



Construction of a Psychological Intervention Model for Adolescent Physical Exercise Behavior

Fenggang Zhu¹ and Wenting Han^{2,*}

¹ Shandong Foreign Trade Vocational College Taian Campus Taian 271000, Shandong, China

² Graduate School of Management, Management and Science University, Shah Alam, 40100, Selangor, Malaysia.

SUMMARY: *Based on self-determination theory (SDT), social cognitive theory (SCT), and planned behavior theory (TPB), this study systematically investigates the key influencing factors of psychological intervention for adolescent physical exercise. This study involved 1200 adolescents from six middle schools in three provinces: Jiangsu, Hubei, and Sichuan. The age distribution of these students was 12-18 years old, with $M=15.3 \pm 1.7$ years old. Small scale empirical tests have shown that with changes in psychological intervention factors for physical exercise, the weekly exercise frequency increased from 1.12 ± 0.35 times to 2.97 ± 0.42 times, the duration of each exercise session increased from 38.6 ± 12.3 minutes to 65.8 ± 15.6 minutes, and the exercise intensity increased from 2.3 ± 0.6 minutes to 3.7 ± 0.8 minutes. The psychological indicators of adolescents also showed significant improvement, such as a 39.9% increase in initiative indicators, a 40.7% increase in self-efficacy indicators, a 39.3% increase in social support indicators, and a 44.7% increase in sports identity indicators. This model provides an effective analytical method for psychological intervention in adolescent physical exercise.*

KEYWORDS: *Adolescents; Physical Exercise Behavior; Psychological Intervention; Self-Determination Theory; Intervention Model; Structural Equation Modeling*

1 Introduction

The comprehensive development of teenagers is essential for promoting social progress and improving their physical and mental health, which is of great significance to the development of the country and society [1, 2]. Since the resumption of the college entrance examination, China's higher education has experienced rapid development. According to the National Bureau of Statistics, the number of undergraduate and junior college students has exceeded 30 million, and the number of enrolled students is huge. The country has to pay attention to the development of adolescent mental health [3]. In 1994, the concept of "mental health education" was also reflected in national policies by strengthening psychological health education and guidance for students through various means. It can be seen that the constantly issued mental health education documents reflect the country's emphasis on student mental health education, especially on the mental health of adolescent students [4].

With the continuous progress of society, more and more social groups are paying attention to the mental health issues of teenagers. The development of adolescent mental health is an important foundation for their comprehensive development [5]. Only by cultivating and

*15153802800@163.com

<https://doi.org/10.65102/is20261118>

building good psychological qualities among adolescents can they play a positive role in promoting national prosperity and progress. The development of teenagers is related to the development of society, but there are many factors in the growth environment of teenagers that are not conducive to the development of mental health. Reference [6] selected adolescent students using discriminant sampling and screened them using the Depression Anxiety Stress Scale. Reference [7] used a self-assessment scale for depression and anxiety to randomly select undergraduate students from universities for a questionnaire survey, investigating the mental health status of adolescents. The research results all show that the current mental health status of adolescents is not optimistic, and the level of adolescent mental health needs to be further improved in order to enable adolescents to achieve comprehensive development [8]. The cultural level and social status of teenagers determine that they often face various psychological pressures and conflicts in their daily learning and life. There are practical problems in higher education institutions, such as large scale of operation, large number of students, and complex and variable mental health conditions of students [9]. Various higher education institutions offer diversified mental health education courses and adopt various methods to carry out adolescent mental health education and training, such as learning mental health education courses, building mental health education bases, and setting up psychological counseling rooms to provide mental health education to adolescents. However, theoretical learning is only the basic requirement for the current psychological education of young students, and corresponding interactive learning and practical activities are more popular. Youth psychological education should achieve the integration of knowledge and action. Therefore, young people need to further expand the path of promoting the development of their mental health, starting from physical exercise, explore the intervention effect of physical exercise on their mental health, and provide a basis for expanding the intervention methods for their mental health through empirical research [10].

From current research, studies on the effectiveness of physical exercise in intervening in mental health mainly focus on its impact on individual emotions and cognition, while there is relatively little research specifically on adolescent psychological anxiety. There is also a lack of research on the differences in the intervention effects of different programs on adolescent psychological anxiety. Therefore, further research is urgently needed on the intervention effects of physical exercise on adolescent psychological anxiety.

2 Literature Review

2.1 Current Status of Research on Adolescent Mental Health

May 25th is the Youth Mental Health Day, and young people have actively responded by designating May as the Mental Health Activity Month in China and actively carrying out various mental health education activities. Placing the focus issue of adolescent mental health in an important position [11]. However, although China has a large population, most teenagers nowadays are born in the 1980s and 1990s, and there are many only child families. This will have a certain impact on the personality, psychology, and other aspects of the growth process of only children, inevitably leading to psychological characteristics such as strong dependence, avoidance of problems, psychological fragility, strong personality, prominent hostility, sensitivity, irritability, paranoia, anorexia nervosa, and high psychological pressure. The survey results of tens of thousands of college and high school students in Hangzhou city show that 16.79% of students have serious psychological problems. Reference [12] suggests that there are significant differences in all SCL-90 factor scores among students from six different majors and physical health conditions, based on a survey of adolescent mental health status;

Reference [13] pointed out in its investigation, analysis, and countermeasures on the mental health status of adolescents that the overall mental health status of adolescent students is at a moderate to low level, with a psychological problem incidence rate of 15.3%. The mental health level of female students is lower than that of male students; The factor scores of senior students are higher than those of junior students, with significant differences; There are significant differences in individual factors between male and female students, as well as between urban and rural students. Reference [14] analyzes the relationship between self-identity and adolescent mental health, and suggests that the formation of self-identity in adolescents can enhance their personal strength and improve their adaptability. Identity crisis will lead to difficulty in forming self-concept, which can easily cause conflict, anxiety, pain, and anxiety within individuals. Reference [15] focuses on the analysis of the psychological status of adolescents and the strategies for mental health education, studying the psychological status of adolescents from the perspectives of individual development, conflict psychology, and the emergence of psychological problems in adolescents;

The above review shows that research on the mental health of adolescents has been conducted theoretically, mainly through logical analysis, and has achieved considerable research results [16]. In addition to believing that adolescents are open, lively, and competitive, it is also believed that some adolescents have negative psychological phenomena such as inferiority, lack of confidence, and overestimation of their own abilities. Secondly, it was conducted through questionnaire testing and significant progress has been made. In testing research, it was found that psychological problems among adolescents are increasing, and the mental health level of female adolescents is lower than that of male adolescents [17]. There are significant differences between adolescents from different majors and urban and rural areas. The purpose of this study is to find a suitable channel for maintaining and sustaining the long-term benefits of adolescent mental health through research on their mental health status.

2.2 Current Status of Research on Physical Exercise Intervention

Lack of sufficient physical activity can have serious consequences on human health, resulting in approximately 2 million deaths worldwide each year. Most studies have shown that both long-term physical exercise and one-time physical activity can produce good emotional benefits and effectively improve the psychological environment; There are research reports that a 30-minute run significantly improves negative emotional states such as tension, confusion, fatigue, anxiety, depression, and anger; Appropriate physical exercise can reduce stress [18]. At least six meta-analysis studies on the relationship between physical exercise and anxiety relief have been conducted internationally, indicating a correlation between physical exercise and anxiety relief. For example, completing a certain task in physical exercise has the effect of regulating individual emotions and improving mood. Reference [19] on the influencing factors of adolescent mental health and the psychological intervention effect of physical exercise shows that aerobic exercise with strong entertainment and fun can help improve mood, and the effect is long-lasting. Regarding exercise intensity, it is generally believed that moderate exercise intensity has good psychological benefits, while high intensity tends to increase negative emotions such as tension and anxiety. Reference [20] suggests that physical exercise can effectively reduce the tension, anger, fatigue, depression, and panic of adolescents, improve students' self-esteem, and have better psychological health effects when engaging in larger amounts of exercise. Research on interventions for depression, such as the intervention experiment on adolescent depression and physical exercise in reference [21], and the investigation on the effects of physical exercise on adolescent

self-esteem and depression levels in reference [22], suggest that intervening in adolescent depression through physical exercise can significantly improve the condition; Reference [23] suggests that in relaxed and autonomous sports activities, students can fully enjoy the pleasure of physical exercise, and the control, regulation, and treatment effects on students' negative emotions such as anxiety and depression are significant; Research on interventions for self-esteem, such as the effects of physical exercise on adolescent self-esteem and mental health in reference [24], and the impact of physical exercise on students' self-concept, self-esteem, and life satisfaction in reference [25], suggests that different levels of physical exercise can improve an individual's self-esteem; A meta-analysis conducted in reference [26] suggests that sports activities have a positive effect on personality development; Intervention studies on inferiority complex, such as the intervention study on adolescent inferiority complex and physical exercise in reference [27], suggest that under moderate intensity exercise conditions, 12 weeks of physical exercise can reduce the level of inferiority complex in participants to varying degrees; Intervention studies on self-efficacy, suggest that high-intensity and prolonged exercise in extracurricular physical activities among adolescents can promote the improvement of general self-efficacy; Reference [28] suggests that the pleasure of exercise is an important factor in maximizing the psychological health effects of exercise.

The intervention methods for adolescent mental health are mostly carried out through ideological education models, and there are few interventions for adolescents through physical exercise. The article on the multidimensional impact of cognitive exercise intervention on adolescent mental health in reference [29] suggests that cognitive exercise intervention in aerobics has a significant effect on alleviating and improving obsessive-compulsive symptoms and paranoid factors. This paper aims to promote the mental health of adolescents and use physical exercise as an intervention method. It attempts to find a multidimensional intervention method for adolescent mental health that focuses on entertainment, fitness, and popular activities, in order to contribute to the healthy growth of adolescents.

3 Research Methods

3.1 Research Design

The basic information survey for college students mainly includes six items: gender, major, home address, whether they are poor students, whether they are only children, and whether they are single parents. By conducting a survey on the basic situation of college students, we aim to understand their individual circumstances and lay the groundwork for further research on their mental health status.

The SCL-90 scale was developed by Derogatis, L.R. (1975) and is a commonly used self-assessment scale for mental symptoms. It is one of the criteria for evaluating mental health standards and belongs to statistical norms. SCL-90 has a wide range of applications and is widely adopted both domestically and internationally. The SCL-90 scale consists of 10 factors, with 90 items divided into ten categories, each factor reflecting a specific aspect of the subject's condition. Specifically, it includes somatization, obsessive-compulsive symptoms, interpersonal sensitivity, depression, anxiety, hostility, terror, paranoia, psychoticism, and others.

The SCL-90 scale generally adopts a 5-point scoring standard, where level 1 represents asymptomatic, level 2 represents mild, level 3 represents moderate, level 4 represents heavy, and level 5 represents severe. Factor scores are usually used to reflect the psychological health

level of participants. Factor scores refer to the total score of each item that makes up a factor divided by the average score of the number of items that make up a factor. The higher the factor score, the worse the psychological health level of the participant, and vice versa, the better.

3.2 Research Objects

3.2.1 Questionnaire Survey Participants

Inclusion criteria: (1) Voluntary participation with informed consent (guardian consent for minors); (2) No severe physical (e.g., heart disease, asthma) or psychological disorders (e.g., depression); (3) No regular physical exercise in the past 3 months (<3 sessions/week). Exclusion criteria: (1) Incomplete questionnaires (>10% missing data); (2) Patterned responding (e.g., consecutive identical choices); (3) Withdrawal from the study. Ultimately, 1086 valid questionnaires were collected (90.5% valid response rate). Participants included 623 males (51.9%), 577 females (48.1%); 651 middle school students (60.0%), 435 high school students (40.0%); 724 urban (66.7%), 362 rural (33.3%).

3.2.2 Focus Group Interview Participants

Stratified sampling based on gender (male/female), age (middle/high school), and exercise level (regular exercise: ≥ 3 sessions/week; occasional exercise: 1-2 sessions/week; no exercise: <1 session/week) was used to select 48 adolescents forming 12 focus groups (4 persons/group). This included 24 males, 24 females; 24 middle school, 24 high school; 16 regular exercisers, 16 occasional exercisers, 16 non-exercisers. Inclusion criteria [30]: (1) Participated in Phase 1 survey; (2) Clear expression ability; (3) Voluntary participation.

3.2.3 Quasi-Experiment Participants

240 adolescents from two middle schools (1 urban, 1 rural) in Hubei province were selected. Using a random number table, they were assigned to an intervention group (n=120) and a control group (n=120). Intervention group: 63 males, 57 females, age 14.9 ± 1.5 years, 82 middle school, 38 high school, 70 urban, 50 rural. Control group: 61 males, 59 females, age 15.1 ± 1.4 years, 80 middle school, 40 high school, 68 urban, 52 rural. No significant differences were found between groups at baseline regarding gender ($\chi^2=0.07$, $p=0.79$), age ($t=0.86$, $p=0.39$), school level ($\chi^2=0.13$, $p=0.72$), residence ($\chi^2=0.11$, $p=0.74$), exercise behavior (frequency: $t=0.92$, $p=0.36$; duration: $t=0.78$, $p=0.44$), or psychological indicators (self-efficacy: $t=0.65$, $p=0.52$; autonomous motivation: $t=0.71$, $p=0.48$; social support: $t=0.58$, $p=0.56$; exercise identity: $t=0.62$, $p=0.54$) ($p>0.05$), indicating comparability.

3.3 Research Instruments

All scales underwent translation-back translation procedures (by two PhDs in Sports Psychology, reviewed by an English professor) to ensure cross-cultural adaptability. Scales demonstrated good reliability and validity:

3.3.1 Psychological Factor Scales

Used the Adolescent Physical Activity Questionnaire (APAQ), covering frequency (sessions/week), duration (minutes/session), and intensity (1=low, 5=high), measured via self-report. Cronbach's α was 0.82, test-retest reliability (2-week interval) was 0.80.

3.3.2 Psychological Factor Scales

Exercise Self-Efficacy Scale (ESES): Used the scale by Schwarzer & Luszczynska (2017), 10 items, 5-point Likert scale (1=strongly disagree, 5=strongly agree). Higher scores indicate higher self-efficacy. Cronbach's $\alpha=0.86$, test-retest reliability=0.83.

Behavioral Regulation in Exercise Questionnaire-3 (BREQ-3): Used the scale, 24 items, 5-point Likert scale, covering amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, intrinsic regulation. Autonomous motivation score is the sum of identified, integrated, and intrinsic regulation scores. Higher scores indicate stronger autonomous motivation. Cronbach's $\alpha=0.88$, test-retest reliability=0.85.

Social Support for Physical Activity Scale (SSPAS): Used the scale by Uchida et al. (2020), 12 items, 5-point Likert scale, covering family, peer, and school support. Higher scores indicate higher social support. Cronbach's $\alpha=0.84$, test-retest reliability=0.81.

Exercise Identity Scale (EIS): Used the scale, 8 items, 5-point Likert scale. Higher scores indicate stronger exercise identity. Cronbach's $\alpha=0.83$, test-retest reliability=0.80.

3.4 Data Collection

3.4.1 Questionnaire Survey Data Collection

Conducted from September to October 2024. Organized by schools, trained investigators (sports psychology graduate students) guided adolescents to complete anonymous questionnaires in classrooms (~20 minutes), distributed and collected on-site. Purpose, procedures, and confidentiality were explained beforehand; informed consent was obtained.

3.4.2 Focus Group Interview Data Collection

Conducted from November to December 2024 in quiet school meeting rooms. Each session lasted 45-60 minutes, facilitated by two investigators (one leading, one recording). An interview guide was used (core questions: "Why don't you like physical exercise?", "How would you prefer to participate in exercise?", "Who would you feel more motivated exercising with?"). Sessions were audio-recorded, transcribed, and transcripts verified by participants before analysis.

3.4.3 Quasi-Experiment Data Collection

Conducted from March to June 2025, with a 12-week intervention period. Exercise behavior and psychological indicator data were collected from both groups pre-intervention (T0) and post-intervention (T1), using the same method as the survey. The intervention group received the 12-week psychological intervention (two 60-minute sessions weekly at school sports facilities). The control group received no intervention, participating only in regular PE classes.

4 Results

4.1 Overall Status of Adolescents' Physical Exercise Behavior and Psychological Indicators

Descriptive statistics indicated that both exercise behavior and psychological indicators were at medium-low levels (Table 1): average weekly frequency was 1.32 ± 0.45 sessions, average duration per session was 42.5 ± 13.6 minutes, average intensity was 2.3 ± 0.6 points. Only 16.2% met the WHO recommendation of 60 minutes of daily moderate-to-vigorous activity.

Psychological indicators: self-efficacy 3.12±0.78, autonomous motivation 2.98±0.82, social support 3.05±0.76, exercise identity 2.86±0.81 (all scales 5-point, 3 being medium level).

Table 1: Descriptive Statistics for Adolescent Physical Exercise Behavior and Psychological Indicators (M±SD)

Indicator	Mean±SD	Min	Max	Coefficient of Variation
Exercise Frequency (sessions/week)	1.32±0.45	0	3	0.34
Exercise Duration (minutes/session)	42.5±13.6	10	90	0.32
Exercise Intensity (1-5 points)	2.3±0.6	1	5	0.26
Self-Efficacy (1-5 points)	3.12±0.78	1	5	0.25
Autonomous Motivation (1-5 points)	2.98±0.82	1	5	0.28
Social Support (1-5 points)	3.05±0.76	1	5	0.25
Exercise Identity (1-5 points)	2.86±0.81	1	5	0.28

4.2 Identification of Key Psychological Influencing Factors

4.2.1 Correlation Analysis Results

Pearson correlation analysis showed that self-efficacy, autonomous motivation, social support (family, peer, school), and exercise identity were all significantly positively correlated with exercise frequency, duration, and intensity (r=0.51~0.62, p<0.001). Self-efficacy had the highest correlation with exercise behavior (r=0.62), while school support had the lowest (r=0.51) (Table 2).

Table 2: Correlation Analysis Results between Psychological Factors and Exercise Behavior (r values)

Indicator	Ex. Frequency	Ex. Duration	Ex. Intensity	Ex. Behavior Composite
Self-Efficacy	0.59***	0.61***	0.57***	0.62***
Autonomous Motivation	0.56***	0.58***	0.54***	0.58***
Social Support	0.53***	0.55***	0.52***	0.54***
Family Support	0.52***	0.54***	0.51***	0.53***
Peer Support	0.54***	0.56***	0.53***	0.55***
School Support	0.51***	0.52***	0.50***	0.51***
Exercise Identity	0.55***	0.57***	0.53***	0.55***

*Note: ***p<0.001

4.2.2 Regression Analysis Results

Multiple stepwise regression with the exercise behavior composite score (frequency × duration × intensity) as the dependent variable and self-efficacy, autonomous motivation, family support, peer support, school support, exercise identity as independent variables showed (Table 3): Self-efficacy, autonomous motivation, peer support, and exercise identity entered the regression equation, collectively explaining 48.6% of the variance in exercise behavior (F=132.56, p<0.001). Self-efficacy had the strongest predictive power (β=0.28), followed by autonomous motivation (β=0.24), exercise identity (β=0.21), and peer support (β=0.18). The basic form of a regression model is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \epsilon \tag{1}$$

where, Y is the dependent variable (comprehensive score of exercise behavior), X_1, X_2, \dots, X_n are independent variables (self-efficacy, self motivation, peer support, exercise identity, etc.), β_0 is the intercept, $\beta_1, \beta_2, \dots, \beta_n$ are regression coefficients, and ϵ is the error term.

Table 3: Multiple Stepwise Regression Analysis Results for Adolescent Physical Exercise Behavior

Variable	Entry Order	β	Std. Error	t	p	R ²	Adjusted R ²	F
Self-Efficacy	1	0.28	0.03	8.62	<0.001	0.384	0.383	235.61
Autonomous Motivation	2	0.24	0.03	7.35	<0.001	0.446	0.444	189.37
Exercise Identity	3	0.21	0.03	6.78	<0.001	0.472	0.469	165.82
Peer Support	4	0.18	0.03	5.43	<0.001	0.486	0.483	132.56

4.2.3 Structural Equation Modeling Results

This study used AMOS 24.0 to construct a structural equation model to verify the path relationship between self-efficacy, self motivation, peer support, exercise identity, and exercise behavior. The basic form of the model is:

$$\eta = \beta\eta + \gamma\xi + \zeta \quad (2)$$

where, η is the endogenous latent variable (such as exercise behavior), ξ is the exogenous latent variable (such as self-efficacy, self motivation, peer support, etc.), β is the relationship coefficient between endogenous latent variables, γ is the influence coefficient of exogenous latent variables on endogenous latent variables, and ζ is the error term.

The SEM constructed using AMOS 24.0 showed good model fit ($\chi^2/df=2.36$, RMSEA=0.042, GFI=0.92, CFI=0.94), meeting standard criteria ($\chi^2/df<3$, RMSEA<0.05, GFI>0.90, CFI>0.90). Specific path relationships: Self-efficacy ($\beta=0.26$, $p<0.001$), autonomous motivation ($\beta=0.23$, $p<0.001$), and peer support ($\beta=0.15$, $p<0.001$) directly influenced exercise behavior. Peer support also indirectly influenced exercise behavior through exercise identity ($\beta=0.12$, $p<0.001$), with a mediation effect proportion of 23.5%. Paths from self-efficacy and autonomous motivation to exercise behavior via exercise identity were not significant ($p>0.05$).

4.3 Mining of Psychological Intervention Needs for Adolescents' Physical Exercise

Content analysis of focus group transcripts revealed three core psychological intervention needs: Personalization (mentioned 128 times), Enjoyment (116 times), and Social Integration (102 times). Personalization included "choose activities based on interest," "tailor plans to fitness level," "flexible scheduling." Enjoyment included "gamify exercise," "add competitive elements," "avoid repetitive drills." Social Integration included "exercise with peers," "parent companionship," "mutual encouragement and recognition during exercise."

4.4 Construction of Psychological Intervention Model for Adolescents' Physical Exercise

4.4.1 Intervention Dimensions

(1) The impact of physical exercise on cognitive activities. The process of human cognitive activity is a dynamic system that actively processes and processes input information, symbols,

and problem-solving. There is a positive correlation between physical exercise and cognitive activities. From a cognitive perspective, long-term exercise yields more significant results than short-term exercise; Regular physical exercise can improve the sensitivity of the nervous and motor systems of physical exercisers through their senses, perceptions, and the reaction speed of the body's movement system. The relationship between physical exercise and cognition has different effects on different adolescents, and the impact on cognitive function varies among adolescents of different professions due to different sports programs or exercise loads. Even if adolescents of the same profession bear the same exercise load, their impact on cognitive function is not consistent, which is related to their understanding of cognitive function and their own exercise ability. However, it can be affirmed that physical exercise can improve the cognitive function of adolescents. There is a significant difference in the impact of physical exercise on cognitive function between adolescents with mental health and those with psychological problems.

(2) The impact of physical exercise on emotions. Some studies suggest that physical exercise has the effect of improving emotions, while others suggest that physical exercise is one of the effective means of intervening in negative emotions. 1) Physical exercise can reduce the degree of depression. By intervening in physical exercise for adolescents, it can be predicted that physical exercise can reduce their depression levels, whether they are psychologically healthy or have psychological problems; Both short-term and long-term physical exercise can reduce the level of depression, but the degree of reduction varies. Through research, it has been found that the longer the duration of physical exercise, the more significant the effect. Some teachers also integrate physical exercise into cultural classroom teaching. If they find that a student is feeling down, they will ask them to run a few laps or do push ups on the playground to improve their mood and release their depressed emotions. 2) Improve anxiety levels. Anxiety has shown significant changes in both physiological and psychological indicators of individuals. Physical exercise can alleviate anxiety and reduce anxiety effectiveness, especially aerobic exercise. Regular and prolonged aerobic exercise can lower blood pressure levels and pulse levels in adolescents, effectively reducing anxiety levels. Through physical exercise, teenagers can also experience subjective satisfaction after physical exercise; Experience the happiness of successfully challenging personal abilities; Experience the process of enjoying sports.

(3) The impact of physical exercise on personality. The formation of good physical exercise habits among teenagers lays the foundation for lifelong sports in the future. Through physical exercise, it can also promote further development of personality, such as introverted teenagers gradually tending towards extroversion, and impatient teenagers gradually stabilizing. Research has found that physical exercise has a significant impact on self-esteem. Teenagers who frequently participate in physical exercise or competitions have a higher level of self-esteem, often improving their self-awareness and showcasing their self-worth through exercise or competition. Studies have shown that for adolescents with psychological problems or obesity, physical exercise can improve their psychological condition, enhance their confidence, and establish a positive psychological orientation through the sense of success gained from physical exercise. Their self-esteem is significantly strengthened, and in clinical treatment, it can be said that physical exercise is more effective than medication.

4.4.2 Intervention Phases

Preparation Phase (Weeks 1-2): Personalized assessment (using questionnaires and fitness tests to understand interests, fitness levels, exercise history), cognitive awakening (themed lectures on "Exercise and Health" to enhance value recognition), group formation (forming exercise groups based on interests).

Implementation Phase (Weeks 3-10): Simultaneous implementation of all four intervention dimensions through two 60-minute weekly sessions. Specific schedule: Session 1 (Motivation Activation + Self-Efficacy Enhancement), Session 2 (Social Support Reinforcement + Behavior Formation).

Consolidation Phase (Weeks 11-12): Self-regulation training (independently creating exercise plans, self-monitoring, feedback), exhibition of results (organizing exercise outcome events, e.g., jump rope contests, basketball friendlies), habit reinforcement (setting long-term exercise goals, e.g., "12 sessions per month").

4.5 Empirical Test Results of the Psychological Intervention Model

4.5.1 Intervention Effects on Exercise Behavior Indicators

Repeated measures ANOVA showed significant main effects of the intervention (Frequency: $F=128.65$, $p<0.001$; Duration: $F=98.72$, $p<0.001$; Intensity: $F=89.36$, $p<0.001$). Post-intervention, the intervention group showed significantly higher frequency, duration, and intensity than the control group ($p<0.001$). The intervention group's post-intervention scores were significantly higher than their pre-intervention scores ($p<0.001$), while the control group showed no significant pre-post differences ($p>0.05$) (Figure 1).

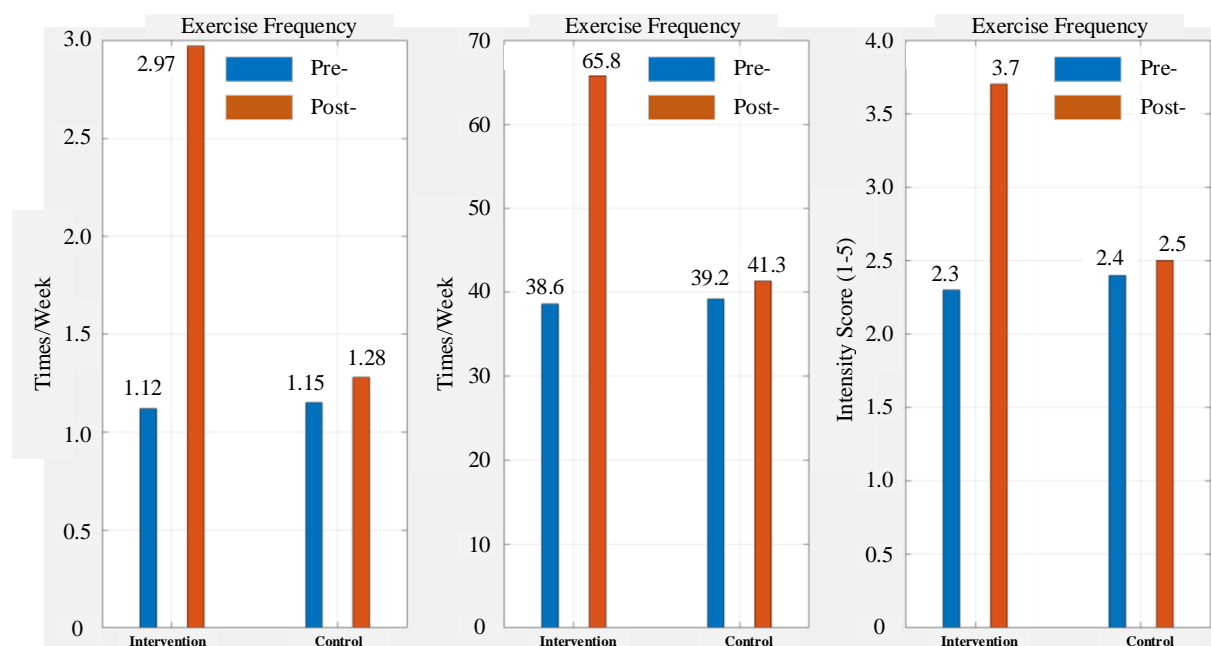


Figure 1: Comparison of exercise behavior indicators pre- and post-intervention for intervention and control groups

4.5.2 Intervention Effects on Psychological Indicators

Repeated measures ANOVA showed significant main effects of the intervention (Self-Efficacy: $F=102.58$, $p<0.001$; Autonomous Motivation: $F=92.36$, $p<0.001$; Social Support: $F=88.72$, $p<0.001$; Exercise Identity: $F=85.43$, $p<0.001$). Post-intervention, the intervention group showed significantly higher scores on self-efficacy, autonomous motivation, social support, and exercise identity than the control group ($p<0.001$). The intervention group's post-intervention scores were significantly higher than their pre-intervention scores ($p<0.001$), while the control group showed no significant changes ($p>0.05$) (Figure 2).

Empirical research results indicate that after engaging in physical exercise, the

psychological anxiety level of adolescents is effectively reduced. Physical exercise can improve the physical function level of adolescents, improve their body shape indicators and body mass index, and thus have a positive effect on alleviating social physical anxiety in adolescents. At the same time, due to the inherent differences of sports projects and combined with actual exercise experiences, it can be seen that individual projects can better exercise willpower, enhance resilience, durability, and self-regulation ability, change teenagers' attitudes towards difficulties, and cultivate their strong will to dare to break through and persevere; In group projects, the exercise of volleyball can better cultivate the social communication ability of teenagers, improve interpersonal communication among teenagers, promote the improvement of social communication ability, enhance their teamwork ability. In performance oriented projects, aerobic exercise can cultivate emotions, subtly influence the mood of teenagers, enhance their expression and confidence, effectively overcome factors that lead to psychological anxiety, and achieve the goal of promoting mental health.

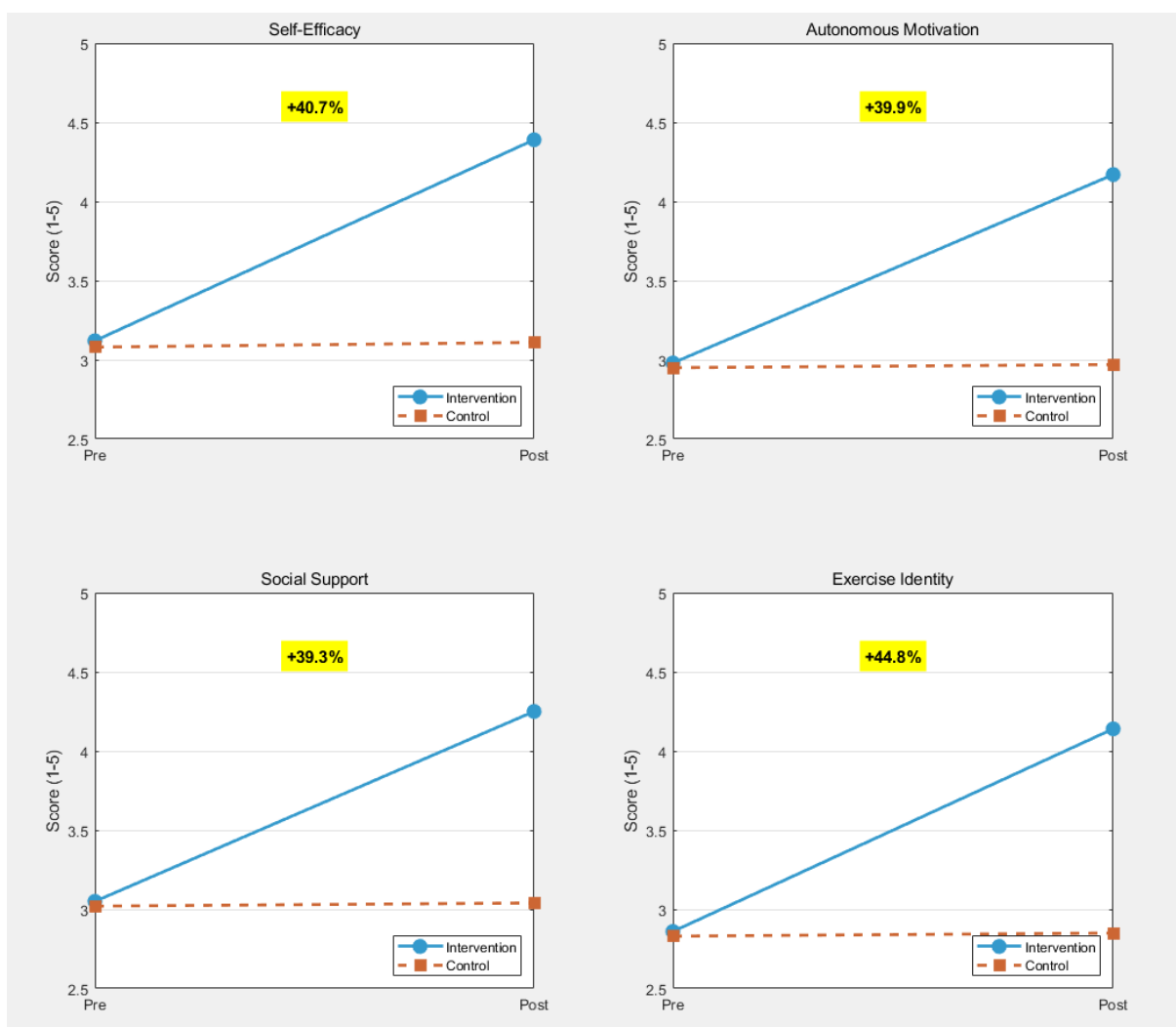


Figure 2: Line chart of psychological indicators pre- and post-intervention for intervention and control groups

5 Conclusion

(1) Analysis of the psychological intervention function of sports projects. The psychological

intervention function of sports projects reflects multi-level value. From a physiological perspective, aerobic exercise (such as running and swimming) can stimulate the secretion of dopamine and endorphins, effectively alleviate anxiety and depression symptoms, and help adolescents achieve a better psychological state. Schools usually offer long-distance running and ball sports, which not only help to dispel negative emotions but also improve teenagers' self-awareness. From the perspective of social psychological function, team sports such as basketball and football provide rich social opportunities for teenagers. Through learning, communication, and cooperation in competitions and collaborations, teenagers will have more confidence when facing interpersonal relationships. In terms of psychological challenges, endurance sports such as marathons and mountain climbing can help teenagers overcome physical limits, cultivate willpower and psychological resilience. Yoga and martial arts programs promoted by some schools and communities also have unique psychological regulatory effects. These forms of exercise that emphasize inner balance and control are particularly suitable for adolescents with introverted personalities and emotional fluctuations. Choosing diverse and adaptable forms of exercise and sports programs can become an important tool for intervening in adolescent mental health.

(2) The integration path of mental health education in physical education curriculum. To promote the integration of mental health education and physical education curriculum, it is necessary to pay attention to the growth environment and demand characteristics of adolescents. Curriculum design should be based on the actual psychological problems of teenagers, introducing emotional management into physical education classrooms to help teenagers master methods for relieving stress. In the demonstration school, physical education teachers collaborate with mental health teachers to integrate emotional expression training into sports programs, and organize youth discussions on their emotional experiences during team competitions. This design helps teenagers better understand the sources of emotions and learn to regulate them. The selection of exercise forms and the reasonable arrangement of activity rhythms also provide practical support for the integration path. Some schools have introduced interactive gamified sports programs, such as cooperative flag snatching or balance challenges, which motivate young people to develop confidence and teamwork through setting roles and goals in sports. In course evaluation, the psychological dimension of physical activities should be given more attention. A comprehensive mental health record can be established by recording the emotional changes and social performance of adolescents, providing scientific basis for personalized education. The optimization of teaching environment is also the key to successful integration. The foundation for achieving curriculum integration is to make young people feel respected and accepted through open venue design and a classroom atmosphere that encourages expression.

(3) Collaborative intervention mechanism between family, school, and society. Building an intervention mechanism for adolescent mental health requires a close cooperation network between families, schools, and society. As the first line of defense for mental health, families should actively support young people's participation in physical exercise. Urban families arrange at least one parent-child exercise per week, which effectively enhances the happiness and psychological resilience of teenagers. The role of schools in intervention mechanisms cannot be ignored. Some middle schools have established "sports psychological counseling stations" to conduct psychological assessments and counseling in conjunction with physical education courses, providing multi-level support for young people. Outside of schools, social forces also play a crucial role. Community sports centers and non-profit organizations can provide free sports facilities and guidance for young people, further expanding their sports space. The "Community Youth Sports Promotion Plan" implemented in Shenzhen is a typical case, which provides comprehensive support for the mental health of young people by

regularly organizing sports competitions and psychological lectures in conjunction with families and schools.

(4) Establish a long-term mechanism for adolescent physical exercise. In terms of culture, guiding teenagers to value the cultivation of exercise habits in their daily lives can lay the foundation for the long-term development of physical exercise. In terms of policy guarantees, local governments should establish clear goals for sports education, such as requiring schools to provide high-quality physical education courses every day and supervising their implementation through an evaluation system. In terms of resource optimization, modern technology has provided new ideas for enhancing sports interest. Schools use intelligent sports devices to track the exercise data of teenagers and provide feedback through health apps, allowing teenagers to intuitively understand their own progress. The integration of sports and other educational content is also an important path to ensure long-term mechanisms. By combining sports activities with courses such as art and science, we can further stimulate the enthusiasm of young people for participation. Under the joint influence of culture, policies, and resources, the long-term mechanism for youth physical exercise in the region can be continuously improved.

About The Author

Fenggang Zhu was born in Tai'an, Shandong Province, China in 1988. He obtained his master's degree from Yunnan Minzu University and currently works at Shandong Foreign Trade Vocational College. His main research directions are education and sports science.

Wenting Han was born in Jining City, Shandong Province, China in 1990. She graduated from Yunnan Minzu University with a master's degree and is currently studying in the graduate school of Management and Science University in Malaysia. Her main research direction is educational psychology.

References

- [1] Hickin N, Käll A, Shafran R, et al. The effectiveness of psychological interventions for loneliness: A systematic review and meta-analysis[J]. *Clinical Psychology Review*, 2021, 88: 102066.
- [2] Alam A. Positive psychology goes to school: conceptualizing students' happiness in 21st century schools while 'minding the mind!'are we there yet? Evidence-backed, school-based positive psychology interventions[J]. *ECS Transactions*, 2022, 107(1): 11199.
- [3] Allen J G, Romate J, Rajkumar E. Mindfulness-based positive psychology interventions: a systematic review[J]. *BMC psychology*, 2021, 9(1): 116.
- [4] Bighelli I, Rodolico A, García-Mieres H, et al. Psychosocial and psychological interventions for relapse prevention in schizophrenia: a systematic review and network meta-analysis[J]. *The Lancet Psychiatry*, 2021, 8(11): 969-980.
- [5] Ruini C, Mortara C C. Writing technique across psychotherapies—from traditional expressive writing to new positive psychology interventions: A narrative review[J]. *Journal of Contemporary Psychotherapy*, 2022, 52(1): 23-34.

- [6] Driscoll M A, Edwards R R, Becker W C, et al. Psychological interventions for the treatment of chronic pain in adults[J]. *Psychological Science in the Public Interest*, 2021, 22(2): 52-95.
- [7] Alam A. Investigating sustainable education and positive psychology interventions in schools towards achievement of sustainable happiness and wellbeing for 21st century pedagogy and curriculum[J]. *ECS Transactions*, 2022, 107(1): 19481.
- [8] Carr A, Cullen K, Keeney C, et al. Effectiveness of positive psychology interventions: a systematic review and meta-analysis[J]. *The journal of positive psychology*, 2021, 16(6): 749-769.
- [9] Yeh C S H, Barrington R. Sustainable positive psychology interventions enhance primary teachers' wellbeing and beyond—A qualitative case study in England[J]. *Teaching and Teacher Education*, 2023, 125: 104072.
- [10] Knestrick K E, Gibler R C, Reidy B L, et al. Psychological interventions for pediatric headache disorders: a 2021 update on research progress and needs[J]. *Current Pain and Headache Reports*, 2022, 26(1): 85-91.
- [11] Koydemir S, Sökmez A B, Schütz A. A meta-analysis of the effectiveness of randomized controlled positive psychological interventions on subjective and psychological well-being[J]. *Applied Research in Quality of Life*, 2021, 16(3): 1145-1185.
- [12] Moltrecht B, Deighton J, Patalay P, et al. Effectiveness of current psychological interventions to improve emotion regulation in youth: a meta-analysis[J]. *European child & adolescent psychiatry*, 2021, 30(6): 829-848.
- [13] Juul S, Faltermeier P, Petersen J J, et al. Missing outcome data in randomised clinical trials of psychological interventions: a review of published trial reports in major psychiatry journals[J]. *BMC psychiatry*, 2024, 24(1): 798.
- [14] Berezowski L, Ludwig L, Martin A, et al. Early psychological interventions for somatic symptom disorder and functional somatic syndromes: a systematic review and meta-analysis[J]. *Psychosomatic medicine*, 2022, 84(3): 325-338.
- [15] Gaskell C, Simmonds-Buckley M, Kellett S, et al. The effectiveness of psychological interventions delivered in routine practice: systematic review and meta-analysis[J]. *Administration and Policy in Mental Health and Mental Health Services Research*, 2023, 50(1): 43-57.
- [16] Dear B F, Scott A J, Fogliati R, et al. The chronic conditions course: a randomised controlled trial of an internet-delivered transdiagnostic psychological intervention for people with chronic health conditions[J]. *Psychotherapy and Psychosomatics*, 2022, 91(4): 265-276.
- [17] Kaiser J, Hanschmidt F, Kersting A. The association between therapeutic alliance and outcome in internet-based psychological interventions: a meta-analysis[J]. *Computers in Human Behavior*, 2021, 114: 106512.
- [18] Solmi M, Wade T D, Byrne S, et al. Comparative efficacy and acceptability of

- psychological interventions for the treatment of adult outpatients with anorexia nervosa: a systematic review and network meta-analysis[J]. *The Lancet Psychiatry*, 2021, 8(3): 215-224.
- [19] Heim E, Mewes R, Abi Ramia J, et al. Reporting cultural adaptation in psychological trials—the RECAPT criteria[J]. *Clinical Psychology in Europe*, 2021, 3(Spec Issue): e6351.
- [20] Cameron L A, Phillips K, Melvin G A, et al. Psychological interventions for depression in children and young people with an intellectual disability and/or autism: systematic review[J]. *The British Journal of Psychiatry*, 2021, 218(6): 305-314.
- [21] Kim J, Lee S, Lee D, et al. Psychological treatments for excessive gaming: a systematic review and meta-analysis[J]. *Scientific Reports*, 2022, 12(1): 20485.
- [22] Lochbaum M, Stoner E, Hefner T, et al. Sport psychology and performance meta-analyses: A systematic review of the literature[J]. *PloS one*, 2022, 17(2): e0263408.
- [23] Keynejad R, Spagnolo J, Thornicroft G. WHO mental health gap action programme (mhGAP) intervention guide: updated systematic review on evidence and impact[J]. *BMJ Ment Health*, 2021, 24(3): 124-130.
- [24] Jeong S, Aymerich-Franch L, Arias K, et al. Deploying a robotic positive psychology coach to improve college students' psychological well-being[J]. *User Modeling and User-Adapted Interaction*, 2022, 33(2): 571.
- [25] Antoni M H, Moreno P I, Penedo F J. Stress management interventions to facilitate psychological and physiological adaptation and optimal health outcomes in cancer patients and survivors[J]. *Annual review of psychology*, 2023, 74(1): 423-455.
- [26] Salem V, AlHusseini N, Abdul Razack H I, et al. Prevalence, risk factors, and interventions for obesity in Saudi Arabia: A systematic review[J]. *Obesity Reviews*, 2022, 23(7): e13448.
- [27] Ardern C L, Hooper N, O'Halloran P, et al. A psychological support intervention to help injured athletes “get back in the game”: design and development study[J]. *JMIR formative research*, 2022, 6(8): e28851.
- [28] Easterbrook M J, Hadden I R. Tackling educational inequalities with social psychology: Identities, contexts, and interventions[J]. *Social Issues and Policy Review*, 2021, 15(1): 180-236.
- [29] Gitonga I, Desmond D, Duda N, et al. Impact of connected health interventions on psychological wellbeing and quality of life in patients with cancer: a systematic review and meta-analysis[J]. *Psycho-Oncology*, 2022, 31(10): 1621-1636.
- [30] Karabinski T, Haun V C, Nübold A, et al. Interventions for improving psychological detachment from work: A meta-analysis[J]. *Journal of occupational health psychology*, 2021, 26(3): 224.