school PE classes. If proper health-related knowledge and lifestyle habits are formed during adolescence, it will not only strengthen physical health and growth but also contribute to society by reducing mental illnesses and behavioral problems. School PE classes should evolve into a subject that transcends basic physical activities and promotes health man-

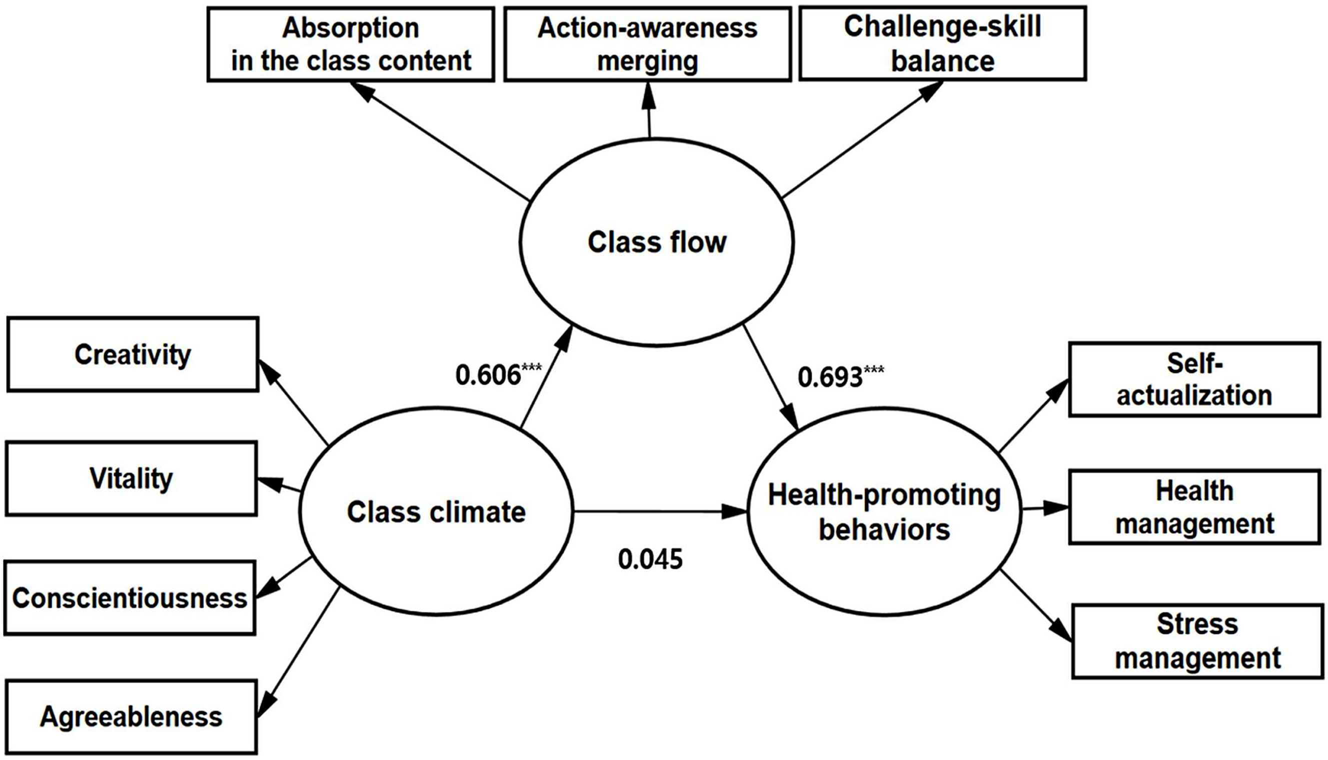

FIGURE 2. Standardized estimates of the research model in structural equation modeling. ***$p < 0.001$.

agement skills.

This study contributes to the existing literature by confirming the value of class flow in the relationship between the climate of PE classes and students' HPBs. However, it has some limitations. First, because the study participants were limited to only male middle school students in one region of Korea, the results may not be generalizable to all Korean students. Future studies should include other countries, regions, school levels, and genders. Second, various extraneous variables were not considered in this study, given that several HPBs (such as smoking and drinking) were not investigated. Third, participants' perceptions of class climate, class flow, and HPBs may have been affected by unobserved factors. Fourth, the current study did not consider supplementing the analysis conducted herein with robustness checks using methods such as the Karlson-Holm-Breen method to further clarify the mediation analysis procedure and the process of testing statistical significance. In the future, well-performed statistical research is necessary. Fifth, 335 participants are not considered a particularly large sample. Sixth, there may be bias in the results, as data were collected using self-reported questionnaires. The participants' responses may have been influenced by individual behavior or social preferences. Future studies should explore mechanisms that improve class flow, school climate, and students' HPBs. They must expand the scope of the study population, conduct large-scale group studies, and identify PE programs that lead to the formation of healthy lifestyle habits. Additionally, longitudinal studies are needed to determine whether HPBs in adolescence continue into adulthood and to study the process of behavioral change. Further, research is needed on teaching and learning methods that enhance the climate and flow in PE classes.

5. Conclusions

The climate of PE classes bolsters class flow, which fosters students' HPBs. The class climate does not exert a direct impact on students' HPBs. Instead, class flow mediates the relationship between class climate and HPBs. These results suggest that improving the climate and flow in PE classes can help strengthen HPBs among middle school boys. PE teachers should provide students with tasks that gradually increase in difficulty to maintain their engagement. They should also provide immediate feedback to students when they successfully complete a task, leading them to feel a sense of competence. Moreover, school PE classes can positively influence health behaviors beyond class time.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

AUTHOR CONTRIBUTIONS

JHP, WYS, HHS—conceptualization; methodology; formal analysis; data curation; writing–original draft preparation; writing–review and editing; visualization; supervision; project administration. All authors have read and agreed to the published version of the manuscript. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by the Institutional Review Board of the Korea National University of Education (approved number: KNUE-202505-SB-0205-01, approval date: 08 May 2025) and conducted according to the principles outlined in the Declaration of Helsinki. All participants were informed about the study procedure and its purpose, and they voluntarily signed an informed consent form.

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CONFLICT OF INTEREST

The authors declare no conflict of interest. Wi-Young So is serving as one of the Editorial Board members of this journal. We declare that Wi-Young So had no involvement in the peer review of this article and has no access to information regarding its peer review. Full responsibility for the editorial process for this article was delegated to SUP.

REFERENCES

[1] Folland S, Goodman AC, Stano M, Danagoulian S. The economics of health and health care. 9th Edition. Routledge: New York. USA. 2024.
[2] Mahindru A, Patil P, Agrawal V. Role of physical activity on mental health and well-being: a review. Cureus. 2023; 15: e33475.
[3] Lee MK, Oh J. Health-related quality of life in older adults: its association with health literacy, self-efficacy, social support, and health-promoting behavior. Healthcare. 2020; 8: 407.
[4] Kohl HW III, Cook HD. Committee on Physical Activity and Physical Education in the School Environment; Food and Nutrition Board; Institute of Medicine. Educating the student body: taking physical activity and physical education to school. National Academies Press: Washington DC. USA. 2013.
[5] Ryan RM, Deci EL. Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist. 2000; 55: 68–78.
[6] Shang C, Moss AC, Chen A. The expectancy-value theory: a meta-analysis of its application in physical education. Journal of Sport and Health Science. 2023; 12: 52–64.
[7] Wong ZY, Liem GAD. Student engagement: current state of the construct, conceptual refinement, and future research directions. Educational Psychology Review. 2022; 34: 107–138.
[8] Mallik B. Teacher-student relationship and its influence on college student engagement and academic achievement. Anatolian Journal of Education. 2023; 8: 93–112.
[9] Rodrigues F, Monteiro D, Teixeira DS, Cid L. The relationship between teachers and peers' motivational climates, needs satisfaction, and physical education grades: an AGT and SDT approach. International Journal of Environmental Research and Public Health. 2020; 17: 6145.
[10] Guo Q, Samsudin S, Yang X, Gao J, Ramlan MA, Abdullah B, *et al*. Relationship between perceived teacher support and student engagement in physical education: a systematic review. Sustainability. 2023; 15: 6039.
[11] Fierro-Suero S, Fernández-Ozcorta EJ, Sáenz-López P. Students' motivational and emotional experiences in physical education across profiles of extracurricular physical activity: the influence in the intention to be active. International Journal of Environmental Research and Public Health. 2022; 19: 9539.
[12] Erdem C, Kaya M. The relationship between school and classroom climate, and academic achievement: a meta-analysis. School Psychology International. 2024; 45: 380–408.
[13] Guirado T, Chambonnière C, Chaput JP, Metz L, Thivel D, Duclos M. Effects of classroom active desks on children and adolescents' physical activity, sedentary behavior, academic achievements and overall health: a systematic review. International Journal of Environmental Research and Public Health. 2021; 18: 2828.
[14] Xu T, Tomokawa S, Gregorio ER Jr, Mannava P, Nagai M, Sobel H. School-based interventions to promote adolescent health: a systematic review in low- and middle-income countries of WHO Western Pacific Region. PLOS ONE. 2020; 15: e0230046.
[15] Wilkins NJ, Krause KH, Verlenden JV, Szucs LE, Ussery EN, Allen CT, *et al*. School connectedness and risk behaviors and experiences among high school students—youth risk behavior survey, United States, 2021. MMWR Supplements. 2023; 72: 13–21.
[16] Tuckman BW. Feedback and the change process. The Phi Delta Kappan. 1976; 57: 341–344.
[17] Csikszentmihalyi M. Flow: the psychology of optimal experience. First Harper Perennial Modern Classics edition. Harper Perennial Modern Classics: New York, USA. 2008.
[18] Walker SN, Sechrist KR, Pender NJ. The health-promoting lifestyle profile: development and psychometric characteristics. Nursing Research. 1987; 36: 76–81.
[19] Kline RB. Principles and practice of structural equation modeling. 5th edn. Guilford publications: New York, USA. 2023.
[20] Verma JP, Verma P. Understanding structural equation modeling: a manual for researchers. Springer Nature: Cham, Switzerland. 2023.
[21] Kim YH. Korean adolescents' health risk behaviors and their relationships with the selected psychological constructs. The Journal of Adolescent Health. 2001; 29: 298–306.
[22] Korea Disease Control and Prevention Agency. The 20th Korea youth risk behavior web-based survey. Korea disease control and prevention agency. 2024. Available at: https://www.kdca.go.kr/yhs/ (Accessed: 31 May 2025).
[23] Cavinato AG, Hunter RA, Ott LS, Robinson JK. Promoting student interaction, engagement, and success in an online environment. Analytical and Bioanalytical Chemistry. 2021; 413: 1513–1520.
[24] Shin M, Bolkan S. Intellectually stimulating students' intrinsic motivation: the mediating influence of student engagement, self-efficacy, and student academic support. Communication Education. 2020; 70: 146–164.
[25] Monteiro V, Carvalho C, Santos NN. Creating a supportive classroom environment through effective feedback: effects on students' school identification and behavioral engagement. Frontiers in Education. 2021; 6: 661736.
[26] Tabrizi JS, Doshmangir L, Khoshmaram N, Shakibazadeh E, Abdolahi HM, Khabiri R. Key factors affecting health promoting behaviors among adolescents: a scoping review. BMC Health Services Research. 2024; 24: 58.
[27] Ko YJ, Kim JS. Effect of exercise immersion experience on health promotion and lifelong physical education of high school students in sports club activities. Journal of Exercise Rehabilitation. 2021; 17: 169–174.
[28] Beck H, Tesler R, Barak S, Moran DS, Marques A, Harel Fisch Y. Can health-promoting schools contribute to better health behaviors? physical activity, sedentary behavior, and dietary habits among Israeli adolescents. International Journal of Environmental Research and Public Health. 2021; 18: 1183.
[29] Wu X, Gai X, Yu T, Yu H, Zhang Y. Perceived motivational climate and stages of exercise behavior change: mediating roles of motivation within and beyond physical education class. Frontiers in Psychology. 2021; 12: 737461.
[30] Chen R, Wang L, Wang B, Zhou Y. Motivational climate, need satisfaction, self-determined motivation, and physical activity of students in secondary school physical education in China. BMC Public Health. 2020; 20: 1687.

[31] Ma Y, Wei C. The relationship between perceived classroom climate and academic performance among English-major teacher education students in Guangxi, China: the mediating role of student engagement. Frontiers in Psychology. 2022; 13: 939661.

[32] Phuntsho U, Dendup R. The relationship between school climate, student engagement and academic achievement in higher secondary school. Bhutan Journal of Research and Development. 2021; 9: 98–131.

[33] Podiya JK, Navaneetham J, Bhola P. Influences of school climate on emotional health and academic achievement of school-going adolescents in India: a systematic review. BMC Public Health. 2025; 25: 54.

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