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The influence of social cognitive factors on physical activity of Chinese university students: The moderating role of gender

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ABSTRACT

This study constructed a prediction model of physical activity among Chinese college students based on the social cognitive theory to investigate the factors and mechanisms influencing physical activity among Chinese college students. Questionnaires were dispensed to a cohort of 2000 university students hailing from 10 academic institutions located in Guangzhou, Guangdong Province, China resulting in the retrieval of 1897 questionnaires deemed valid. The conceptual framework was subsequently modeled using the PLS-SEM methodology based on the sample data collected. Sports social support (β = 0.191***), outcome expectation (β = 0.306***) and self-efficacy (β = 0.459***) positively impact college students' physical activity through self-regulation (β = 0.346***). Male self-efficacy has a weaker influence on self-regulation. Male college students' self-regulation also has a weaker effect on physical activity. External disturbance (β = -0.192***) negatively affects physical activity while internal disturbance has a minor impact (β = -0.135***, f2=0.010) almost negligible. The research validated the impact of various social cognitive elements on the exercise habits of university students. It offers a solid empirical foundation for advancing physical activity engagement among college students in China. Furthermore, the findings can serve as a fundamental reference point for Chinese educational institutions to develop comprehensive sports policies tailored specifically for college students.

Contribution/Originality: This study introduced a pioneered perspective by integrating social cognitive factors and perceived barriers to elucidate physical activity among Chinese college students. It also delved into the moderating effect of gender, offering a theoretical foundation for informing intervention strategies to enhance physical activity among Chinese college students.

1. INTRODUCTION

1.1. Research Background

In 2023, an examination done among university students in Southern China illustrated that the ratio of overweight and obesity was 26% and 14% in males and females (Hao et al., 2023). Mahmoud, Kimonis, and Butler (2022) underscored the importance of genetic factors in contributing to obesity alongside the crucial influence of lifestyle choices like diet and exercise. Conversely, Balgoon, Al-Zahrani, Alkhattabi, and Alzahrani (2019) identified sedentary lifestyles as a leading cause of weight increase. Furthermore, Miller and Hartman (2020) affirmed the pivotal role of physical exercise in weight management. Giandonato, Tringali, and Thoms (2021) underscored the various advantages of physical activity in mitigating the onset, intensity, and frequency of depression as well as in

alleviating stress and anxiety. Martinez, Sánchez-Díaz, Alfonso-Asencio, Courel-Ibáñez, and Sánchez-Pay (2020) reported a robust relationship between physical activity levels and academic performance (indicating a significant impact on academic achievements with varying physical activity). Engaging in physical activity offers numerous advantages for university students underscoring the importance of exploring strategies to encourage participation. Keating, Guan, Piñero, and Bridges (2005) previously observed a lack of priority on physical activity among university students with investigations often employing restricted methodologies and subjective assessments of physical activity levels. A meta-analysis by Plotnikoff et al. (2015) deduced that university campuses offer an ideal health-promotion environment given the wealth of expert knowledge, interdisciplinary health professionals and cutting-edge sports facilities. Moreover, students are at a developmental stage where positive health behaviors can be cultivated presenting ample opportunities for implementing lifestyle interventions aimed at enhancing the well-being of college students.

1.2. Research Questions

The present study will elucidate the social cognitive theory pertaining to physical activity among college students based on the aforementioned studies. The examination primarily delves into the impact of various social cognitive factors on the physical activity levels of college students while also exploring gender-related regulatory mechanisms. This study will tackle the following three queries:

RQ1: How much do social support, outcome expectations, self-efficacy, and perceived impairments directly and statistically significantly influence physical activity in college students?

RQ2: How do social support, outcome expectations, and self-efficacy indirectly affect the physical activity levels of university students through the exercise self-regulation process?

RQ3: How does gender serve as a mediating factor in the relationship between social support, outcome expectations, self-efficacy, and physical activity among college students specifically through exercise self-regulation?

1.3. Research Significance

This investigation draws upon social cognitive theory in conjunction with the specific context of physical activity among Chinese university students to address the aforementioned research inquiries. A theoretical framework is developed to explicate the physical activity patterns of these students. The framework asserts that social support, outcome expectations, self-efficacy and perceived barriers directly influence university students' physical activity. Social support, outcome expectations and self-efficacy contribute positively to physical activity, while perceived barriers contribute negatively. Furthermore, the framework suggests that exercise self-regulation mediates social support, outcome expectations, self-efficacy and physical activity. Additionally, it proposes that gender moderates the mediating role of exercise self-regulation. This study offers a novel interpretation of overlooked relationships among variables enhancing the ability to predict and explain physical activity among college students through a comprehensive conceptual model. Moreover, this study explores both positive and negative social cognitive factors influencing physical activity filling a gap in existing literature (Busa et al., 2024; Deliens, Deforche, De Bourdeaudhuij, & Clarys, 2015; Favieri, French, Casagrande, & Chen, 2023; Peterson, Sirard, Kulbok, DeBoer, & Erickson, 2018; Plotnikoff et al., 2015; Wibowo, Kelly, & Baker, 2020; Zhai et al., 2021; Zhang, He, Qian, Qi, & Tong, 2023). Former studies have not explored the potential mediating impact of gender in exercise self-regulation highlighting it as a central objective of this research.

2. LITERATURE REVIEW

2.1. Physical Activity

Physical activity levels of university students are associated with university students' health, psychological status, and academic performance as evidenced by several studies. It has been found that physical inactivity may

lead to health problems among university students (Smith, Disler, & Watson, 2020). Similarly, lack of physical activity can lead to negative emotions, anxiety, and depression in university students (Petruzzello & Box, 2020). Lack of physical activity also reduces university students' academic performance while being physically active improves students' psychological state and academic performance (Jose & Sruthi, 2019). Huang, Wang, and Zhang's (2023) research also found that physical activity interventions have a positive effect on alleviating university students' anxiety with aerobic exercise being the best form of exercise. Tong and Meng's (2023) study based on empirical evidence revealed a significant and negative relationship between the physical activity levels of university students and both mobile phone addiction and negative emotions. For female college students, moderate exercise and moderate to intense physical activity efficiently decrease premenstrual syndrome symptoms (Shi et al., 2023). A Brazilian study of university students suggests that free-time physical activity may help improve the quality of sleep among university students (Santos et al., 2023). All the investigations imply that insufficient bodily movement among college students might result in various issues whereas engaging in physical exercises benefits physical well-being, positive mental condition and academic success. Hence, an examination of the variables impacting physical movement among Chinese college students and a conceptual structure that can elucidate the level of physical activity among Chinese university students are the central points of interest in this inquiry.

2.2. Social Cognitive Theory

Dzewaltowski, Noble, and Shaw (1990) verified that social cognitive theory constructs notably forecast engagement in physical exercise with self-assurance and self-assessment of conduct substantially adding to the prognosis. Neal, Chu, Motl, and Pekmezi (2024) examined self-disclosed levels of physical activity and their relationship with social cognitive theory (SCT) variables. The study found that SCT variables were significantly associated with physical activity levels. An analysis conducted in 2005 detected a relationship between social cognitive theory (SCT) variables and the incidence of moderate-intensity physical workouts among high school students (Petosa, Hortz, Cardina, & Suminski, 2005). The SCT variables encompass self-control, societal setting, workout result anticipation, external result anticipation, health result anticipation, adverse result anticipation, workout self-confidence and perceived workout dysfunction.

2.3. Social Support

In recent academic investigations, the relationship between social support and engagement in physical exercises has garnered significant attention. Todd, Czech, and Biber (2024) completed research on the effect of perceived social encouragement on worries correlated with falls in the aging demographic. Their results indicate that interventions focusing on social support and physical activity could potentially alleviate the apprehension of falling within this demographic. Moreover, Nagy-Pénzes, Vincze, and Bíró (2020) carried out a health survey that unveiled a relationship between diminished social support among teenagers and heightened levels of depression emphasizing the crucial role of social support in the mental well-being of young individuals. Additionally, Brailovskaia, Ozimek, and Bierhoff (2021) explored the relationship between online social support, physical activity and tendencies towards addiction in the context of social media use. Their study underscores the significance of social support in mitigating the adverse effects of excessive engagement with social media platforms. An extensive body of literature (Howie, Daniels, Human, Gray, & Baum, 2021; Petersen, Kemps, Lewis, & Prichard, 2020, 2021; Vaziri et al., 2020) illustrates that social support is vital for fostering physical activity in people of all ages. Social support has been proven to yield beneficial impacts on motivation, fear of falling, psychological health and even addictive tendencies linked to the use of social media ranging from adolescents to the elderly population.

Hagger, Wood, Stiff, and Chatzisarantis (2010) stressed the significance of fostering a scientific mindset to grasp children's regulatory skills highlighting the participation of teachers and peers in cultivating self-regulation in educational contexts. This perspective posits that early educational experiences are fundamental for nurturing

and applying self-regulation competencies. Yuhuan et al. (2022) investigated the relationship between academic pressure, interpersonal assistance and exhaustion related to self-regulation in nursing students. These inquiries underscore the influence of interpersonal support on self-regulation and its function in alleviating the repercussions of academic stress on students' physical and mental well-being. Martínez-López, Nouws, Villar, Mayo, and Tinajero (2023) and Guzman Villegas-Frei, Jubin, Bucher, and Bachmann (2024) analyzed the interaction among social support, self-regulation and cognitive abilities in varied living arrangements such as with partners, shared accommodation and alone. Otundo and MacGregor (2019) conducted a mixed study that highlighted the positive impact of social support on university students' motivation to participate in sports activities. Leyton-Roman, Nunez, and Jimenez-Castuera (2020) emphasized the importance of implementing incentive strategies for university students' physical activities. Relevant subjects can enhance university students' motivation to engage in physical activities by meeting their psychological needs. These inquiries propose that social support and self-regulation are crucial in improving students' mental well-being and self-regulation. These inquiries indicate that social support and self-regulation competencies can affect students' educational achievements, professional behaviors and overall preparedness for the job market. Overall, the literature emphasizes the significance of social support in honing students' self-regulation skills within various academic and professional contexts. Therefore, the present study puts forth the subsequent hypothesis:

H_{1a}: The social support of Chinese college students has a significant promoting effect on self-regulation.

H_{1b}: The social support of Chinese college students has a significant promoting effect on physical activity.

2.4. Outcome Expectations

The impact of "outcome expectation" on self-regulation is a crucial element of social cognitive theory. In influencing behavior and decision-making processes, outcome expectations, self-efficacy, self-regulation, and social support all play a paramount role (Nematollahi & Eslami, 2021). These elements are crucial to understanding how people perceive their actions' consequences and modify their behaviour accordingly. Studies have demonstrated a strong relationship between outcome expectations, self-regulation and self-management behaviors in various scenarios. For instance, positive outcome expectations in diabetes management correlate with improved self-efficacy and emotional well-being (Villaécija, Luque, Castillo-Mayén, Farhane-Medina, & Tabernero, 2023).

Moreover, outcome expectations alone are not the sole factor influencing involvement in self-regulation behaviors emphasizing the need to grasp the relationship between outcome expectations and self-regulation in nutrition and physical activity (Anderson-Bill, Winett, & Wojcik, 2011). Feedback is known as a factor that influences both outcome expectations and self-efficacy. Current investigations have suggested that feedback may influence interview self-efficacy, result in expectations, and, subsequently, individuals' motivation and achievement-oriented behaviors (Petruzziello, Chiesa, Guglielmi, & Mariani, 2021).

Moreover, result expectations for self-care have been recognized as mediating the influence of interventions in a randomized controlled trial targeted at improving self-management practices in individuals with various sclerosis, emphasizing the importance of result expectations in behavior modification (Plow, Motl, Finlayson, & Bethoux, 2020). Existing literature emphasizes the critical role of outcome expectations in self-regulation and behavior modification. It is important to grasp how individuals perceive the outcomes of their behavior and adjust their behavior based on these expectations to promote positive health behaviors and self-management strategies (Young, Plotnikoff, Collins, Callister, & Morgan, 2014). Further exploration is necessary in various populations and environments to delve into the intricate interplay among outcome expectations, self-regulation and behavior modification. Outcome expectations in exercise participation and adherence are fundamental across diverse populations. Several research studies have examined the determinants affecting anticipated results of physical activities. One example is how research has shown the significance of self-efficacy and result expectations in promoting physical activity especially among older women (Garland et al., 2021). Alterations in outcome

expectations also directly influence self-efficacy levels related to physical activities highlighting the dynamic essence of these constructs (Lithopoulos, Williams, & Rhodes, 2020). Additionally, variables like symptoms of depression, perceived stress, self-efficacy, and outcome expectations can forecast the fitness levels in adolescents with obesity demonstrating the intricate relationship between mental factors and physical activity (Tulloch et al., 2020). Bogataj, Pajek, Buturović, Ponikvar, and Pajek (2020) discovered a significant correlation between poor adherence to exercise programs and lower expected exercise (OEE) results. Siagian, Agustiningsih, and Supriyati (2023) found that outcome expectations positively impact self-regulation and physical activity levels. Oyibo, Adaji, and Vassileva (2018) demonstrated that outcome expectation significantly predicts weight exercise behavior. These studies emphasize the importance of outcome expectations in molding movement behavior and stress the need for customized interventions that target individual factors influencing these expectations. Therefore, the present study puts forth the subsequent hypotheses:

H_{2a}: The outcome expectation of Chinese college students has a significant promoting effect on self-regulation.

H_{2b}: The outcome expectation of Chinese college students has a significant promoting effect on physical activity.

2.5. Self-Efficacy

Oyibo et al. (2018) discovered that the self-efficacy exhibited by model observers in the behavioral context had a favorable influence on their self-regulation. The input from the research participants indicated: "I face difficulties in achieving my exercise targets even when they are set at a modest level." My hectic schedule interfered leading to forgetfulness." Drawing from this feedback, Oyibo, Orji, and Vassileva (2018) suggested that self-regulatory beliefs may only impact an individual's sports performance if self-efficacy is present. Consequently, the current investigation introduces the subsequent hypothesis:

H_{3a}: The self-efficacy of Chinese college students has a significant promoting effect on self-regulation.

Bandura (2004) theorized that people with raised self-efficacy are prone to foresee favorable consequences from engaging in physical exercises recognized as outcome expectations. Besides, they illustrate a superior likelihood of being involved in self-regulation activities such as setting targets to kick off and uphold an active way of living. Elavsky et al. (2005) and Joseph, Royse, Benitez, and Pekmezi (2014) probed the relationship between physical activity and quality of life in both young and elderly individuals. Notably, Joseph et al. (2014) discovered a direct association between physical activity and self-efficacy whereas self-efficacy did not exhibit a direct link with quality of life. In addition, Ren et al. (2021) found that Chinese college students with diminished self-efficacy levels were prone to participate in a reduced amount of physical activity. Li and Zhang (2022) expanded upon the investigation initiated by Ren et al. (2021) implementing a cross-sectional survey involving 564 students from Zhejiang University. The observations disclosed that Chinese academic students in Zhejiang presented diminished levels of physical exertion during their recreation time ascribed to insufficiencies in their self-management and self-efficacy (Li & Zhang, 2022).

Similarly, Siagian et al. (2023) found that self-efficacy has the strongest predictive effect on physical activity among a series of social cognitive predictors. Acebes-Sánchez, Diez-Vega, Esteban-Gonzalo, and Rodriguez-Romo (2019) discovered a positive correlation between university students' self-efficacy and their level of physical activity. Therefore, the present study puts forth the subsequent hypothesis:

H_{3b}: The self-efficacy of Chinese college students has a significant promoting effect on physical activity.

2.6. Perceived Barriers

Khodaveisi, Azizpour, Jadidi, and Mohammadi (2021) conducted an empirical study that found a positive relationship between perceived impairment scores and negative motor behavior scores. Gong and Sheng (2022) conducted a study on 313 Chinese university students from Sichuan University of Arts and Sciences which found a negative correlation between perceived subjective impairment and physical activity levels. Brown et al. (2024)

conducted a study with 17,771 participants and identified several barriers that affect physical activity levels, including environmental, resource-related, social and goal-related factors. Therefore, the present study puts forth the subsequent hypotheses:

H_{5a}: Perceived internal barriers have a significant negative effect on physical activity levels.

H_{5b}: Perceived external barriers have a significant negative effect on physical activity levels.

2.7. Self-Regulation

Additionally, exercise self-regulation can significantly and positively predict physical activity. Therefore, self-regulation mediates the relationship between social support, outcome expectation and physical activity. Liu et al. (2022) discovered that sports social support, outcome expectation, and self-efficacy significantly and positively predict sports self-regulation among Chinese adolescents. Additionally, the level of physical activity is favorably and strongly predicted by sports self-regulation, and it serves as a mediator. The direct effects of social support, outcome expectation and self-efficacy on physical activity levels were also statistically significant. Therefore, the present study puts forth the subsequent hypothesis:

H_6: Self-regulation has a significant and positive effect on physical activity levels.

2.8. The Moderating Role of Gender

Liu et al. (2022) conducted a multigroup analysis. They found that the impact of physical activity did not significantly differ based on social support, outcome expectation and self-efficacy among different gender groups. However, gender may regulate the effects of social support, outcome expectation and self-efficacy on exercise self-regulation. Therefore, the present study puts forth the subsequent hypotheses:

H_{7a}: Gender moderates the relationship between social support and self-regulation.

H_{7b}: Gender moderates the relationship between outcome expectations and self-regulation.

H_{7c}: Gender moderates the relationship between self-efficacy and self-regulation.

H_{7d}: Gender moderates the relationship between self-regulation and physical activity.

In a nutshell, this study sorted out the potential factors affecting the physical activity level of university students including the positive factors that can promote the physical activity level which are social support for sports, sports outcome expectation, sports self-efficacy, and sports self-regulation ability based on the social cognitive theory. At the same time, there are also negative factors that may reduce the physical activity level of university students such as the barriers university students perceive when engaging in physical activity. Some studies have also found that gender may play a moderating role in these relationships. This paper proposes a model of influencing factors on the physical activity level of Chinese university students based on the results of social cognitive theory and literature review.

2.9. Conceptual Framework and Hypothesis

This research combines the common factors influencing university students' physical activity. The conceptual framework shown in Figure 1 to establish a theoretical model explaining Chinese university students' physical activity levels based on social cognitive theory. In the conceptual framework shown in Figure 1, social support, outcome expectations and self-efficacy were used as independent variables, self-regulation was used as a mediator variable and perceived external barriers and perceived internal barriers were the two negative factors affecting university students' physical activity. Gender as a moderator variable moderates the effect of the three independent variables on the mediator variable and gender also moderates the effect of the mediator variable self-regulation on the amount of physical activity.

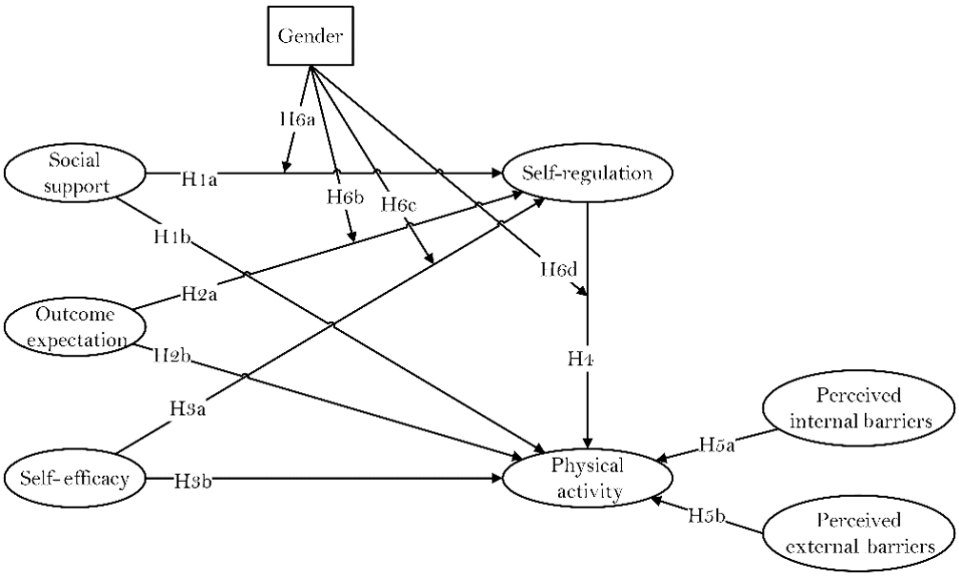

Figure 1. Conceptual framework.

3. METHODOLOGY

3.1. Research Design

The study was conducted using a quantitative approach. Empirical data was collected through a questionnaire survey. Before data collection, a conceptual framework of physical activity among Chinese university students was constructed based on the Social Cognitive Theory (SCT). The variables involved in the study were identified based on this framework and appropriate measurement instruments were selected from the literature to measure these variables. Research data was collected through questionnaires using these measurement instruments. After the data collection, the structural equation model will be used to verify the conceptual framework proposed in this paper.

3.2. Participants and Sample Size

This research delves into examining full-time undergraduate students in Guangzhou, China as the focal point of investigation. A total of 1897 valid samples were meticulously acquired for this study showcasing an impressive proportion of 94.85% in terms of valid samples obtained within the realm of the actual empirical inquiry. The precise origin of these samples can be meticulously observed in Table 1 providing a comprehensive overview of the data collection process.

Table 1. Source of participants.

University	Number of samples distributed	Number of valid questionnaires received	Percentage of valid samples
Guangdong second normal university	200	188	94.0%
Guangdong University of technology	200	186	93.0%
Guangdong Polytechnic normal university	200	186	93.0%
Guangdong Polytechnic college	200	178	89.0%
Guangdong university of foreign languages	200	199	99.5%
Guangzhou university of sports	200	184	92.0%
South China university of technology	200	193	96.5%
South China agricultural university	200	196	98.0%
South China normal university	200	192	96.0%
Jinan university	200	195	97.5%
Total	2000	1897	94.9%

As delineated by the conceptual framework meticulously constructed within this scholarly manuscript, the requisite minimum effect size f^2 mandated for testing was rigorously established at 0.02 while the statistical power was methodically set at 0.80 and the significance level was unwaveringly fixed at 0.05. This study's indispensable minimum sample size was meticulously computed using sophisticated statistical analysis to be 822 leveraging the esteemed G*Power3.1.9.7 software for precise calculations and data analysis.

3.3. Measure Instruments

The investigation was carried out through the utilization of a survey to gather the essential sample data. The survey incorporated three demographic aspects (specifically gender, age and university grade) and six sub-components. Table 2 lists the ideas, language editions, and literary sources for each of the six survey questionnaires. Various surveys were used in this research to assess diverse facets associated with physical activity. It is noteworthy that the PAPB and PASR-12 surveys are presented in English. Therefore, proficient English people were requested to translate and re-translate the two measures before implementation to guarantee that individuals from Chinese mainland universities could accurately comprehend the scale's content. The surveys underwent preliminary testing and the outcomes indicated satisfactory reliability and validity.

Table 2. Research variables and instruments.

Construct	Instrument	Items	Source
Physical activity	The international physical activity questionnaire short Chinese version (IPAQ-S-C).	7	Macfarlane, Lee, Ho, Chan, and Chan (2007)
Social support	The Chinese version of the physical activity social support scale (PASSS-C).	24	Cao, Yuan, and Luo (2024)
Self-efficacy	The shortened Chinese version of the physical activity self-efficacy scale (S-PASESC).	8	Chen, Dai, and Gao (2019)
Outcome expectation	The Chinese version of the outcome expectations for exercise scale (OEE-C).	9	Lee, Chiu, Ho, Wu, and Watson (2011)
Perceived barriers	The physical activity perceived barriers questionnaire (PAPB).	12	Arzu, Tuzun, and Eker (2006)
Self-regulation	The physical activity self-regulation scale (PASR-12).	12	Umstattd, Motl, Wilcox, Saunders, and Watford (2009)

3.3.1. Physical Activity

Physical activity was calculated using the IPAQ-Short-Chinese version questionnaire (IPAQ-S-C). The development of IPAQ can be attributed to the International Working Group on Physical Activity Measurement (Craig et al., 2003). This questionnaire is acknowledged globally as an efficient tool for evaluating an individual's physical activity levels. The Chinese translation of the IPAQ short version was conducted by Macfarlane et al. (2007) a notable Chinese academic with its reliability and validity confirmed among Chinese university students leading to its extensive utilization in China. The IPAQ short version categorizes physical activity intensity into high, moderate and walking intensities. A total of 7 questions are included in the survey focusing on the frequency of physical activities with various intensities (days per week), duration (minutes per day) and daily sitting time over the previous 7 days.

3.3.2. Social Support

The Physical Activity Social Support Questionnaire (PASSS-C) modified from the work of Cao et al. (2024) underwent translation and implementation in the Chinese context. The questionnaire comprised four key dimensions: emotion, information, tools and peer support encompassing 24 individual items. An examination

employing a 5-point Likert scale will be performed to gauge the opinions of university students spanning from strongly disagree to agree and segmented into five specific levels strongly.

3.3.3. Self-Efficacy

Self-efficacy was assessed by the Chinese version of the Physical Activity Self-Efficacy Scale (S-PASESC) (Chen et al., 2019). The top of the scale states "Please assess how you perceive when you engage in physical activities based on your real experience." The 8-item single-dimensional S-PASESC uses a five-point Likert scale ranging from entirely incongruous (1) to entirely harmonious (5). Chen et al. (2019) revealed that the S-PASESC has been identified as a dependable scale for evaluating the self-efficacy of Chinese students in physical activity.

3.3.4. Outcome Expectation

Outcome expectation was assessed using the OEE-C, a Chinese version of the outcome expectations for exercise scale created by Lee et al. (2011). Participants were required to assess nine outcome expectation statements on a five-point Likert scale ranging from 1 (completely inconsistent) to 5 (completely consistent). The validity and reliability of the scale in assessing physical exercise outcome expectations among the elderly in China were found to be satisfactory (Cronbach $\alpha = .85$) (Lee et al., 2011). The scale is titled "Please assess the following items based on your current sentiments " with a sample statement: "Engaging in exercise enhances my well-being."

3.3.5. Perceived Barriers

The Physical Activity Perceived Barriers Questionnaire (PAPB) by Arzu et al. (2006) examined obstacles to physical exercise. This questionnaire comprises a total of 12 inquiries categorized into two distinct sub-domains: perceived internal barriers and perceived external barriers. An illustration of a statement from the questionnaire includes, “I have contemplated that physical activity is arduous and overly fatiguing.”

3.3.6. Self-Regulation

Self-regulation was assessed by employing the Physical Activity Self-Regulation Questionnaire (PASR-12) (Umstattd et al., 2009). The researchers evaluated the psychometric properties of PASR-12 encompassing its structural and construct validity and reliability and ascertained its favorable psychometric attributes. The PASR-12 survey comprises six subdimensions and 12 items covering self-monitoring, goal establishment, seeking social backing, reinforcement, time organization, and relapse prevention. A specific query within the questionnaire prompts individuals to reflect on the practice of mentally acknowledging factors aiding in their physical activity engagement.

3.4. Validity and Reliability

A preliminary survey on a small scale was carried out, resulting in the collection of 188 valid pre-test samples prior to administering the formal questionnaire survey. These preliminary test samples were used to evaluate the dependability and accuracy of the five measurement scales selected for this research. A confirmatory factor analysis was conducted to ascertain the structural validity of the scale. The results presented in Table 3 indicated that the fitting index of confirmatory factor analysis for the various measuring tools all adhered to the measurement requirements. The reliability of the measuring tools was assessed using Cronbach's alpha which revealed in Table 3 that the Cronbach's alpha values for all measuring tools were above 0.7. The results of the reliability and validity assessments show that the measurement tools chosen for this study display sufficient reliability and validity.

Table 3. Reliability and validity test results.

Scales	$\chi 2$	df	$\chi 2$/df	RMSEA	SRMR	TLI	CFI	IFI	Cronbach's alpha
C-SSSE	299.699	246	1.218	0.033	0.032	0.988	0.989	0.989	0.976
S-PASESC	30.633	17	1.802	0.064	0.027	0.975	0.985	0.985	0.905
OEE-C	40.254	27	1.491	0.050	0.021	0.987	0.990	0.991	0.947
PASR-12	98.573	50	1.971	0.070	0.036	0.968	0.976	0.976	0.953
PAPB	92.753	53	1.750	0.062	0.022	0.979	0.984	0.984	0.963

Note: RMSEA = Root mean square error of approximation, SRMR = Standardized root mean residual, TLI = Tucker Lewis index, CFI = Comparative fit index , IFI = Incremental fit index.

3.5. Data Analysis

In this current study, Partial Least Squares Structural Equation Modelling (PLS-SEM) was used for the statistical analysis and hypothesis testing of the model formulated here. The utilization of Smart-PLS 4.0.8.7 software facilitated the completion of the analysis and computational procedures entailed in this investigation. The sample data underwent a preliminary examination to detect common method bias by implementing Harman's single-factor method and the Full Collinearity Assessment Approach before subjecting the model to testing. Subsequently, the measurement model underwent scrutiny utilizing the PLS algorithm encompassing a comprehensive evaluation of outer loading, Cronbach's alpha, combined reliability (CR), average variance extracted (AVE), variance inflation factor (VIF), and discriminant validity. The structural model underwent evaluation for collinearity diagnosis, overall model fit assessment, determination of the significance of path coefficients and scrutiny for mediating and moderating effects.

4. RESULTS

4.1. Descriptive Analysis

The total number of valid participants in this research was 1,897. Table 4 shows that out of the total participants, 780 (41.1%) were male, and 1,117 (58.9%) were female. The age distribution was as follows: 63 participants (3.3%) were under 18 years old, 558 participants (29.4%) were 18 years old, 608 participants (32.1%) were 19 years old, 444 participants (23.4%) were 20 years old, 144 participants (7.6%) were 21 years old, 40 (2.1%) were 22 years old, 20 (1.1%) were 23 years old and 20 (1.1%) were 24 years old. In the first year of university, 976 students (51.4%) were enrolled followed by 714 students (37.6%) in the second year, 144 students (7.6%) in the third year, 24 students (1.3%) in the fourth year and 39 students (2.1%) with other statuses.

Table 4. Characteristics of the samples.

Variables	Value	Frequency	Percentage
Gender	Male	780	41.1%
	Female	1117	58.9%
Age	Under 18	63	3.3%
	18	558	29.4%
	19	608	32.1%
	20	444	23.4%
	21	144	7.6%
	22	40	2.1%
	23	20	1.1%
	Age 24	20	1.1%
University grade	Freshman	976	51.4%
	Sophomore	714	37.6%
	Junior	144	7.6%
	Senior	24	1.3%
	Others	39	2.1%

4.2. Common Method Deviation Test

In the questionnaire design phase of this research, the various possible sources of method variance were first pre-controlled according to the recommendations of Rodríguez-Ardura, Meseguer-Artola, Rodríguez-Ardura, and Meseguer-Artola (2020) and the main procedures included the optimization of the questionnaire, the addition of an appropriate number of reversed questions to the questionnaire, and the seeking of the cooperation of the participants to try to control the common method bias procedurally. However, 5 Likert scales of the same form were added to the same questionnaire in this research to avoid the influence of common method bias on the statistical results.

This paper will also test the common method bias using statistical analysis methods. Firstly, Harman's single-factor test was used to scrutinize common method bias. An exploratory factor analysis was conducted on the data collected from the Likert scale assessments in the survey wherein extraction was carried out through principal component analysis without any rotation.

The total variance explained in the table was obtained as shown in Table 5 where 8 factors had eigenvalues greater than one. The variance contribution of the first factor was 38.553% which is much less than the threshold value of 50%. Indications suggest that the issue of common method variance lacks severity in the examined context as evidenced by the data and analyses conducted. This implies that the potential bias introduced by a single data collection or measurement method is relatively minimal and should not significantly impact the overall interpretation of results (Philip & Dennis, 1986).

Table 5. Test results of the Harman single factor method (Total variance explained).

Components	Initial eigenvalues			Extraction sums of squared loadings		
	Total	% of variance	Cumulative %	Total	% of variance	Cumulative %
1	25.059	38.553	38.553	25.059	38.553	38.553
2	8.845	13.608	52.161	8.845	13.608	52.161
3	4.827	7.427	59.588	4.827	7.427	59.588
4	2.866	4.409	63.997	2.866	4.409	63.997
5	1.951	3.001	66.997	1.951	3.001	66.997
6	1.542	2.372	69.370	1.542	2.372	69.370
7	1.066	1.640	71.010	1.066	1.640	71.010
8	1.003	1.543	72.553	1.003	1.543	72.553
9	0.764	1.176	73.729	-	-	-
...				-	-	-
65	0.161	0.248	100.000	-	-	-

The research conducted an examination to detect common method bias by employing the full collinearity assessment approach. A column was added to the dataset and filled with uniformly distributed random numbers generated using the SPSS 26.0 function for generating random numbers following the suggestion of Kock and Lynn (2012). The data was imported into Smart-PLS 4.0.8.7 and a multiple regression model was constructed with the generated random variable as the dependent variable and all other latent variables in the research as independent variables. The PLS algorithm in Smart-PLS 4.0.8.7 software was used to estimate the model. Table 6 shows the obtained Variance Inflation Factor (VIF) metrics. According to Kock (2015) a VIF greater than 3.3 indicates a potential problem with covariance and common method bias in the model. The maximum VIF value obtained in this research was 2.163 which is less than 3.3. In a nutshell, the analysis of the questionnaire data to address the issue of common method bias through Harman's one-factor method and full collinearity assessment approach indicated the absence of significant common method bias concerns.

Table 6. Test results for the common method bias (Based on the full collinearity assessment approach).

Research variables	VIF
Gender	1.031
Outcome expectation	1.159
Perceived external barriers	2.163
Perceived internal barriers	2.128
Physical activity	1.338
Self-efficacy	1.090
Self-regulation	1.265
Social supports	1.377

4.3. Assessment of Measurement Models

The evaluation of the measurement model centered on assessing if the reliability and validity indicators of the measurement tool met the criteria set forth by measurement theory. The C-SSSE questionnaire which has many items was first parceled by parceling its 24 items according to four sub-dimensions as suggested by Matsunaga (2008) which reduces the complexity of the model before evaluating the measurement model. The results of the assessment of the measurement model are shown in Table 7 where the values of the outer loadings range between 0.75 and 0.92 all of which are greater than 0.7. The values of the variance inflation factor (VIF) for all the items range between 2.06 and 4.54, all of which are less than 5 and the values of the Cronbach's alpha for all the constructs range between 0.91 and 0.95, all of which are greater than 0.9; the two indexes ρ_A and ρ_c, which represent the composite reliability also have values above 0.7. The average variance extracted (AVE) values are all above 0.5. These statistical results show that the measurement instrument has reasonable reliability and convergent validity.

Table 7. Measurement model evaluation.

Variables	Items	Outer loadings	VIF	CA	ρ_A	ρ_c	AVE
Social support (SS)	Companion supports	0.91	3.43	0.911	0.913	0.938	0.791
	Emotional supports	0.82	2.13				
	Information supports	0.92	3.76				
	Instrument supports	0.91	3.95				
Outcome expectation (OE)	OE1	0.82	2.49	0.942	0.943	0.951	0.684
	OE2	0.83	2.60				
	OE3	0.83	2.56				
	OE4	0.86	2.98				
	OE5	0.82	2.43				
	OE6	0.86	2.97				
	OE7	0.82	2.50				
	OE8	0.83	2.49				
	OE9	0.77	2.06				
Perceived external barriers (PEB)	PB1	0.88	3.13	0.953	0.953	0.962	0.809
	PB2	0.90	3.91				
	PB3	0.88	3.16				
	PB4	0.90	3.66				
	PB5	0.88	3.08				
	PB6	0.89	3.48				
Perceived internal barriers (PIB)	PB7	0.89	3.44	0.947	0.948	0.958	0.791
	PB8	0.92	4.54				
	PB9	0.87	2.89				
	PB10	0.90	3.56				
	PB11	0.91	3.93				
	PB12	0.92	4.46				
Self-efficacy (SE)	SE1	0.84	2.63	0.937	0.937	0.948	0.694
	SE2	0.84	2.63				
	SE3	0.82	2.36				
	SE4	0.83	2.47				
	SE5	0.85	2.71				
	SE6	0.82	2.39				
	SE7	0.85	2.79				

Variables	Items	Outer loadings	VIF	CA	ρ_A	ρ_c	AVE
	SE8	0.82	2.44				
Self-regulation (SR)	SR1	0.79	2.49	0.949	0.95	0.956	0.644
	SR2	0.76	2.17				
	SR3	0.82	2.78				
	SR4	0.84	3.05				
	SR5	0.82	2.92				
	SR6	0.83	3.12				
	SR7	0.78	2.39				
	SR8	0.75	2.20				
	SR9	0.84	3.21				
	SR10	0.84	3.09				
	SR11	0.80	3.23				
	SR12	0.76	2.76				

Note: VIF = Variance inflation factor; CA = Cronbach's alpha; ρ_A = Composite reliability y(rho_a); ρ_c = Composite reliability(rho_c); AVE= Average variance extracted.

In this article, discriminant validity between measurement instruments measuring different variables was assessed using the Fornell-Larcker criterion and HTMT values together. According to Table 8, the Fornell-Larcker criterion shows that the absolute values of the correlation coefficients between all constructs are less than the square root of the AVE of the corresponding rows and columns. All the HTMT values are less than 0.85. The above analyses indicate acceptable discriminant validity between the different measurement instruments which does not lead to collinearity problems in the subsequent model construction.

Table 8. Discriminant validity.

Variables	Fornell–Larcker criterion						HTMT					
	1	2	3	4	5	6	1	2	3	4	5	6
1. Outcome expectation	0.83											
2. Perceived external barriers	-0.07	0.90					0.08					
3. Perceived internal barriers	-0.06	0.78	0.89				0.06	0.82				
4. Self-efficacy	0.59	0.07	0.08	0.83			0.63	0.07	0.09			
5. Self-regulation	0.66	-0.03	0.03	0.72	0.80		0.70	0.08	0.07	0.76		
6. Social supports	0.56	-0.03	0.05	0.59	0.63	0.89	0.61	0.07	0.09	0.64	0.68	-

4.4. Assessment of Structural Models

The overall model fit was assessed before assessing the significance of the path coefficients in the models. Table 9 shows that the saturated and estimated models had relatively similar fit indices. Both models had a Standardized Root Mean Squared Residual (SRMR) of 0.039 which Pavlov, Maydeu-Olivares, and Shi (2021) deemed indicative of a good fit if the SRMR was less than 0.08. The normalized fit index (NFI) for both models was 0.939 indicating an acceptable fit as NFI values above 0.9 are typically considered acceptable. The evaluation results demonstrate that both the saturated and estimated models have a good fit.

Table 9. Model fit assessment.

Model fit	Saturated model	Estimated model
SRMR	0.039	0.039
d_ULS	1.734	1.740
d_G	0.412	0.416
Chi-square	4654.044	4642.38
NFI	0.939	0.939

The conceptual framework of this research involves 2 multivariate regression sub-models and the problem of collinearity between the independent variables in the two sub-models needs to be assessed to ensure that there is no

problem of collinearity that could lead to an anomalous estimation of the path coefficients. According to Table 10, when physical activity is the endogenous variable, it corresponds to 8 endogenous variables and their VIFs are all less than 5; when self-regulation is the endogenous variable, it corresponds to 7 endogenous variables, and their VIFs are all less than 5. In a nutshell, there is no significant collinearity problem in this research which means that no variables need to be removed or merged due to the collinearity problem. The estimation of the path coefficients in the model does not suffer from the negative effects caused by the collinearity problem.

Table 10. Collinear diagnosis results.

Exogenous variables	Endogenous variables	
	Physical activity	Self-regulation
Self-regulation	3.999	-
Perceived internal barriers	2.658	-
Perceived external barriers	2.654	-
Self-efficacy	2.329	4.655
Gender x self-regulation	2.153	-
Outcome expectation	2.001	4.415
Social supports	1.902	4.325
Gender	1.038	1.041
Gender x self-efficacy	-	4.192
Gender x outcome expectation	-	4.084
Gender x Social supports	-	3.761

The significance of the path coefficients of the structural model was assessed using the bootstrap method, setting bootstrap samples to 5000 and selecting 95% confidence intervals bias corrected, and the estimation of the path coefficients is shown in Figure 2 and Table 11 based on the software Smart-PLS 4.0.8.7. Hypothesis H1a tested the effect of SS on SR and the resulting path coefficient was 0.194, the t-value of the significance test was 5.681, the p-value was less than 0.001, and the path coefficients' 95% confidence intervals did not contain the value of 0 which indicated that hypothesis H1a was supported with certainty. Hypothesis H1b tested the effect of SS on PA and the resulting path coefficient was 0.185.

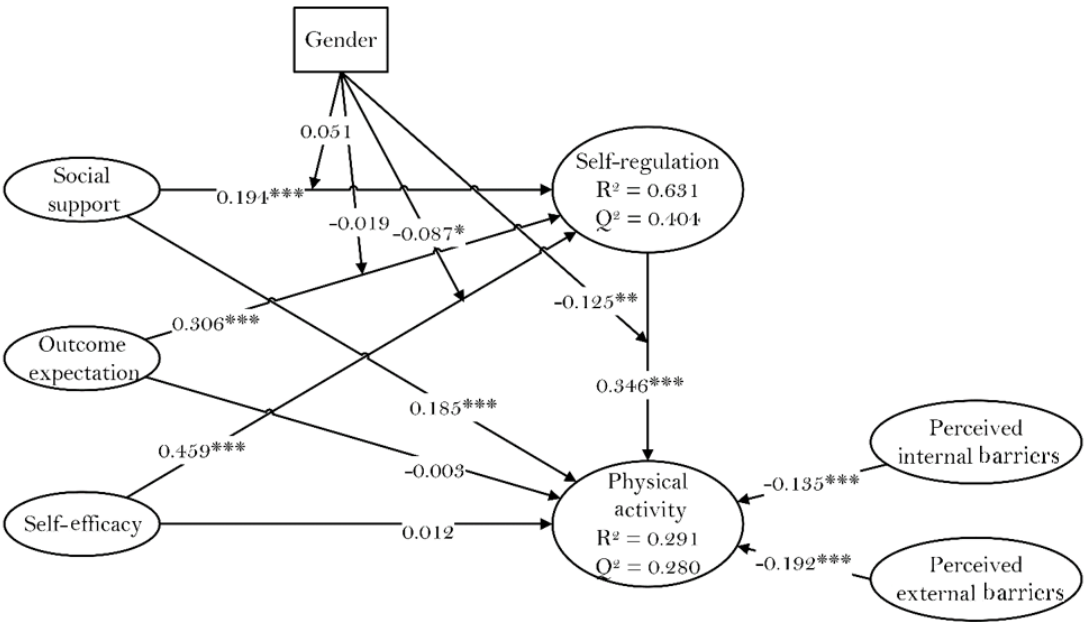

Figure 2. Conceptual framework with parameters.

Note: * p < 0.050; ** p < 0.010; *** p < 0.001.

The t-value of the significance test was 6.127. The p-value was less than 0.001 and the path coefficients' 95% confidence intervals did not contain the value of 0 which indicates that hypothesis H1b was supported with certainty. Hypothesis H2a tested the effect of OE on SR and the resulting path coefficient was 0.306, the t-value of the significance test was 9.067, the p-value was less than 0.001 and the path coefficients' 95% confidence intervals did not contain the value of 0 which indicates that hypothesis H2a was supported with certainty. Hypothesis H2b tested the effect of OE on PA and the resulting path coefficient was -0.003; the t-value of the significance test was 0.114 and the p-value was 0.909 indicating that hypothesis H2b could not be supported.

Hypothesis H3a tested the effect of SE on SR and the observed path coefficient was 0.459. The t-value of the test of significance was 13.761, the p-value was less than 0.001 and the path coefficients' 95% confidence intervals did not contain the value of 0 which indicates that hypothesis H3a was supported with certainty. Hypothesis H3b tested the effect of SE on PA and the resulting path coefficient was 0.012. The t-value of the significance test was 0.363 with a p-value of 0.717 which indicates that hypothesis H3b could not be supported. Hypothesis H4 tested the effect of SR on PA. The resulting path coefficient was 0.346, the t-value of the test of significance was 9.021, the p-value was less than 0.001 and the path coefficients' 95% confidence intervals did not contain the value of 0 which indicated that hypothesis H4 was supported with certainty. Hypothesis H5a tested the effect of PIB on PA and the resulting path coefficient was -0.135, the t-value of the significance test was 4.253, the p-value was less than 0.001, and the path coefficients' 95% confidence intervals did not contain the value of 0 which indicates that hypothesis H5a was definitively supported. Hypothesis H5b tested the effect of PEB on PA and the resulting path coefficient was -0.192, the t-value of the significance test was 6.030, the p-value was less than 0.001 and the path coefficients' 95% confidence intervals did not contain the value of 0. This indicates that hypothesis H5b was supported with certainty. Hypothesis H6 corresponds to the four hypotheses on the moderating effect of gender and the results show that only hypothesis H6c and hypothesis H6d were supported, i.e., gender was shown to significantly modulate the paths "SE→SR" and "SR→PA."

Table 11. Hypotheses test result.

Hypotheses	Path	Path coefficients	f^2	t-statistic	P-values	2.50%	97.50%	Result
H1a	SS-> SR	0.194	0.024	5.681	<0.001	0.130	0.263	Yes
H1b	SS-> PA	0.185	0.025	6.127	<0.001	0.124	0.243	Yes
H2a	OE -> SR	0.306	0.057	9.067	<0.001	0.238	0.370	Yes
H2b	OE -> PA	-0.003	<.001	0.114	0.909	-0.058	0.053	No
H3a	SE -> SR	0.459	0.123	13.761	<0.001	0.392	0.521	Yes
H3b	SE -> PA	0.012	<.001	0.363	0.717	-0.051	0.073	No
H4	SR -> PA	0.346	0.042	9.021	<0.001	0.267	0.418	Yes
H5a	PIB-> PA	-0.135	0.010	4.253	<0.001	-0.199	-0.075	Yes
H5b	PEB -> PA	-0.192	0.020	6.030	<0.001	-0.255	-0.130	Yes
H6a	Gender x SS-> SR	0.051	-	1.183	0.237	-0.038	0.130	No
H6b	Gender x OE -> SR	-0.019	-	0.453	0.650	-0.097	0.067	No
H6c	Gender x SE -> SR	-0.087	-	2.048	0.041	-0.172	-0.003	Yes
H6d	Gender x SR -> PA	-0.125	-	3.297	0.001	-0.196	-0.046	Yes

According to the rule of thumb mentioned by Hair, Hult, Ringle, and Sarstedt (2016) an R^2 value of 0.75, 0.50, and 0.25 for the endogenous latent variables corresponds to the predictive power of the model that can be characterized as strong, moderate or weak, respectively. The graph of the model estimation results shown in Fig. 2 indicates that the R^2 value of the endogenous variable self-regulation is 0.631and that of the endogenous variable physical activity is 0.291. This indicates that the model constructed in the present research has a moderate predictive ability for self-regulation and a weak predictive ability for physical activity.

According to Cohen (1988) the values of f^2 at 0.02, 0.15, and 0.35 correspond to small, medium, and large effects of varying strengths. Furthermore, an f^2 value below 0.02 signifies the absence of any effect. As shown in

Table 12, if the path affect values corresponding to H2b, H3b, and H5a are all less than 0.02, they can be considered to have no effect. It is postulated that the pathway representing H2b and H3b denotes the direct impact of outcome expectation and self-efficacy on physical activity. Upon inspection of the importance test outcomes of the path coefficients, it is evident that the direct influence of outcome expectation and self-efficacy on physical activity is not statistically substantial. Hypothesis H5a pertains to the influence of perceived internal barriers on physical activity. The test findings indicate that the impact of perceived internal barriers on physical activity is noteworthy despite being statistically significant. Its effect value has yet to reach the level of 0.02, and it can be assumed that perceived internal barriers have no effect on the amount of physical activity. Except for the hypothesis of moderating effect, the effect values of the paths corresponding to the other hypotheses of this research are between 0.02 and 0.15, all of which are at the level of minor effects.

4.5. Analysis of Mediating Effects

The significance of the mediating path coefficients was assessed using the bootstrap method in the Smart-PLS 4.0.8.7 software, setting the bootstrap samples to 5000 and selecting a 95% bias-corrected confidence interval. The results are shown in Table 12. The indirect effect value of social support on physical activity through self-regulation was 0.067 with a 95% confidence interval of 0.042, 0.098 and the p-value for the significance test was less than 0.042. The indirect effect value of social support on physical activity through self-regulation is 0.067, the 95% confidence interval is 0.042, 0.098. The p-value of the significance test is less than 0.001 and the indirect effect value accounts for 26.59% of the total effect of social support on physical activity which is partially mediated. The mediating effect of outcome expectation has a direct effect value of -0.003 on physical activity with a 95% confidence interval of -0.058,0.053 and a p-value of 0.909 for the test of significance and the direct effect is statistically insignificant. The indirect effect value of outcome expectation on the indirect effect of outcome expectation on physical activity through self-regulation was 0.106 with a 95% confidence interval of 0.076, 0.139 and a significance test p-value of 0.001 which means that the mediating effect was fully mediated. The value of the indirect effect produced by self-efficacy through self-regulation on physical activity is 0.159 and the 95% confidence interval is 0.119, 0.201. The p-value of the significance test is less than 0.001. The magnitude of the indirect impact corresponds to 93.53% of the overall impact of self-efficacy on physical activity indicating that this intermediary influence completely mediates the relationship.

Table 12. Results of indirect effects analysis.

Hypotheses	Path	Path coefficients	SE	t-statistic	P-values	2.50%	97.50%	VAF
Indirect effect								
H7	SS-> SR -> PA	0.067	0.014	4.736	<0.001	0.042	0.098	26.59%
H8	OE -> SR -> PA	0.106	0.016	6.443	<0.001	0.076	0.139	-
H9	SE -> SR -> PA	0.159	0.021	7.604	<0.001	0.119	0.201	93.53%
Direct effect								
SS-> PA		0.185	0.030	6.127	<0.001	0.124	0.243	-
OE -> PA		-0.003	0.028	0.114	0.909	-0.058	0.053	-
SE -> PA		0.012	0.032	0.363	0.717	-0.051	0.073	-
Total effect								
SS-> PA		0.252	0.031	8.253	<0.001	0.192	0.311	-
OE -> PA		0.103	0.029	3.494	<0.001	0.047	0.161	-
SE -> PA		0.170	0.032	5.387	<0.001	0.107	0.230	-

4.6. Analysis of Moderating Effects

The results in Figure 3 of the significance analysis of the moderating effect of gender show that hypothesis H6a (gender has a significant moderating effect on the path "social support → self-Regulation") corresponds to the coefficient value of the moderating effect being 0.051 and the p-value of the significance test being 0.237 which is greater than 0.05 indicating that hypothesis H6a cannot be supported. Hypothesis H6b posits that gender exerts a notable moderating influence on the relationship between "outcome expectation → self-regulation." The coefficient representing this moderating impact is calculated at -0.019 with the associated P-value for the significance test being 0.650. This measurement surpasses the threshold of 0.05 suggesting a lack of evidence to support hypothesis H6b. Consequently, hypothesis H6b is deemed unsupported. Hypothesis H6c is that gender has a significant moderating effect on the path "self-efficacy → self-regulation." The coefficient value of the corresponding moderating effect is -0.087 and the P-value of the significance test is 0.041 which means that hypothesis H6c is supported. Figure 3(a) shows the moderating effect of gender on the path "self-efficacy → self-regulation" when the gender is male (gender = 1), the corresponding coefficient value of the path "self-efficacy → self-regulation" is -0.087 indicating that hypothesis H6c is supported. Regulation "when gender is male (gender = 1), the path "self-efficacy → self-regulation" corresponds to a smaller regression slope, i.e., the effect of self-efficacy on self-regulation is significantly weaker in the female group. Hypothesis H6d is that gender has a significant moderating effect on the path "self-regulation → physical activity," and the coefficient value of the corresponding moderating effect is -0.125 and the P-value of the significance test is 0.001 which means that hypothesis H6d is supported. Figure 3(b) shows the moderating effect of gender on the path "self-regulation → physical activity." When the gender is male (gender = 1), the path "self-regulation → physical activity" corresponds to the coefficient value of -0.125, the P-value of the significance test is 0.001 indicating that hypothesis H6d is supported. Physical activity" corresponds to a smaller regression slope, i.e., the effect of self-regulation on physical activity is significantly weaker in male groups relative to females.

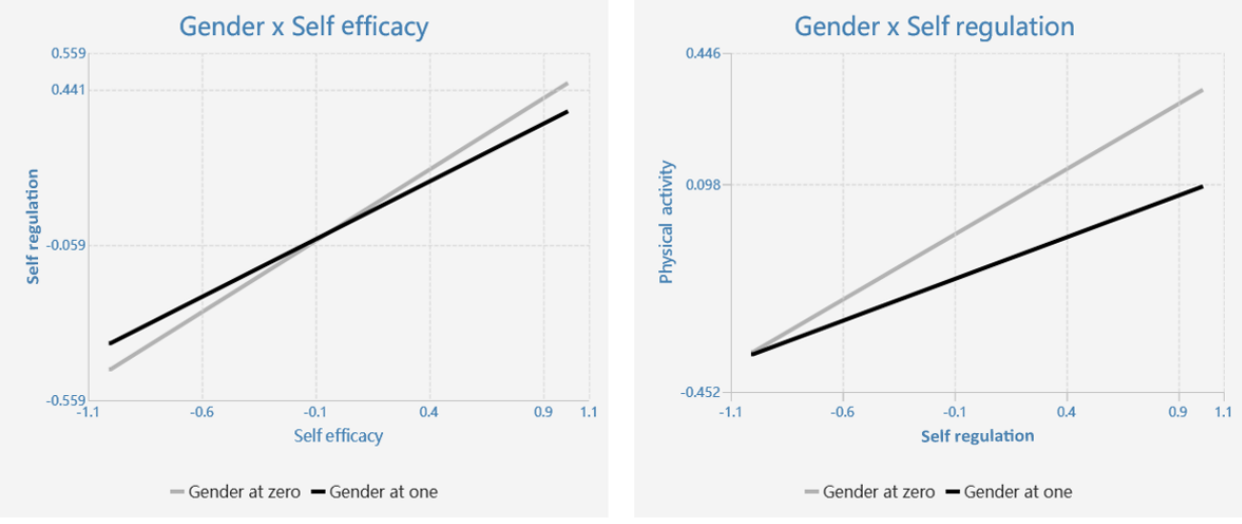

Figure 3. Interaction effect diagram of the moderating role of gender.

5. DISCUSSION

5.1. Key Findings

The findings indicate that out of the three favorable social cognitive factors, namely exercise social support, physical activity outcome expectation, and physical activity self-efficacy only social support directly influences university students' physical activity levels. Conversely, adverse social cognitive factors such as perceived barriers to physical activity have a noteworthy adverse effect on university students' physical activity, thereby addressing

the inquiry denoted as RQ1. Social support, outcome expectation, and self-efficacy all play a constructive and statistically significant role in predicting physical activity levels through the mechanism of self-regulation , thus addressing the research query denoted as RQ2. The intermediary pathways through which social support, outcome expectation, and self-efficacy impact physical activity levels through self-regulation are influenced by gender, hence providing insight into research question RQ3. These outcomes will be comprehensively deliberated in the subsequent sections.

5.2. The Mediating Role of Self-Regulation

In line with the findings of Liu et al. (2022) the mediating role of the variable self-regulation in the present study is also considered to be statistically significant. When assessing the total effect, social support, outcome expectation, and self-efficacy manifest statistically significant impacts on the level of physical activity with social support showing the most significant positive impact followed by self-efficacy and outcome expectation showing the least effect. Analyzing the indirect effects, social support, outcome expectation, and self-efficacy also significantly impact physical activity through intermediary variables. Observing the correlation among variables, social cognitive factors (such as social support, outcome expectation, self-efficacy, and self-regulation) are notably positively associated with the level of physical activity aligning closely with various studies on physical activity (Bogataj et al., 2020 Leyton-Roman et al., 2020; Neal et al., 2024; Otundo & MacGregor, 2019; Petosa et al., 2005; Siagian et al., 2023). The conclusions drawn by Siagian et al. (2023) align with these findings. Nonetheless, a discrepancy is evident in terms of the relative magnitudes of the influences of these social cognitive factors on physical activity. For instance, Siagian et al. (2023) suggest that self-efficacy has the most substantial influence. The data analysis indicates that social support yields the greatest impact. These nuanced distinctions could potentially be attributed to variations in the composition of sample groups across different studies.

5.3. Negative Effects of Physical Activity Perceived Barriers

This investigation also identified that impairment in perception had a notable adverse predictive impact on the level of physical activity aligning with the findings of Gong and Sheng (2022) and Brown et al. (2024). Within this investigation, perceptual disorders are categorized into two sub-dimensions: internal and external perceptual disorders. The statistical findings indicate that both sub-dimensions of perceptual disorders significantly hinder physical activity. Nonetheless, regarding effect size, the impact of internal perceptual disorders is negligible and can be deemed statistically insignificant. The external factors contributing to the disorder in perceiving physical activity generally stem from barriers such as a deficient sports environment, inadequate sports equipment, and other related resources. This corresponds with the research outcome of Brown et al. (2024). This study also uncovered proof of a negative association between them despite the discovery by Gong and Sheng (2022) of an inverse relationship between subjective disruptions in perception and the level of physical activity. However, it was observed that the effect of internal disruptions in perception was relatively feeble when assessed from the perspective of effect size. Brown et al. (2024) highlighted the absence of a strong correlation between internal disruptive factors linked to "memory, attention, and decision-making processes" and physical activity patterns, mirroring the empirical analysis outcomes of this investigation.

5.4. The Moderating Effect of Gender

In terms of the controlling impact of sex, the findings acquired in this investigation differ significantly from the deductions of Liu et al. (2022). In this research, sex has been observed to notably govern the impact of self-confidence on self-regulation. Sex also moderates the impact of self-regulation on physical activity. According to Liu et al. (2022) neither of these two routes was controlled by sex. The research subject of Liu et al. (2022) is Chinese juveniles aged between 12 and 15 years old, predominantly secondary school students. The subject of this

manuscript's research is Chinese university students, predominantly between 18 and 21 years old. In China, the physical activity of secondary school students is largely organized by the school physical education curriculum, and it is logical to assume that there is no evident distinction between males and females. University students have more self-governance in their physical exercises. Each university student can freely organize the kind, duration and intensity of their physical exercises. Data examination in this research reveals that self-confidence exhibits notable variances in its impact on self-regulation for university students of varying sexes. Self-confidence in the male group has a significantly weaker impact on self-regulation. In simpler terms, self-confidence's impact on male university students' self-regulation is weaker. The investigation also discovered that the self-regulation of male university students had a weaker influence on the quantity of physical activity.

6. CONCLUSION

6.1. Theory Implications

The sedentary lifestyle of Chinese university students is associated with health issues including obesity. Additionally, it can lead to increased psychological pressure and reduced academic performance. This study aims to provide empirical evidence on the factors that influence the physical activity levels of Chinese university students. This study presents a conceptual framework based on social cognitive theory. Empirical research findings indicate that social support, outcome expectation, self-efficacy, and self-regulation significantly promote physical activity among university students. Perceptual impairment mainly external impairment such as lack of activity space and sports equipment significantly reduces the physical activity level of university students.

6.2. Practical Implications

It is recommended that China's education authorities, university institutions, parents and other social groups take measures to enhance the physical activity level of Chinese university students based on the study results. University students' parents, university presidents, and teachers should motivate university students to engage in physical activities and offer them financial assistance to provide social support. It is recommended that media organizations promote the benefits of physical activity, foster positive attitudes towards physical activity among university students and emphasize the personal advantages of participating in physical activity and exercise to achieve the desired outcome. Regarding self-efficacy, university students primarily depend on self-learning to acquire fundamental knowledge of scientific exercise and sports, boosting their confidence when participating in physical activities. Education authorities and university institutions should invest more resources in providing free or affordable venues and equipment for university students' physical activities. Additionally, they should lower the threshold for university students to participate in various sports, thus promoting physical activity levels. Self-efficacy has a greater impact on self-regulation and the amount of physical activity for female university students. Therefore, it is important to focus on improving female university students' self-efficacy in exercise. Relevant exercise courses can enhance their confidence to participate in various physical activities.

6.3. Research Limitations and Suggestions

This study primarily focuses on university students in Guangzhou, China as the sample group. Therefore, the results may only be generalizable to some Chinese university students. Future research should involve a larger and more diverse sample of scholars using random sampling to select research objects across China. This will enable the development of a model that can accurately reflect the overall physical activity of Chinese university students. Furthermore, this study solely examined the impact of social cognitive factors on the physical activity levels of university students. The model's explanation of physical activity only accounted for approximately 30% of the variation. To improve future studies, it is recommended to incorporate additional potential influencing factors within an appropriate framework. Finally, this is a cross-sectional study. All variables were collected through the

same questionnaire simultaneously which may introduce some bias. In future research, a longitudinal study with an appropriate framework could be considered to understand how factors affecting university students' physical activity change over time and how changes in these influencing factors affect the physical activity of university students.

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