

RESEARCH ARTICLE

The impact of fluency in college students' leisure sports on happiness: The moderating role of leisure satisfaction

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ABSTRACT

Background: As a key way to promote the physical and mental health of college students, the relationship between leisure sports and happiness has become the focus of social attention.

Purpose: The aim of this study is to analyze the influence of college students' fluency in leisure sports activities on their happiness, and explore the moderating effect of leisure satisfaction.

Results: The questionnaire survey method was adopted to select 589 college students by stratified sampling. The data were collected using the fluency scale, happiness scale and leisure satisfaction scale of leisure sports activities, and statistical analysis was conducted by SPSS software. The results show that fluency positively predicted happiness ($\beta=.510$, $p<.001$). Furthermore, leisure satisfaction significantly moderates this relationship, with higher leisure satisfaction amplifying the positive effect of fluency on happiness ($\Delta R^2=.117$, $p<.01$).

Conclusion: The findings highlight the importance of fostering fluency states in leisure sports to enhance college students' happiness, particularly when coupled with high leisure satisfaction. Universities and sports organizers should create a positive sports culture atmosphere and build a social psychological environment supporting college students to participate in sports activities, so as to help college students gain a sense of fluency in leisure sports activities, improve their happiness, and promote their physical and mental health. Theoretical and practical implications are discussed.

Keywords: college students; leisure sports activities; fluency; leisure satisfaction; happiness

1. Introduction

With the rapid development of society, the mental health problems of college students become more and more prominent (Limone & Toto, 2022) ^[1]. According to the data of the World Health Organization, the incidence of mental diseases such as depression and anxiety among college students is on the rise globally. Meanwhile, the positive impact of leisure sports activities on mental health is gradually recognized (Kim et al., 2021) ^[2]. Rechter and Sverdlik (2016) ^[3] think leisure sports play an important role in the psychological and social development of college students. For many students, leisure is related to their interest in sports or

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other forms of physical activity (Spracklen, 2014)^[4]. Some scholars believe that sporting activities have many potential benefits for young people in terms of developing their physical skills, shaping their character, cultivating their life skills, encouraging sportsmanship, improving their teamwork ability and preparing them for adult life (Goldstein & Iso-Ahola, 2006^[5]; Leech & Marston, 2016^[6]; Scrabis-Fletcher et al., 2016^[7]).

University education plays an important role in students' personal life, and the behavioral pattern they acquire during this period will last for many years (Tomlinson, & Jackson, 2021)^[8]. However, attention needs to be paid to the physical aspect of college students and the harmony of their physical and mental health (Pat-Horenczyk et al., 2021^[9]; Pišot et al., 2014^[10]). Most of the existing research on college students' leisure sports activities is based on lifestyle and leisure education rather than the relationship between leisure satisfaction, happiness and leisure sports activities (Bae, 2022)^[11]. Leisure sports are very important to promote cultural and economic development, improve work efficiency, and support educational and academic efficacy (Brajssa et al., 2011)^[12]. The activities can also deliver physical, emotional and social satisfaction (Joseph et al., 2014)^[13]. Werneck et al. (2021)^[14] believes that different organizations and social aspects of leisure sports activities, such as individuals, small groups, and even large teams, have different levels of social interaction. This study defines leisure sports activities as the sports activities that college students voluntarily choose to participate in during their spare time to seek physical and mental relaxation, improve health and enrich life, mainly including low-intensity and easy-to-carry projects such as running, walking, basketball, badminton, aerobics and yoga.

As a special group of the society, college students are facing the pressure of study, social and other aspects, leisure sports activities provide them with a way to relax their body and mind, which occupies an important position in their daily life (Kišjuhas, 2024)^[15]. Tuggle et al. (2016)^[16] believed that supportive communication in close peer relationship had an impact on teenagers' satisfaction in leisure sports activities. This study aims to investigate the role of fluency—a state of complete immersion and enjoyment during an activity—as a key factor linking leisure sports to happiness, while also examining how leisure satisfaction moderates this relationship. Therefore, it is of vital importance to explore the relationship and influence among college students' fluency, leisure satisfaction and happiness in leisure sports activities. On the one hand, it can enrich the knowledge system in the intersection of leisure sports and positive psychology; On the other hand, clarifying the intrinsic connection among the three can provide empirical evidence for colleges and universities to design leisure sports programs that better meet the needs of students and formulate mental health promotion plans, thereby helping to enhance the sense of happiness and quality of life of college students.

2. Literature review

2.1. Fluency, leisure satisfaction and happiness

The sense of fluency was initially proposed and gradually refined by the renowned American psychologist Csikszentmihalyi in the 1980s. Later, Jackson(1996)^[17] applied it to sports activities. Fluency, as defined by psychologist Csikszentmihalyi (2014)^[18], is the state in which an individual engages in an activity, feels time flies, and is highly satisfied. The sense of fluency is a smooth experience in college students' leisure sports activities (Wang et al., 2024)^[19]. According to Codina et al. (2020)^[20], full concentration is needed for a flow experience and people will probably like any activity if they are fully focused on it. Arashi et al. (2025)^[21] suggests that it is very important to promote a fluid physical education experience for students because it can help to improve the fun in physical education, and stimulate students to participate in sporting activities voluntarily in adolescence and in later life. Im and Varma (2018)^[22] define fluency as a state of putting your heart into your work. If the sense of fluency disappears from a

person's life, the meaning of life becomes almost non-existent. Fluency strongly affects a person's subjective happiness, and it contributes to the emergence of a happy mood and life satisfaction.

Leisure Satisfaction is an individual's sense of comfort, happiness or quality of life (Carr et al., 2020)^[23], De Vos (2019)^[24] defines leisure satisfaction as the positive feeling that individuals obtain when participating in leisure activities that meet their needs. The most direct way to study the orientation of leisure is to measure the kinds of feelings and connotations people experience in leisure situations. Newman et al. (2014)^[25] observe that a sense of freedom, control, creativity and success can be attained by participating in satisfying leisure activities. According to Mutz et al. (2021)^[26], leisure satisfaction has a significant impact on college students' perception of life satisfaction. It also has a positive effect on improving individuals' quality of life and invoking positive emotions (Siegenthaler & O'Dell, 2000)^[27], this shows that leisure activities can bring different satisfaction, and the level of leisure life satisfaction is related to the quality of people's life (Mutz et al., 2021)^[26]. In terms of the measurement of leisure satisfaction, most studies usually refer to the six dimensions developed by Beard and Ragheb (1980)^[28] as the measurement standard. The six dimensions have a certain impact on improving or reducing the quality of life. Therefore, through the study of leisure satisfaction, the positive feeling and satisfaction degree of participants participating in leisure can be known.

Happiness is the result of the current balance between positive and negative emotions (Bailey & Fernando, 2012)^[29]. When individuals experience less negative emotion and more positive emotion, they are happy. This involves an overall evaluation of their quality of life based on their own standards (Bartels et al., 2013)^[30]. Briki (2018)^[31] believes that happiness is a general evaluation composed of happiness, life satisfaction and positive emotions and feelings. It consists of a subjective feeling made up of highly positive emotions whole life satisfaction. Shmotkin (2005)^[32] called happiness a kind of subjective happiness, which is characterized by a large number of positive feelings, a small number of negative feelings, and the improvement of life satisfaction. The definition of happiness belongs to a psychological concept of which different scholars have a different understanding (Zhuravlev & Yurevich, 2014)^[33]. In real life, happiness is a complex and changeable psychological subject for researchers due to the differences of individuals caused by the external environment and their life needs (Badri et al., 2022)^[34]. Cultural knowledge, social responsibility, emotional experience and a myriad of other internal psychological factors interact to form a complex phenomenon. Therefore, happiness is understanding and feeling (Bojanowska et al., 2016)^[35].

2.2. The relationship between fluency, leisure satisfaction and happiness

Many scholars have studied the relationship between fluency and leisure satisfaction. Zheng (2019)^[36] found that fluency is closely related to leisure satisfaction. Liu et al. (2022)^[37] studied the experience of participants in community jogging activities. Through long-term follow-up survey, he found that when participants achieved a smooth state of steady pace and rhythm, even breathing, complete inner immersion and forget external interference during jogging, their satisfaction with this jogging activity was greatly improved. This sense of fluency was not only derived from the comfort brought by physical exercise, but also from the comfort brought by physical exercise. It also includes increased psychological self-efficacy. Chen et al. (2010)^[38] studied players who experienced a sense of fluency in a game, and their leisure satisfaction with their performance in the game also increased significantly. Through questionnaire survey and interview, Choi and Park (2021)^[39] found that the fluency experience in leisure sports activities has a great impact on their overall evaluation of leisure sports activities. For example, when participating in some challenging projects such as rock climbing and marathon, the fluency experience gained by participants in the process of overcoming difficulties and constantly breaking through themselves will positively affect their leisure satisfaction in leisure sports activities. Encourage them to participate in such activities more

frequently and form long-term recreational sports habits (Pombo et al., 2024)^[40]. Accordingly, the following hypothesis is proposed.

Hypothesis 1: There is a significant positive correlation between fluency and leisure satisfaction.

In the study of the relationship between leisure satisfaction and happiness, it is found that leisure satisfaction is one of the important factors to measure happiness. Mutz et al. (2021)^[26] proposed that participants can obtain a deep sense of satisfaction during leisure sports activities, and when the sense of satisfaction accumulates, the happiness of participants will be significantly improved. According to Pavković et al. (2021)^[41], the degree of participation in leisure activities affects leisure satisfaction, and leisure satisfaction will, in turn, affect subjective **happiness**. Walker et al. (2017)^[42] believe that satisfaction is related to subjective happiness and it was found in the study of Yoo (2022)^[43] that people's active participation in leisure activities makes a certain contribution to their leisure satisfaction and happiness. On this basis, the following hypothesis is proposed.

Hypothesis 2: There is a significant positive correlation between leisure satisfaction and happiness.

Several studies have found a relationship between fluency and happiness. Kaya (2016)^[44] found that the more flow experience in leisure activities, the higher was the degree of physical and mental health. Therefore, the flow experience has been proved to have a good predictive effect on the development of college students' physical and mental health. Collins et al. (2009)^[45] found that there is a significant positive correlation between fluency and life leisure satisfaction, and that fluency and subjective **happiness** can predict each other. According to Duan et al. (2022)^[46], as a positive emotional experience, fluency is an important driving force for individuals to participate in sports, and the pleasant flow experience of college students has a positive correlation with their persistent engagement in sports. The above research findings indicate that many scholars have studied the relationship between the flow experience and happiness, and most of their subjects were college students (Acosta-González & Oscar, 2021)^[47]. Accordingly, the following hypothesis is proposed.

Hypothesis 3: There is a significant positive correlation between fluency and happiness.

Although there are many studies on fluency, leisure satisfaction and happiness, most of them are conducted in non-college or non-leisure sports contexts. The unique characteristics of college students' leisure sports have not been explored, and there are few studies on the moderating effects of fluency and happiness in the context of college students' leisure sports. Few studies have integrated these three structures into a comprehensive model to understand the complex interactions among them. This study particularly focuses on the leisure sports of college students and investigates leisure satisfaction as a moderating factor, aiming to reveal how different levels of leisure satisfaction enhance or weaken the impact of flow experience on happiness. The model shown in **Figure 1** is adopted in this study to illustrate the mechanism of fluency's effect on happiness. Fluency may affect college students' leisure satisfaction and happiness in that the leisure satisfaction college students feel when they are participating in leisure sports activities may play a mediating role in the impact of fluency on happiness. Demographic factors and leisure sports activities-related variables are set as background variables, fluency is the independent variable, happiness is set as the dependent variable, and leisure satisfaction is set as a mediator between the independent variable and the dependent variables. On this basis, the following hypothesis is proposed.

Hypothesis 4: Leisure satisfaction plays a moderating role in fluency and happiness.

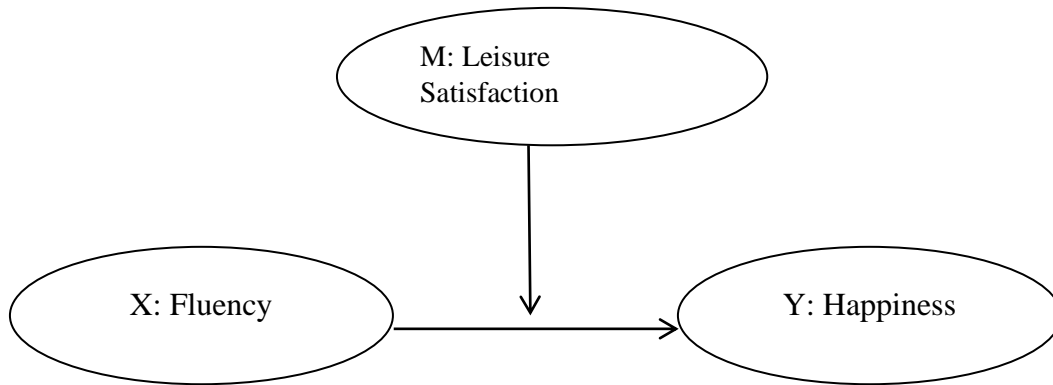


Figure 1. Conceptual framework.

3. Method

3.1. Participants

This cross-sectional study was conducted at several universities in China from October 2024 to December 2024. Participants were recruited by using the method of convenient sampling. Inclusion criteria: (1) The subjects must be college students. (2) Participants are required to have the experience of participating in leisure sports activities within a certain period of time (such as the last six months). (3) Students majoring in sports are excluded. (4) Students who are undergoing treatment and have serious physical diseases (such as heart disease, severe sports injuries, etc.) or mental diseases (such as depression, etc.) are excluded. This study was approved by the Ethics Committee of Ningbo University.

3.2. Data collection

This study distributed questionnaires through the Wenjuanxing platform (Zhao & Wei, 2017) ^[48]. To further ensure the quality of the questionnaire survey, this study excluded some inappropriate questionnaires (for example, questionnaires with the same answers to all questions, and the completion time of the questionnaire was less than 100 seconds or more than 1000 seconds). All participants participated voluntarily and were informed that this research was for academic purposes and that they would not receive any form of compensation. A total of 632 questionnaires were completed online with prior informed consent, of which 589 were valid, with a valid questionnaire rate of 93.2%. As can be seen from **Table 1**, 273 of the respondents were boys and 316 were girls. There were 196 freshmen, 187 were sophomores, and 92 were juniors and 114 were seniors. There were 115 of them who majored in science, 142 in engineering, 190 in liberal arts and 142 in sports and the arts. There were 91 of them who lived in big cities, 203 in small and medium-sized ones, 159 in small towns and 136 in rural areas. There were 32 of them had monthly living expenses of less than 1000 yuan, the monthly living expenses of 416 of them were between 1001 and 2000 yuan, 116 of them had monthly living expenses of between 2001 and 3000 yuan, and 25 of them spent more than 3001 yuan on living expenses every month.

Table 1. Demographic analysis.

Items	option	N	%
Gender	man	273	46.3
	woman	316	53.7
Grade	freshman	196	33.3
	sophomore	187	31.7
	junior	92	15.6

Items	option	N	%
Major	senior	114	19.4
	Science	115	19.5
	Engineering course	142	24.1
	liberal arts	190	32.3
Family	Sports and Arts	142	24.1
	metropolis	91	15.4
	small-medium cities	203	34.5
	town	159	27.0
Alimony	rural area	136	23.1
	Less than RMB 1,000	32	5.4
	RMB 1001-2000	416	70.6
	RMB 2001-RMB 3,000	116	19.7
Activity projects	RMB 3,001 or above	25	4.2
	running	56	9.5
	Walk	115	19.5
	basketball	69	11.7
	volleyball	41	7.0
	badminton	98	16.6
	aerobic	53	9.0
	yoga	81	13.8
	swimming	46	7.8
	other	30	5.1

Table 1. (Continued)

3.3. Measures tooles

3.3.1. Fluency, scale

In this study, the Flow State Scale (FSS) compiled by Jackson (1996)^[17] was adopted to measure the immersion experience and psychological involvement of college students in leisure sports activities. The scale has only one dimension and a total of 4 items. The scale uses a 5-point Likert scale (1= completely disagree, 5= completely agree), with a score range of 1-5 points for each item and a total score range of 4-20 points. Exploratory factor analysis results show that 74.853% variance can be explained, and the A-value of the scale in this study is.884.

3.3.2. Leisure satisfaction scale

In this study, the Leisure Satisfaction Scale (LSS) developed by Beard and Ragheb (1980)^[28] was adopted to evaluate the leisure experience quality of college students' leisure sports activities. The scale is a classic measurement tool in the field of leisure research. It consists of 24 items and comprehensively measures six core dimensions of leisure activities: psychological satisfaction, educational satisfaction, social satisfaction, relaxation satisfaction, physical satisfaction and aesthetic satisfaction. The scale used a 5-point Likert scale (1= strongly disagree, 5= strongly agree), with a score range of 1-5 points for each item and a total score range of 6-30 points. In this study, cultural adaptability adjustment was made to the scale,

including the localization of language transformation and the supplement of situational examples, and the measurement validity of the scale in the context of this study was ensured through expert review and pretest, and the internal consistency reliability was .800 and the value of the scale in this study was .975.

3.3.3. Happiness scale

This study adopts the Satisfaction With Life Scale (SWLS) compiled by Diener et al. (1985)^[49], which is a classic tool for measuring subjective happiness. It has been widely validated in cross-cultural studies to have good psychometric properties (reliability coefficient is usually between .790-.890, retest reliability is .820) and structural validity (Emerson et al., 2017)^[51]. Specifically, the college student happiness scale contains four dimensions: Overall subjective happiness (5 items), life satisfaction (5 items), positive emotion (6 items) and negative emotion (8 items). Each item is a 7-point Likert scale, with 1 being very unhappy or strongly opposed and 7 being very happy or very supportive. The higher the cumulative score of the whole scale, the higher the subjective happiness. The A-value of this scale was .872.

3.4. Statistical analysis

In investigation-based research, there is always the possibility of bias. As this study collected data using a survey-based approach, non-response bias was tested by comparing early and late responses, as suggested by Af Wählberg and Poom (2015)^[51]. *t*-test showed no statistically significant difference between early and late responses, suggesting that non-response bias was not a problem in this study.

In this study, a validated maturity scale was used (Sun et al., 2013)^[52], and the questionnaire expression was optimized and adjusted after the pre-test to improve the validity of the measurement tool. Harman single factor method was used for common method bias test. The cumulative explanatory variance of the first factor extracted without rotating EFA was 32.5%, which was lower than the 40% threshold proposed by Howard et al. (2024)^[53], indicating that there was no serious common method variation problem. The data collected were analyzed using IBM SPSS Statistics 26.0 in this study. Furthermore, we used AMOS 21.0 to compare the fitting of the single-factor model with the research model. Generally speaking, if CFI \geq .900, TLI \geq .900, and RMSEA \leq .080, it indicates that the fitting degree of the model is acceptable (Jiang et al., 2023)^[54]. According to the test results of the confirmatory factor analysis fitting index, the fitting degree of the entire model meets the requirements (**Table 2**).

Table 2. The results of confirmatory factor analysis.

Items	χ^2	df	<i>p</i>	CFI	TLI	RMSEA
Fluency	1576.503	142	.000	.949	.930	.072
Leisure Satisfaction	1787.802	247	.000	.918	.912	.075
Happiness	653.576	59	.000	.935	.928	.077

4. Results

4.1. Analysis of the correlation among the variables

This study focuses on college students, aiming to deeply explore the internal relationship between "fluency", "leisure satisfaction" and "happiness" when they participate in leisure sports activities. To achieve this research goal, Pearson product difference correlation coefficient was used to conduct correlation analysis for each variable (Ravli-Gulan & Auhan, 2020)^[55]. Pearson product difference correlation coefficient, a widely used method in statistics, can effectively measure the strength and direction of the linear relationship between two variables (Bishara & Hittner, 2012)^[56]. In this study, the degree of correlation between each

variable can be visually determined by the size of the correlation value through this method, and the specific results are shown in **Table 3**.

Table 3. Correlation coefficient of each variable.

Variables	M	SD	1	2	3	4	5	6	7	8	9	10	11
1 Gender	1.54	.499	-										
2 Grade	2.21	1.105	-.045	-									
3 Major	2.61	1.055	.030	-.088*	-								
4 Family	2.58	1.008	-.005	.082*	-.031	-							
5 Alimony	2.23	.608	.068	-.016	.067	-.306***	-						
6 Each time	2.16	.893	-.284***	.135**	.151***	-.023	.086*	-					
7 Weeks' time	2.39	.489	-.341***	.067	.017	.040	-.015	.449***	-				
8 Strength	2.50	.844	-.420***	.013	.045	-.046	.041	.497***	.478***	-			
9 Form	2.01	1.497	-.016	-.022	-.098*	.045	.072	-.050	.085*	.034	-		
10 Fluency	3.665	.896	-.299***	.058	-.012	-.039	.008	.288***	.257***	.316***	-.094*	-	
11 Satisfied	3.736	.845	-.265***	.022	.052	-.038	.000	.302***	.295***	.307***	-.110**	.766***	-
12 Happiness	3.217	.526	-.193***	.032	.025	-.036	.006	.183***	.137**	.168***	-.110**	.446***	.554***

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$, As follows.

It can be seen from **Table 3** that gender, exercise form and fluency, leisure satisfaction and happiness show a significant negative correlation. Specifically, women are more likely to have fluency, leisure satisfaction and happiness during exercise compared with men. However, diverse forms of exercise may reduce an individual's sense of fluency, leisure satisfaction and happiness during exercise. Meanwhile, the duration and intensity of exercise are positively correlated with fluency, leisure satisfaction and happiness. That is, extending the exercise duration and moderately increasing the exercise intensity can significantly enhance the fluency experience of individuals during the exercise process, thereby improving leisure satisfaction and promoting the growth of subjective happiness. This correlation reveals the complex connection between exercise behavior and psychological feelings, providing a theoretical basis for scientifically planning exercise programs and optimizing exercise experiences.

According to the data results in **Table 3**, there is a significant positive correlation between the three variables.

Specifically, the correlation between fluency and leisure satisfaction reached a significant level ($r=.766$, $p<.01$). This indicates that the smooth experience obtained by college students in leisure sports activities will significantly affect their satisfaction with the activities. Research hypothesis 1 is valid. The sense of fluency can not only improve the satisfaction, but also when students fully enjoy the fun and realize their self-worth in the leisure sports activities, the leisure satisfaction of the activities will also increase.

Secondly, leisure satisfaction and happiness also reached a significant level ($r=.446$, $p<.01$), and hypothesis 2 was valid. College students' leisure satisfaction with leisure sports activities is the key factor affecting their happiness. If the students are satisfied with the organization form and facilities of the activities, they will get more pleasure and improve their happiness.

Moreover, the correlation between fluency and happiness also reached a significant level ($r=.554$, $p<.01$). This indicates that when college students participate in leisure sports activities, the stronger the fluency experience, the higher their happiness. The two are closely related, and the research hypothesis 3 is valid. When students are fully immersed in leisure sports activities, their sense of time and self-awareness will gradually weaken, and this state of total engagement greatly improves their happiness.

In addition, gender factors were significantly correlated with fluency, leisure satisfaction and happiness. This means that college students of different genders have obvious differences in emotional experience when they participate in leisure sports activities. The study also found that the time, frequency, intensity and form

of college students' participation in leisure sports activities were closely related to their sense of fluency, leisure satisfaction and happiness. Moderately extending the participation time and increasing the frequency of participation can enable students to experience the fun of activities more deeply, and thus enhance the relevant feelings. The intensity of activity needs to be reasonably adjusted according to the individual's physical condition, and excessive exercise may be counterproductive. In addition, the rich variety of activities can meet the interests of different students, promote their more active participation and enhance the overall experience.

4.2. Regression analysis of each variable

In order to further explore the regulating mechanism of leisure satisfaction in college students' sense of fluency and happiness in leisure sports activities, this study uses multiple regression analysis (Tornwall et al., 2020) ^[57] to test the relationship between leisure satisfaction and happiness on the basis of controlling demographic variables such as gender. This study takes fluency as independent variable, happiness as dependent variable and leisure satisfaction as moderating variable, and systematically examines the moderating effect of satisfaction through a three-step regression model.

First, in order to reduce the multivariate collinearity problem between variables, all continuous variables (fluency, leisure satisfaction, happiness) were centralized in this study (Tsuruta & Bax, 2006) ^[58]. Then, three hierarchical regression models were constructed: Model 1 included only the control variable (gender); In Model 2, independent variables (fluency) and moderating variables (leisure satisfaction) are added to control variables. Model 3 further added the interaction term of fluency and leisure satisfaction. As shown in **Table 4**, in Model 2, both sense of fluency ($\beta=.041$, $p<.05$) and leisure satisfaction ($\beta=.510$, $p<.001$) have significant positive predictive effects on happiness. In model 3, the interaction term ($\beta=.102$, $p<.01$) reached a significant level, $\Delta R^2=.117$ ($p<.01$), indicating that leisure satisfaction does play a positive regulating role between fluency and happiness, and hypothesis 4 is valid.

Table 4. Analysis of the regulatory effect of leisure satisfaction on fluency and happiness.

	variable	Model 1	Model 2	Model 3	VIF
Control variable	Gender	.066	.046	.040	1.000
Step1	Fluency	.426***	.041*	.062*	1.098
Step2	leisure Satisfaction		.510***	.505***	2.430
Step3	Fluency * leisure Satisfaction			.102**	1.027
	R ²	.203	.310	.320	
	ΔR^2	-	-	.117	
	F	74.641***	87.698***	68.832***	

Notes: * $p<.05$ ** $p<.01$ *** $p<.001$

Figure 2 shows the moderating effect of leisure satisfaction on the relationship between fluency and happiness. Two distinct development tracks can be clearly observed from the interaction diagram: For the group with high leisure satisfaction (dotted line at the top of the figure), with the improvement of fluency level, the sense of happiness presents a rapid upward trend, and the slope is significantly steep, which indicates that when college students have a high degree of satisfaction with leisure sports activities, their fluency experience can be more effectively transformed into happiness. However, for the low leisure satisfaction group (bottom solid line in the figure), the promotion effect of fluency on happiness is relatively

flat, indicating that when students are not satisfied with activity conditions, organizational forms and other factors, even if they have fluency experience, the improvement of their happiness will be limited.

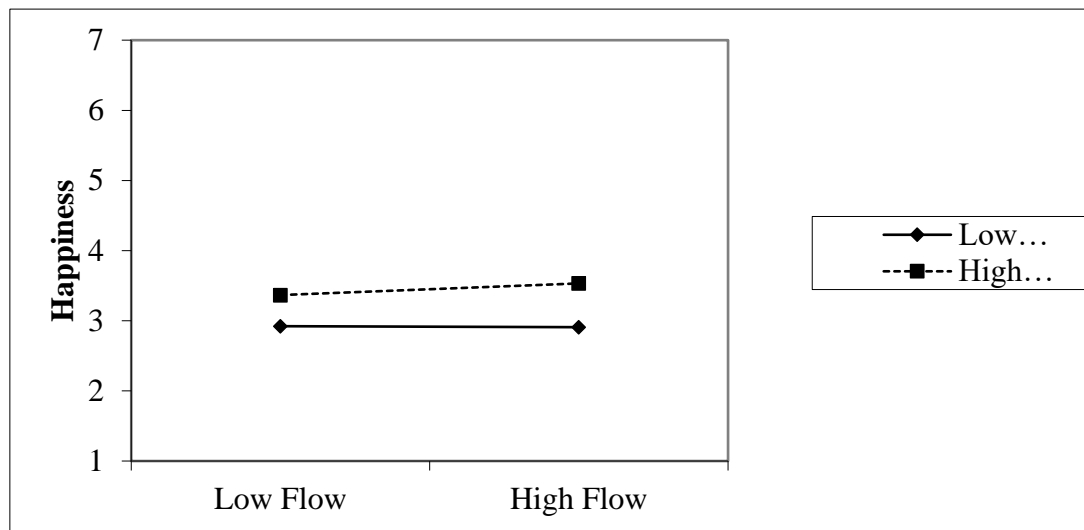


Figure 2. Relationship between fluency and happiness regulated by leisure satisfaction.

5. Discussion

5.1. Relationship between fluency and leisure satisfaction

The results of this study show that fluency has a significant positive impact on leisure satisfaction. This finding is consistent with the findings of Chen et al. (2010) ^[38], Collins et al. (2009) ^[45], Er et al. (2019) ^[59] and Vella-Brodrick et al. (2009) ^[60]. This is because fluency, as a highly engaged and pleasant psychological state, can satisfy individuals' basic psychological needs, thus enhancing their overall satisfaction with leisure activities (Wang et al., 2024) ^[19].

Specifically, when college students experience fluency in leisure sports activities, they tend to be in a state of "self-absorption," where attention is highly focused, challenges are balanced with skills, and they feel a strong sense of control and immediate feedback (Csikszentmihalyi, 1993) ^[61]. Such immersive experience can not only enhance the intrinsic pleasure of activities, but also enhance individuals' self-efficacy and sense of accomplishment, thus improving their satisfaction with leisure activities (Tükel & Temel, 2020) ^[62]. In addition, fluency may indirectly influence leisure satisfaction by promoting social interaction, reducing stress, and improving emotional state (Paliga, 2023) ^[63].

The results of this study further support the hypothesis of self-determination theory, that is, when individuals' behaviors are driven by intrinsic motivation, their psychological needs are more easily satisfied, resulting in higher happiness and satisfaction (Tang et al., 2020) ^[64]. Therefore, in the context of leisure sports, fluency is not only a temporary psychological state, but also an important factor affecting long-term participation willingness and mental health.

5.2. Relationship between leisure satisfaction and happiness

The results show that the higher the leisure satisfaction of college students, the higher their subjective happiness. This finding is consistent with the research results of Machul et al. (2020) ^[65], Tokay Argan and Mersin (2021) ^[66], Tükel and Temel (2020) ^[64], who point out that leisure satisfaction as an individual's positive evaluation of leisure activity experience, The ability to enhance overall happiness by fulfilling psychological needs such as autonomy, competence, and belonging. This is because when individuals experience higher levels of satisfaction in leisure activities, they experience more positive emotions (such as

pleasure, relaxation, and a sense of accomplishment) while reducing negative emotions (such as stress, anxiety, and boredom), thus enhancing subjective happiness (Freire & Teixeira, 2018)^[67].

In addition, the study of Kuykendall et al. (2015)^[68] also supports this view. They found that high-quality leisure participation can promote psychological recovery, enhance the sense of meaning of life, and thus enhance happiness. Specifically, recreational physical activity not only provides opportunities for physical exercise, but also creates Spaces for social interaction and self-expression, factors that work together to influence an individual's perception of happiness. For example, in team sports, individuals can not only enjoy the fun of the sport itself, but also gain a sense of belonging through cooperation and socializing, and this multidimensional leisure satisfaction will eventually translate into higher subjective happiness (Inoue et al., 2020)^[69]. Arslan and Akkas (2014)^[70] believe that studying life satisfaction and happiness can make us think more about how to help college students improve their quality of life and guide them to become happier people. All these studies have found that leisure satisfaction has a certain impact on people's physical and mental health and life satisfaction. The higher the leisure satisfaction, the higher the psychological happiness, which provides theoretical support for this paper (Yoo, 2022)^[43]. This paper holds that leisure satisfaction directly affects happiness. Through leisure sports activities, college students feel energetic, healthy and relaxed, and their psychology and spirit have been greatly improved. At the same time, it can promote individual positive emotions and enable individuals to obtain higher happiness.

5.3. Relationship between fluency and happiness

The research results show that fluency has a significant positive impact on happiness, which is consistent with the research results of Cummins (2010)^[71]. This is because fluency is often accompanied by high concentration, a balance of tasks and skills, and internal motivation, which together promote positive emotions and psychological happiness. When individuals enter a state of flow during leisure physical activities, they temporarily forget the passage of time and become fully immersed in the experience of the present moment, thereby reducing anxiety and negative thinking and enhancing feelings of pleasure and leisure satisfaction (Boudreau et al., 2020)^[72].

As a state of deep engagement, fluency can enhance individual autonomy, competence and sense of meaning, thus enhancing overall happiness (Wang et al., 2024)^[19]. Similarly, a study by Collins et al. (2009)^[45] found that individuals who frequently experience flow report higher life leisure satisfaction and positive emotions, which corroborates the results of this study. Cheng and Lu (2015)^[73] believe that the attitude of active participation in leisure sports activities will produce a certain degree of smooth experience, which is conducive to the production of enjoyment, happiness and other adaptive results, indicating that the sense of fluency in leisure sports activities will affect happiness. This proves that the fluency of college students participating in leisure sports activities does have a positive impact on their subjective happiness. Fluency is premised on a love of leisure physical activity, which enhances participants' confidence in achieving their desired goals (Wang et al., 2024)^[19]. Therefore, fluency and happiness have the same effect on leisure physical activity.

5.4. Moderating effect of leisure satisfaction

The results show that the leisure satisfaction of college students participating in leisure sports activities has a significant moderating effect on the relationship between fluency and happiness. This finding is consistent with the findings of Cummins (2010)^[71], Wang et al. (2024)^[74], and Zhang et al. (2021)^[75], because individuals with high leisure satisfaction are more likely to derive stronger happiness gains from smooth experiences.

Specifically, when college students are highly satisfied with their leisure sports activities, the flow states they experience during the activities (such as focus, enjoyment, loss of sense of time) further reinforce their positive emotions and psychological happiness. Conversely, if individuals are less satisfied with the activity itself, even if they occasionally enter a flow state, its effect on happiness may be limited. Therefore, leisure satisfaction can be viewed as a key psychological mechanism that reinforces the positive impact of fluent experiences on happiness (Kuykendall et al., 2015) ^[69]. This finding suggests that when designing and promoting leisure sports activities for college students, attention should be paid not only to how to promote smooth experiences (e.g. optimizing the challenge-skill balance, enhancing the fun of activities), but also to enhance the overall leisure satisfaction of participants (e.g. providing diverse activity choices, enhancing social interaction, and reducing external pressure). Only when the individual is satisfied with the leisure physical activity itself, the fluid experience can be more effectively translated into lasting happiness enhancement (Doğaner & Balci, 2018) ^[76].

6. Conclusions

6.1. Conclusions

This study deeply explored the influence of college students' feeling of fluency in leisure sports activities on their happiness and the moderating role of leisure satisfaction in it, and reached the following conclusions:

Fluency has a significant positive impact on leisure satisfaction. This shows that the quality of fluent experience directly affects the leisure satisfaction of individuals with leisure activities. (2) Fluency has a significant positive impact on happiness. Studies have shown that the smooth experience obtained by college students in leisure sports activities has a direct effect on their overall happiness through enhancing positive emotions, enhancing self-efficacy and promoting social connection. (3) Leisure satisfaction has a significant impact on happiness. The results suggest that when college students are satisfied with their leisure sports activities, this positive evaluation will generalize to their overall happiness. (4) Leisure satisfaction has a regulating effect between fluency and happiness, that is, fluency has a positive regulating effect on happiness through leisure satisfaction. The results show that when college students are more satisfied with the facilities and organizational forms of leisure sports activities, the sense of fluency has a more significant promoting effect on happiness. High leisure satisfaction creates a high-quality leisure sports environment for college students, making it easier for them to immerse themselves in activities, and thus strengthening the positive impact of fluency. On the contrary, low leisure satisfaction will prevent college students from entering the state of fluency in leisure sports activities, and weaken the role of fluency in improving happiness.

6.2. Implications

6.2.1. Theoretical implications

At the theoretical level, this study verifies the causal relationship among fluency, leisure satisfaction and happiness through empirical data, and builds the interaction model among the three. First, the study confirmed the direct positive impact of fluency on leisure satisfaction, a finding that echoes Csikszentmihalyi's (1990) ^[77] flow theory and supports the core idea that "positive psychological feelings will occur when individuals are in the optimal experience state of balancing skills and challenges". Secondly, the research reveals the direct promoting effect of fluency on happiness, and expands the application of positive psychology in the field of leisure sports. Most importantly, this study found the moderating role of leisure satisfaction in the relationship between fluency and happiness, which exceeded the simple mediation effect studies in the past and provided a new theoretical perspective for understanding the boundary

conditions of leisure experience into happiness. These findings jointly enrich the research on psychological mechanisms in the field of leisure sports and lay an empirical foundation for the construction of subsequent theoretical models (Newman et al., 2014) ^[25].

6.2.2. Practical implications

In practice, the results of this study provide important implications for leisure sports education and management in colleges and universities. First, educators should enhance the smooth experience of students by optimizing the design of leisure sports activities (Powers et al., 2022) ^[78]. Specifically, challenges can be set appropriately according to the student's skill level, activity formats with clear goals and immediate feedback can be designed, and immersive engagement environments can be created. Secondly, attention should be paid to cultivating students' intrinsic motivation to enhance activity satisfaction (Mackenzie et al., 2018) ^[79], which includes respecting students' independent choice, providing diversified activity options, and emphasizing the fun of activities themselves rather than external rewards. Finally, it is necessary to establish a diversified evaluation system to comprehensively promote students' happiness (Liu et al., 2025) ^[80]. Comprehensive evaluation of students' participation experience can be adopted instead of focusing only on sports skills and psychological and social benefits brought by sports activities, and a sustainable happiness tracking mechanism can be established.

In conclusion, this study not only deepens the understanding of the psychological mechanism of leisure sports activities, but also provides practical suggestions for improving the quality of life of college students. These findings have important reference value for promoting the reform of physical education in colleges and universities and optimizing students' mental health services.

6.3. Limitations and future research prospects

Although this study provides valuable insights into the relationship between fluency, leisure satisfaction and happiness in college students' leisure sports activities, there are still some limitations, which also point the way for future research.

First, the limitations of the study sample. The sample of this study is mainly from university students in the same area, and the representativeness of the sample may be limited. Future studies can expand the sampling scope to include samples from universities in different regions and at different levels, so as to improve the universality of research results (Huang & Long, 2023) ^[81]. At the same time, we can consider extending the research objects to other age groups or social groups to test the external validity of the research model.

Secondly, limitations of the study design. A cross-sectional design was used in this study to verify the correlation between variables, but it was difficult to determine a strict causal relationship. Future studies can use longitudinal tracking designs or experimental intervention studies to more accurately reveal causal links between variables through time series data (Pekrun & Marsh, 2022) ^[82].

Finally, the necessity of cross-cultural research. This study was conducted in the context of Chinese culture, and the applicability of the findings in other cultural contexts remains to be verified. In the future, cross-cultural comparative studies can be conducted to investigate the moderating effect of cultural values on the research model (Goodwin et al., 2020) ^[83].

In conclusion, although there are some limitations in this study, these limitations provide clear directions for future research. By improving the research method, expanding the research content and deepening the theoretical construction, we can further improve the understanding of the psychological

mechanism of leisure sports activities, and provide more scientific theoretical basis and practical guidance for promoting the physical and mental health of college students.

Conflict of interest

The authors declare no conflict of interest.

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