

The Relationship Between Trait Mindfulness and Well-Being in College Students: The Serial Mediation Role of Flow Experience and Sports Participation

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Purpose: The current college students have a lot of mental pressure due to their heavy study, life and work burdens, and the incidence of college students' problems continues to rise. Sports are considered to be one of the best ways to improve the well-being of college students. However, the mechanism of college students' well-being is still unclear. This article is intended to exploring the mechanism of action of Trait Mindfulness (TM) on well-being in college students.

Methods: Four hundred and ninety six college students were tested with Mindfulness Attention Awareness Scale, Flow Experience Scale, Physical Activity Rating Scale, and Subjective Well-being Scale.

Results: College students' trait mindfulness (TM) can predict well-being, college students' trait mindfulness (TM) can have an indirect impact on well-being through flow experience, and college students' trait mindfulness (TM) has an indirect impact on well-being through sports participation. In addition, flow experience and sports participation play a sequential mediating role between college students' trait mindfulness (TM) and well-being.

Conclusion: Flow experience and sports participation play a sequential mediating role between college students' trait mindfulness (TM) and well-being. The current research results indicate that college students get well-being in sport activities. Trait mindfulness influences the behavioral tendency of sports participation through the mediation of thinking activities and cognitive function sequences. The results of this study provide a new literature reference for expanding the theory of positive emotion expansion and well-being. In addition, this study also provides an important basis for improving college students' well-being and college education.

Keywords: college students, trait mindfulness, well-being, flow experience, sports participation

Introduction

With the development of positive psychology, the important role of subjective well-being in promoting health has been widely concerned. However, among college students, the heavy burden of study, life and work, as well as the unfavorable social atmosphere have caused them a lot of mental stress.¹ The incidence of problems increases year by year, which largely reduces their experience of happiness.² Fortunately, a series of studies have shown that healthy sports can positively promote individual subjective well-being.³ Moreover, some researchers pointed out that sports is one of the best ways to improve the well-being of college students.⁴ Therefore, we should pay attention to the discussion of the issue of sports promotes the well-being of college students.

People's happiness in sports will be affected by many factors. For example, Huang et al suggested that sports enthusiasm and coaches' leadership style can affect athletes' well-being.⁵ Also, when athletes perceive their coach as a good role model and guiding them in a positive way, they are more likely to experience well-being. Park and Wang (2019) used a nationally representative longitudinal survey to examine whether children's participation in youth activities affects subjective well-being.⁶ The results of the study found that the longer the time involved, the greater the overall

sense of well-being and joy. A study by Kwak (2017) on women's well-being found that family support for sports participation positively affects women's well-being.⁷ Constraints on sports participation (eg, time and finances) can have a negative impact on well-being.

Increasing the well-being experience of college students has become an important content in the current university education. According to Seligman and Csikszentmihalyi (2014), well-being is an overall assessment of life satisfaction and perceived positive and negative emotions.⁸ Well-being as an emotional response may be related to metacognition. For example, Wolff (2014) pointed out that under the action of mindfulness, it is helpful for individuals to experience emotional and emotional responses from a higher level of consciousness, and it has a positive effect on the individual's cognitive and emotional processes.⁹ It can be seen that trait mindfulness(TM) has important value in improving and enhancing well-being. In addition, the positive emotion expansion theory suggests that positive emotion experience can expand the individual's thinking and cognitive ability, it can also change the individual's original attention, cognition, and action patterns.¹⁰ This theory regards the individual's thinking and cognitive ability and behavior tendency as a single parallel influencing factor. However, we have reason to believe that individuals' cognitive functions and behavioral tendencies have a sequential mediating effect on well-being. Therefore, this study examines the mechanism by which individuals gain positive emotional experiences in sports through empirical research, which plays an important role in expanding existing theories.

Literature Review

TM and Well-Being of College Students

Mindfulness originated from the ancient Eastern meditation culture. Later, Kabat-Zinn (2003) introduced mindfulness into the field of psychology, and defined it as paying attention to the current state of mind and body, and paying attention and awareness through a conscious, purposeful and non-judgmental attitude.¹¹ Mindfulness can be both a state and a trait. State mindfulness refers to a state in which an individual presents a state of non-judgmental awareness of the experience of the moment, and it is also the degree to which attention is placed on the moment without judgment at all times.¹² TM refers to the general tendency of individuals to pay attention to and be aware of the moment without judgment. It is a non-habitual judgmental way of thinking.¹³ Moreover, the TM is not a stable personality trait, and will be affected by the innate and acquired environment. Therefore, it can be improved through acquired education and intervention methods. At the same time, TM can bring a series of benefits to people, such as improving individual emotional regulation and mental health.¹⁴

Since the advent of positive psychology, there has been increasing focus on the impact of well-being on individual development. As early as 1984, the famous scholar Diener (1984) defined well-being as an individual's comprehensive assessment of current living conditions according to his own preset standards, and divided happiness into cognitive and emotional levels.¹⁵ The well-being gained from sports mainly refers to people's enjoyment and subjective vitality of sports.¹⁶ Therefore, from the perspective of happiness, only by maintaining the vitality and fun of sports can sports personnel stimulate their potential and finally achieve better results.

However, sports personnel need to face a tense competition environment and bear considerable training pressure during the training process, which poses a huge challenge to the acquisition of happiness.¹⁷ For example, McLoughlin et al learned from interviews with athletes that the long-term accumulated life pressure of athletes often causes them to have bad emotions such as anxiety and depression, which leads to bad mental states and reduces subjective well-being.¹⁸ The basic elements of mindfulness have been shown to play a positive role in improving psychology and well-being. As Vidic et al pointed out, mindfulness can improve and regulate athletes' awareness, enhance self-control, and put them in a state of relaxation and focus on the present, which is beneficial to athletes' training activities and life.¹⁹ Therefore, we can speculate that TM and athletes' well-being are closely related.¹⁷

In summary, we propose the following hypotheses:

Hypothesis 1: TM is significantly positively linked to well-being.

College Students' TM, Flow Experience and Well-Being

Flow is defined as an individual's engrossed concentration in an activity, so that they may ignore the surrounding environment, forget about time, and filter out inappropriate external stimuli.²⁰ Flow experiences are characterized by intense engagement, clear goals and feedback, focus, loss of self-awareness, distortions in perception of time, challenges and skills in balancing, and a feeling of complete control over the activity.²¹ In recent years, people experience flow in a variety of professional and leisure activities. For example, physical activities,^{22,23} gamification teaching,²⁴ and online games,²⁵ etc.

Some flow experts believe that when a person is anxious, it may be difficult to experience the feeling of flow. This is because anxiety creates a negative sense of self in individuals, which disrupts attention.²⁶ Therefore, when an athlete is in a state of anxiety, it may affect their ability to perform. And mindfulness can help athletes deal with negative thoughts and emotions during training and competitions,²⁷ allowing them to fully devote their attention to the activity and function in the best way, and then reach a Peak State, that is, flow experience.²⁸ The research results of Hill et al also show that long-term mindfulness practice will enable individuals to obtain better sport benefits and flow experience.²⁹

Self-determination theory is an important theoretical basis for the study of well-being. This theory shows that the generation of individual happiness comes from some inner needs in human nature, and only when these inner needs are satisfied, people will achieve happiness.³⁰ The flow experience reflects a pleasant state, which has strong internal motivation and can make the internal motivation reach its peak, so that the individual can actively participate in the activity, thereby enhancing the individual's sense of well-being in the activity.³¹ Ilies et al also believe that when individuals feel flow during activities, their basic psychological needs will be satisfied to a large extent, and individuals will feel that activities become more interesting and enjoyable, and their happiness and efficiency will also increase.³² Therefore, according to self-determination theory, when sporters experience flow during sporting, their levels of well-being can be enhanced.

Therefore, we propose the following hypothesis:

Hypothesis 2: Flow experience mediates the relationship between TM and well-being.

Hypothesis 2a: TM is significantly positively associated with flow experience.

Hypothesis 2b: Flow experience is positively linked to well-being.

TM, Sports Participation and Well-Being of College Students

Participating in sports has become an important way to maintain individual physical and mental health. Such as Lee et al noted that fitness is closely related to sports participation.³³ Individual participation in physical activity can not only promote physical health (increase bone density, muscle strength, and reduce the probability of cardiovascular disease), but also have great benefits for individual mental health and social development. Reed and Buck (2009) also pointed out that sports participation can affect individuals' attitudes towards participating in sports activities, enhance individuals' awareness of sports activities, and bring physical, psychological, and emotional pleasure to participants.³⁴ Participating in sport is an important part of the healthy life of college students. Even though most people are aware of the benefits, still very few people consistently participate in physical activity.³⁵

According to the concept of intrinsic motivation in self-determination theory, people participate in an activity not because of external rewards or coercion, but because they have a natural interest in novel and challenging activities, which can fully enjoy the benefits of participation.³⁶ This theory can be used to explain the relationship between mindfulness and intrinsic motivation for individual sports participation. Mindfulness is the skill of focusing on an activity without being influenced by inner reactions and external circumstances. Therefore, it can stimulate the intrinsic motivation of individuals to participate in physical activities and make them devote themselves to the activities for a long time,³⁷ which is very effective in maintaining the long-term sport behavior of college students.

Participating in physical activity not only improves people's health, but also has a significant positive effect on well-being. Brand et al believe that college students who frequently participate in sports activity tend to have higher subjective well-being and life satisfaction.³⁸ Physical activities can also make college students energetic, happy and less prone to

fatigue in life and study. The research of Graupensperger et al also shows that participating in sports can provide individuals with more social support, and can effectively protect and improve people's mental health and well-being.³⁹ Although, some researchers also point out that too much sport is not always beneficial. Individuals vary in the type, duration, and frequency of sport, which may be more useful for people's health.⁴⁰ However, it is undeniable that scholars agree that the impact of sports on well-being is worthy of recognition.

Therefore, we propose the following hypothesis:

Hypothesis 3: Sports participation mediates the relationship between TM and well-being.

Hypothesis 3a: TM is positively and significantly related to sports participation.

Hypothesis 3b: Sports participation is positively linked to well-being.

Flow Experience and Sports Participation

Flow experience is a subjective state that people achieve when they are so fully involved in an activity that they forget about time, fatigue, and everything else except the activity itself.⁴¹ Also, people are usually very focused and happy in a flow state. For athletes, in this state, they feel that they are enjoying rather than exercising hard, and they are eager to repeat this experience again and again, so they will actively participate in physical activity. Increasing the frequency of sport will increase the effectiveness of the training, which in turn will improve performance. Therefore, some researchers regard heart flow as a highly functional state, and heart flow is considered to be the basis for individual sports performance.⁴²

When individuals participate in a challenging task, but they think their skills are sufficient to meet the requirements of the task, there will be a flow experience.²¹ Athletes experience flow after a successful challenge and continue to engage in more difficult skills, thereby increasing participation in the sport. Chang (2017) suggested that those who exercised with higher levels of participation were more likely to experience flow experiences.⁴³ In this way, a virtuous circle is formed to continuously stimulate the potential of athletes and create more excellent sports performance. According to this view, flow can also be used as an intrinsic motivation mechanism, which can increase the frequency of people's participation in sports by enhancing the motivation to practice.^{44,45}

Therefore, We hypothesized that:

Hypothesis 4: Flow experience is significantly positively associated with sports participation.

Hypothesis 5: Flow experience and sports participation sequentially mediated the relationship between TM and well-being.

Theoretical hypothesis see [Figure 1](#).

Methodology

Participants

This study used random sampling method to sample two universities in Shandong Province, China. The time for this survey is from February 23 to March 5, 2023. A total of 496 college students participated in the survey and included in the data analysis. Among them, there were 259 males, accounting for 52.22%, and 237 females, accounting for 47.78%. [Table 1](#) shows the detailed demographic information of the 496 subjects. Questionnaires were distributed on-site via paper questionnaire test. Five hundred and thirty eight questionnaires were distributed in this study. Five hundred and eight questionnaires were returned. The final results excluded the missing questionnaires and recovered 496 valid questionnaires. The effective recovery rate of the questionnaire in the current study was 92.19%. The corresponding author reported to the Research Ethics Committee of his institution for an ethical review in accordance with the Declaration of Helsinki.

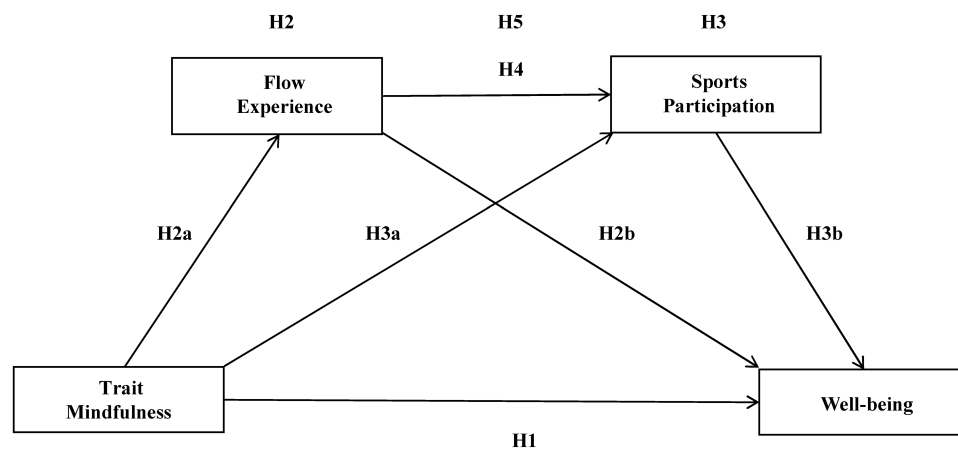


Figure 1 Theoretical hypothesis.

Measures

Mindfulness Attention Awareness Scale

In this study, the Mindfulness Attention Awareness Scale compiled by Brown and Ryan (2003) was used to measure the TM.⁴⁶ The scale contains 39 items, one item is: “I tend to walk quickly to get where I’m going without paying attention to what I experience along the way”. According to the actual situation, choose the description level that best suits you for each item. The scale uses a 6-point Likert scale (1=almost always, 6=almost never). The scale is diffusely used in the research of Chinese population as subjects, and has been proved to be a good measurement tool by many studies.⁴⁷ The Cronbach’s α value of this scale was 0.961. The Cronbach’s α values of the subdimensions of the scale were 0.904, 0.888, 0.918, 0.877, and 0.902, respectively.

Flow Experience Scale

The flow experience scale used the scale compiled by Jackson et al according to the flow model of Nakamura and Csikszentmihalyi (2014).^{48,49} There are 36 items on this scale, covering nine dimensions, namely challenge-skill balance, action-awareness merging, clear goals, sense of control, unambiguous feedback, and concentration on the task at hand, time transformation, loss of self-consciousness, and autotelic experience. One item read: “I often feel like time flies”. A five-point Likert scale was used (1=strongly disagree, 5=strongly agree). The scale has been shown to have fine reliability and validity in previous studies.⁵⁰ The Cronbach’s α value of this scale was 0.973. The Cronbach’s α of the subdimensions of the scale were 0.893, 0.895, 0.905, 0.876, 0.900, 0.865, 0.889, 0.897, and 0.886, respectively.

Table 1 Demographic Information of the Sample (N = 496)

Variables		Percentages
Gender	Male	52.22%
	Female	47.78%
Age	18 years old	2.02%
	19 years old	15.73%
	20 years old	15.52%
	21 years old	37.10%
	22 years old	11.90%
	23 years old	13.91%
	24 years old	3.83%
Grade	College freshman	28.43%
	College sophomore	27.02%
	Third year college	28.63%
	Senior year of college	15.93%

Physical Activity Rating Scale

The Physical activity rating scale compiled by Liang (1994) was used to investigate the physical exercise of college students.⁵¹ The scale contains three items, namely exercise intensity, exercise frequency and exercise time. (1) Exercise intensity, the item is: what do you think of the intensity of physical activity you take part in. As the actual situation, choose “hardly get a fever every time you exercise, slight fever every time you exercise, a little sweat every time you exercise, more sweat every time you exercise, and sweat every time you exercise”; (2) exercise frequency, the item is: how often do you participate in physical activity every week. According to the actual situation, choose “1 time and below/week, 2–3 times/week, 4 times/week, 5 times/week, 6 times and above/week”; (3) exercise time, the project is: how long have you been participated in physical activity. Select “Less than 20 min, 21–30 min, 31–40 min, 41–50 min, 51 min or more”, according to the actual situation. Scores are assessed using a 5-point Likert scale. Physical exercise score = exercise intensity score \times (exercise time score – 1) \times exercise frequency score, and the score range is 0–100 points. The Cronbach’s α value of this scale was 0.817.

Subjective Well-Being Scale

The subjective well-being scale used in this study is the subjective well-being scale compiled by Diener (1984),¹⁵ with a total of 5 questions. The scale has nice applicability in Chinese research.^{47,52} In order to make the scale better measure the happiness of the subjects in sports, we added expressions related to sports in the original scale items. One item is, “I am satisfied with my motor activity”. We performed a confirmatory factor analysis on the scale and the results showed that the model fit of the scale was perfect (ML $\chi^2 = 7.336$, $df = 5$, $\chi^2/df = 1.467$, CFI = 0.997, TFI = 0.994, RMSEA = 0.031, SRMR = 0.014). All items had standardized factor loadings > 0.60 . This scale uses a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree). The Cronbach’s α value for this scale in this study was 0.815.

Statistical Analysis

Data were analyzed using SPSS 22.0, and Mplus 8.3. First, data entry, descriptive statistics and correlational analyses were performed for all variables using SPSS 22.0.

Second, the mediating role was tested using Mplus 8.3. All tests were conducted using the bootstrap method with 95% confidence intervals, a bootstrap sample size of 5000, and a significance level of 0.05. The gender, age and grade of college students were considered as control variables in the current study. We virtualized the gender variable (0 = male, 1 = female).

Results

Common Method Bias Test

Since the data comes from a single report, in order to avoid the problem of method bias, we first conducted a common method bias test. Harman single factor test was adopted in this study, through the test we found there are 15 factors whose eigenvalues are greater than one. The first factor pair variation is only 28.01%, which is less than 40%.⁵³ So there was no serious common method bias problem in the current research.

Descriptive Statistical Analysis

The correlation analysis was carried out on the scores of all dimensions of TM, all dimensions of flow experience, sports participation, and well-being. The statistical results demonstrated that all dimensions of TM were significantly positively related to all dimensions of flow experience, sports participation, and well-being. All dimensions of flow experience were significantly positively associated with sports participation and well-being. All dimensions of sports participation and well-being were also significantly and positively correlated (Table 2).

Structural Equation Model Index Test

We used Mplus to test the goodness of fit of the structural equation model. The fitting index of the model was ML $\chi^2 = 416.905$, $df = 260$, $\chi^2/df = 1.603$, CFI = 0.975, TFI = 0.971, RMSEA = 0.035, SRMR = 0.036. All indicators of the structural equation model are acceptable, which shows that the model we constructed is good (Table 3).

Table 2 Means, Standard Deviations, and Correlations of the Major Study Variables

Variable	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1. Gender	0.480	0.500	I																		
2. Age	20.980	1.411	-0.122**	I																	
3. Grade	2.320	1.052	-0.142**	0.817**	I																
4. Observe	3.246	0.841	0.092*	-0.014	0.016	I															
5. Describe	3.464	0.741	-0.018	-0.041	-0.012	0.592**	I														
6. ActAware	3.470	0.890	0.073	-0.004	-0.011	0.594**	0.612**	I													
7. NonJudge	3.292	0.724	0.007	-0.056	-0.002	0.646**	0.616**	0.503**	I												
8. NonReact	3.459	0.853	0.084	0.019	0.034	0.588**	0.595**	0.738**	0.562**	I											
9. CSB	3.476	0.956	0.065	0.037	0.045	0.176**	0.248**	0.144**	0.159**	0.166**	I										
10. AAM	3.405	0.969	0.032	0.094*	0.088*	0.169**	0.214**	0.107*	0.179**	0.169**	0.652**	I									
11. CG	3.464	0.978	0.073	-0.006	-0.019	0.148**	0.225**	0.129**	0.183**	0.164**	0.653**	0.638**	I								
12. UFB	3.214	0.964	0.043	0.031	0.046	0.311**	0.398**	0.274**	0.341**	0.299**	0.671**	0.633**	0.678**	I							
13. COTTAH	3.437	0.958	0.053	0.06	0.059	0.214**	0.299**	0.218**	0.250**	0.216**	0.597**	0.628**	0.650**	0.704**	I						
14. SOC	3.648	0.884	0.097*	0.060	0.060	0.152**	0.204**	0.167**	0.143**	0.177**	0.603**	0.569**	0.652**	0.638**	0.608**	I					
15. LOS	3.356	0.992	0.067	0.033	0.031	0.220**	0.303**	0.201**	0.229**	0.239**	0.669**	0.655**	0.678**	0.722**	0.674**	0.629**	I				
16. TT	3.453	0.908	0.039	0.042	0.037	0.188**	0.276**	0.174**	0.256**	0.228**	0.673**	0.633**	0.712**	0.742**	0.702**	0.654**	0.741**	I			
17. AE	3.598	0.912	0.067	0.039	0.017	0.154**	0.246**	0.122**	0.144**	0.162**	0.593**	0.592**	0.614**	0.629**	0.624**	0.521**	0.626**	0.599**	I		
18. SP	32.559	22.189	0.135**	-0.055	-0.085	0.194**	0.179**	0.168**	0.187**	0.140**	0.218**	0.191**	0.208**	0.190**	0.259**	0.227**	0.229**	0.226**	0.244**	I	
19. WB	4.045	0.916	0.331**	-0.033	-0.068	0.213**	0.200**	0.261**	0.192**	0.243**	0.213**	0.145**	0.228**	0.202**	0.248**	0.184**	0.205**	0.207**	0.191**	0.411**	I

Notes: ** $p < 0.01$, * $p < 0.05$. Gender is the dummy variable (0 = male, 1 = female).

Abbreviations: CSB, Challenge-Skill Balance; AAM, Action-Awareness Merging; CG, Clear Goals; UFB, Unambiguous Feed-Back; COTTAH, Concentration on The Task at Hand; SOC, Sense of Control; LOS, Loss of Self-consciousness; TT, Time Transformation; AE, Autotelic Experience; SP, Sports Participation; WB, Well-being.

Table 3 Model Fit Information of the Structural Equation Modeling

Fit indices	Recommended Threshold	Scores	Remarks
ML χ^2	–	416.905	–
Df	–	260	–
χ^2/df	$1 < \chi^2/df < 3$	1.603	Acceptable
CFI	> 0.9	0.975	Acceptable
TLI	> 0.9	0.971	Acceptable
RMSEA	< 0.08	0.035	Acceptable
SRMR	< 0.08	0.036	Acceptable

Abbreviations: CFI, Comparative fit index; TLI, Tucker Lewis index; RMSEA, Root mean squared error of approximation; SRMR, Standardised root mean squared residual.

Test of Mediation Effect

We used Mplus to test the mediation model. The results reveal that the path coefficients of TM, flow experience, sports participation and well-being are all significant.

TM is positively related to well-being ($\beta = 0.204$, $p < 0.001$), supporting our hypothesis 1. TM is positively related to flow experience ($\beta = 0.337$, $p < 0.001$), supporting our hypothesis 2a. Flow experience is positively related to well-being ($\beta = 0.125$, $p = 0.010$), supporting our hypothesis 2b. TM is positively related to sports participation ($\beta = 0.135$, $p = 0.006$), supporting our hypothesis 3a. Sports participation is positively related to well-being ($\beta = 0.297$, $p < 0.001$), supporting our hypothesis 3b. Flow experience is positively related to sports participation ($\beta = 0.162$, $p = 0.004$), supporting our hypothesis 4. See Table 4.

The indirect pathways of the structural equation modeling are shown in Table 5. Flow experience mediates the relationship between TM and well-being ($\beta = 0.052$, $p = 0.024$), and the 95% CI for the path coefficient is 0.014 to 0.108. The interval does not include 0, which indicates that research hypothesis 2 is supported. The mediating effect accounted for 13.83%.

Table 4 The Direct Effect of the Research Paths and Research Model Hypothesis Analysis

DV	IV	Std.Est.	S.E.	Est./S.E.	P-value	R ²	Hypo and Path	Remarks
WB	TM	0.204	0.053	3.844	***	***	H1: TM → WB	Support
	FE	0.125	0.049	2.560	0.010		H2b: FE → WB	Support
	SP	0.297	0.049	6.060	***		H3b: SP → WB	Support
FE	TM	0.337	0.050	6.740	***	***	H2a: TM → FE	Support
SP	TM	0.135	0.049	2.736	0.006	0.007	H3a: TM → SP	Support
	FE	0.162	0.057	2.866	0.004		H4: FE → SP	Support

Note: *** $p < 0.001$.

Abbreviations: WB, Well-being; TM, Trait mindfulness; FE, Flow Experience; SP, Sports Participation.

Table 5 The Indirect Effect of the Research Paths

Path	Std.Est.	S.E.	Est./S.E.	P-value	Boot LLCI	Boot ULCI	The Proportion of the Effect
H2: TM → FE → WB	0.052	0.023	2.255	0.024	0.014	0.108	13.83%
H3: TM → SP → WB	0.050	0.021	2.348	0.019	0.015	0.098	13.30%
H5: TM → FE → SP → WB	0.020	0.010	2.117	0.034	0.006	0.045	5.32%
TOTALIND	0.122	0.038	3.202	0.001	0.057	0.210	32.45%
TOTAL	0.376	0.075	5.020	***	0.232	0.530	100.00%

Note: *** $p < 0.001$.

Abbreviations: TM, Trait mindfulness; FE, Flow Experience; WB, Well-being; SP, Sports Participation.

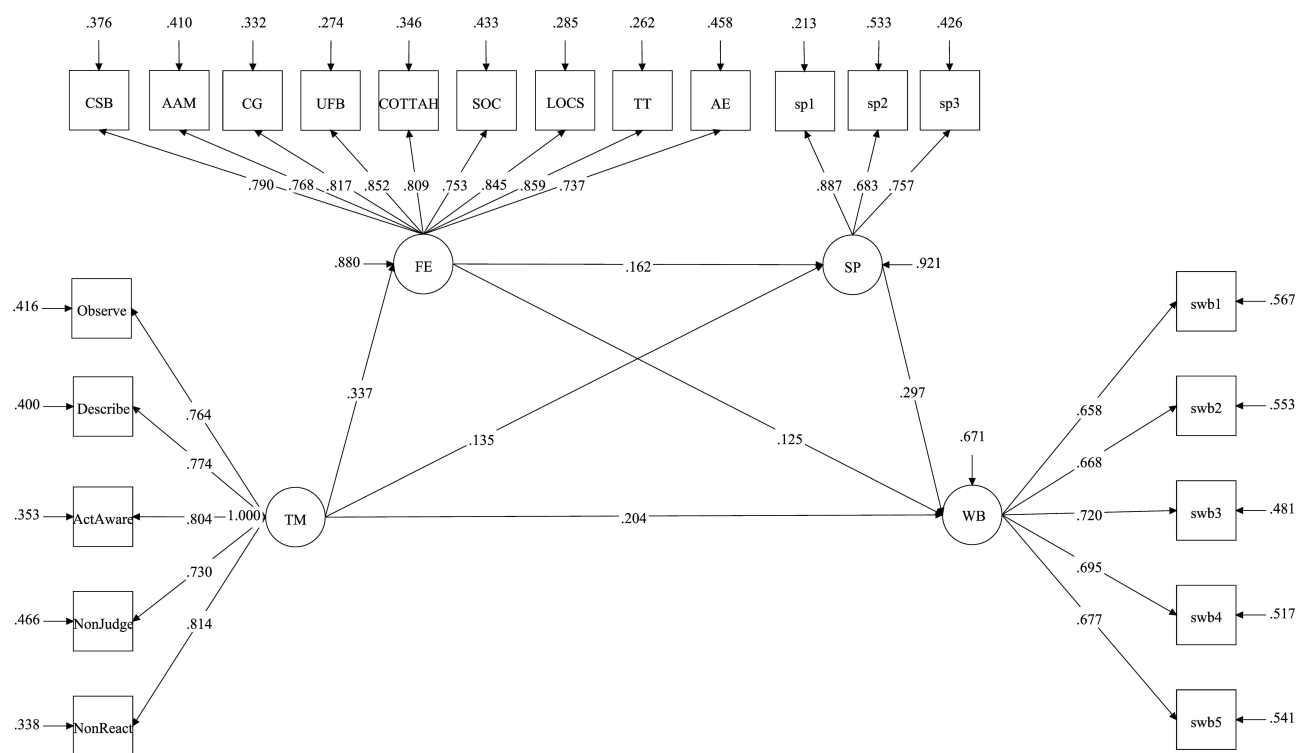


Figure 2 Structural equation model.

Abbreviations: TM, Trait mindfulness; FE, Flow Experience; LE, Learning Engagement; PI, Professional Identity; CSB, Challenge-Skill Balance; AAM, Action-Awareness Merging; CG, Clear Goals; UFB, Unambiguous Feed-Back; COTTAH, Concentration on The Task at Hand; SOC, Sense of Control; LOS, Loss of Self-consciousness; TT, Time Transformation; AE, Autotelic Experience; SP, Sports Participation; WB, Well-being.

Sports participation mediates the relationship between TM and well-being ($\beta = 0.050$, $p = 0.019$), and the 95% CI for the path coefficient is 0.015 to 0.098. The interval does not include 0, which indicates that research hypothesis 3 is supported. The mediating effect accounted for 13.30%.

Flow experience and sports participation sequentially mediate the relationship between TM and well-being ($\beta = 0.020$, $p = 0.034$), and the 95% CI for the path coefficient is 0.006 to 0.045. The interval does not include 0, which indicates that research hypothesis 5 is supported. The mediating effect accounted for 5.32%. See Figure 2.

Discussion

According to the research results, we found that the TM of college students can significantly positively affect the well-being. It is in line with the previous study hypothesis and consistent with the study conclusions of previous researchers. For example, Foster and Chow (2020) mention that mindfulness is a significant predictor of student-athlete well-being.¹⁷ Among them, the sustained attention factor of mindfulness is the key to the well-being of student-athletes. Mindfulness is a mental pattern characterized by paying attention to the experience of the present moment and being aware of each moment-to-moment experience without judgment.¹¹ According to principles of cognitive neuroscience, focusing attention on the task at hand prevents distraction and enhances motor performance and emotional cost.⁵⁴ Therefore, mindfulness training plays an important role in maintaining the sports health of college students.

The research shows that flow experience mediates the relationship between TM and well-being, the mediation effect value is 13.83%. That means TM can affect college students' well-being by flow experience. Empirical evidence on the mechanisms of attentional control and emotion demonstrates that mindfulness has neural effects associated with psychological effects.⁵⁵ And attention and emotional control, both of which are the basic conditions for generating flow. As a result, mindfulness training has been popularized as a means of helping athletes achieve a state of flow.⁵⁶ Activities are fully enjoyed during flow states, where positive mental states are displayed, which increases athletic performance and well-being in athletes.⁵⁷

Simultaneously, we found that sports participation mediates the relationship between TM and well-being, and the mediation effect value is 13.30%. That means TM can improve college students' well-being through sports participation. Mindfulness has significant effects and potential value in sports competitions. It can enhance attentional control to affect the spontaneous wandering of the mind and its neural basis, and promote sporters to maintain stable emotions and high self-focus ability, thereby improving sports performance and participation.⁵⁸ Higher levels of mindfulness lead to higher sport participation.⁵⁹ Frequent physical participation has a significant contribution to positive health outcomes and well-being.⁶⁰ Therefore, college students with high levels of mindfulness tend to have higher participation in sport, and long-term and frequent sport participation can promote college students' physical and mental health and enhance their sense of well-being.

Last but not least, we found that flow experience and sports participation play sequential mediating roles in TM and well-being. The mediation effect value is 5.32%. Individuals in the flow state can fully enjoy the fun of activities and have a positive impact on the motivation to participate in sports, which increases the possibility of athletes participating in sports again.⁶¹ The level of sports participation is positively correlated with an individual's perceived health status.⁶² This is because regular participation in physical activity can provide pleasure, release stress, improve physical health, and reduce anxiety. Therefore, with the further effects of flow experience and sports participation, college students can obtain more sufficient well-being during sport.

Theoretical Implications

The current research has enriched the theory of well-being, especially made an important contribution to the extended theory of positive emotions. Fredrickson (1998) positive emotion expansion theory believes that an individual's positive emotional experience can not only expand the individual's thinking and cognitive ability and behavioral operating system when experiencing positive emotions, but develop the physical and cognitive resources of the individual.¹⁰ More importantly, it can further change the individual's original attention, cognition, and action patterns, improving the original thinking-action pattern to a new level, thereby obtaining a more positive emotional experience. However, this theory regards the individual's thinking and cognitive ability and behavioral tendency as a single parallel influencing factor, and the theory has not yet used empirical research to prove the sequential mediation effect of thinking and cognitive function and behavioral tendency. This study examines the mechanism by which individuals gain positive emotional experiences during sports by empirical research. The current research found that the positive emotional experience of sports pleasure and flow experience obtained by college students in sport affects the behavioral tendency of sports participation through related thinking activities and cognitive functions. The results of this study provide a new literature reference for expanding the theory of positive emotion expansion and well-being.

Practical Contributions

This study also has practical Contributions to the acquisition of college students' well-being. First, college students' well-being can be enhanced through active mindfulness training. Therefore, schools can organize students to participate in some mindfulness training to improve the level of mindfulness of college students, such as body scanning and mindful walking, which use inner attention to body perception to improve the level of mindfulness of individuals. Secondly, flow experience is an emotional experience, which will prompt college students to have positive emotions and lead to an increase in well-being. Teachers can improve the teaching effect and quality of physical education by creating a good teaching environment to promote learners' flow experience in sports. Finally, sports participation also has a positive impact on well-being. Teachers should encourage college students to participate in the sports they love, formulate sports plans, and through long-term sports, college students can obtain physical and mental happiness and satisfaction, and then sublimate to the sense of happiness of participating in sports activities.

Limitations

First of all, this study is a horizontal study. Although the theory and other researchers' viewpoints are used in the study to explain and infer the relationship between variables, the horizontal study cannot reflect the long-term impact of each variable well. Because they often only reflect the correlation between variables rather than causality. Therefore, future

research can be further explored with longitudinal studies. Secondly, this study only discusses the well-being of college students. In the future, under the guidance of positive psychology theory, we should further explore the mechanism of mindfulness and well-being in different social groups, so as to provide a reference for expanding the research on mindfulness and well-being. Finally, there are many factors that affect well-being in sports. This article only examines the influencing factors at the psychological and behavioral levels, and the impact of other factors on well-being remains to be explored.

Conclusion

The results of this study suggest that TM is positively associated with well-being. TM can affect well-being through flow experience. TM also affects well-being by sports participation. Meanwhile, this study also demonstrated that flow experience and sports participation play a sequential mediating role between college students' TM and well-being. The current research results indicate that college students get well-being in sport. Trait mindfulness influences the behavioral tendency of sports participation through the mediation of thinking activities and cognitive function sequences. The results of this study provide a new literature reference for expanding the theory of positive emotion expansion and well-being. In addition, this study also provides an important basis for improving the well-being of college students and the management practice of colleges and universities.

Ethics Approval

The studies involving human participants were reviewed and approved by the Research Ethics Committee of the Shandong Management University (No. 23020701). Written informed consent to participate in this study was provided by the participants.

Disclosure

The author reports no conflicts of interest in this work.

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