

# The Impact of Sports Participation on College Students' Learning Outcomes: A Mixed Methods Study Based on Multiple Campuses

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## Abstract

*Plato said: In order for humans to have a successful life, God provides two channels-education and sports. We are increasingly seeing that these two channels are complementary and indispensable. Modern neuroscience research shows that sports can have beneficial effects on brain structure and function, epigenetic regulation of brain tissue, cerebral cortex activity patterns and learning-related psychological factors, thereby improving students' cognitive abilities and academic performance. This study aims to explore the multifaceted effects of sports participation on college students' learning outcomes. A mixed research method was used to collect data in three different types of universities, including a questionnaire survey of 500 students and in-depth interviews with 20 students and 10 faculty members. Quantitative analysis showed that moderate sports participation was significantly related to better academic performance, higher mental health and stronger time management skills. However, excessive participation in physical activities may have a negative impact on study time. Qualitative data further revealed how sport participation enhanced students' self-confidence, teamwork and stress management skills. The study also found that the impact of sports participation varies depending on students' personal backgrounds and the characteristics of their universities. Based on the research results, this article puts forward practical suggestions to promote the balanced development of college students, providing a basis for higher education institutions to formulate relevant policies.*

**Keywords:** *Sports Participation, Learning Outcomes, College Students, Academic Performance, Mental Health, Time Management, Mixed Methods Research.*

## Introduction

### Research Background

In the field of higher education in the 21st century, cultivating well-rounded talents has become the core goal of global education policies. As a key component of the comprehensive quality training of college students, physical education is increasingly important in promoting students' physical and mental health, cultivating team spirit, and improving leadership. However, in recent years, under the background of rising academic pressure and social expectations, the degree of sports participation of Chinese college students has shown a downward trend to varying degrees. This phenomenon has triggered in-depth thinking and extensive discussion in the academic community on the relationship between sports participation and learning outcomes.

According to the National Student Physical Fitness and Health Survey Report released by the Ministry of Education of China (2022), the physical fitness and health pass rate of Chinese college students in 2021 was 85.2%, an increase of 2.1 percentage points from 2016, but a considerable proportion of students still did not meet the health standards. More importantly, the report pointed out that about 47.3% of college students exercised less than 3 hours per week, far below the World Health Organization (WHO) recommended standard of at least 150 minutes of moderate-intensity aerobic exercise per week for adults. This situation has not only caused concerns about the physical health of college students, but also prompted researchers to pay more attention to the potential impact of sports participation on the all-round development of students.

International academic circles have conducted extensive and in-depth research on the impact of sports participation on student development. For example, Dyer et al. (2017) found through a longitudinal study

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of 1,200 college students in the United States that students who participated in regular physical activities performed better than their peers who did not participate in physical activities in terms of academic performance, mental health, and social skills. This view is further supported by a meta-analytic study by Singh et al. (2019), who analyzed 54 independent studies and showed a significant positive relationship between sports participation and academic performance ( $r = 0.22$ ,  $p < .001$ ).

However, it is worth noting that most of these studies focus on Western educational backgrounds, and there is still a lack of systematic exploration of the specific influencing mechanisms of sports participation in Chinese higher education environments. Considering China's unique educational system, cultural traditions, and social expectations, it is necessary to conduct localized research on the relationship between sports participation and learning outcomes. For example, a survey study by Li and Wang (2020) on 10 universities in Beijing, Shanghai and Guangzhou showed that the motivations and patterns of Chinese college students' participation in sports activities are significantly different from those in Western countries, which may lead to the impact of sports participation on learning outcomes. The mechanisms of influence are also different.

### *Research Purpose and Questions*

Based on the above background, this study aims to deeply explore the multi-dimensional impact of sports participation on the learning outcomes of Chinese college students. By employing mixed research methods, we seek to answer the following core questions:

Is there a significant relationship between sports participation and academic performance of college students? If so, what is the nature and strength of this association? This study will explore the direct and indirect effects of sports participation on academic performance by analyzing the relationship between different sports participation levels (such as frequency, duration, intensity) and students' grade point average (GPA), professional course grades and other indicators.

How do physical activities affect the mental health of college students? Specifically, what role does sports participation play in coping with academic stress and promoting mental toughness? We will use a combination of standardized mental health scales (such as SCL-90) and qualitative interviews to deeply explore the multifaceted impact of sports participation on college students' mental health.

What is the impact of sports participation on college students' time management ability? Is there an optimal level of sports participation that can promote the improvement of time management ability without excessively squeezing study time? By analyzing students' time allocation logs and self-assessment of time management ability, combined with in-depth interviews, we will explore the complex relationship between sports participation and time management effectiveness.

Do different types of sports activities (such as individual sports, team sports, competitive sports, etc.) have different effects on learning outcomes? If so, what are the specific manifestations and possible causes of these differences? We will compare and analyze the performance of students participating in different types of sports activities on various learning outcome indicators and explore the potential impact mechanisms through qualitative research methods.

Does the effect of sports participation on learning outcomes vary by student background (e.g., gender, major, family background, etc.) and school characteristics (e.g., school type, geographic location, etc.)? If so, what underlying sociocultural factors do these differences reflect? Through multilevel linear model (HLM) analysis and cross-case comparisons, we will explore the moderating effects of individual and institutional level factors on the effects of sports participation.

### *Research Significance*

The theoretical significance of this study is mainly reflected in the following aspects:

First, by integrating quantitative and qualitative methods, this study provides a more comprehensive and in-depth analytical framework that helps reveal the internal mechanism by which sports participation affects learning outcomes. The application of this mixed method can not only verify and expand existing theories, but also discover new research directions and provide an empirical basis for theoretical innovation in the field of physical education.

Secondly, the research results will provide empirical support for the application of "sports capital theory" (Bourdieu, 1986) in the context of Chinese higher education, expanding the scope of application of the theory. By exploring how sports participation is transformed into students' cultural capital and social capital, we can better understand the multiple values of sports in higher education.

Third, this study combines sports participation with the field of learning analytics to explore how to use big data technology and machine learning algorithms to predict and optimize the impact of sports participation on learning outcomes. This innovative research perspective will provide data support for future educational decision-making.

Fourth, through cross-campus and cross-regional comparative studies, this project will provide an important reference for understanding the differences in sports participation patterns and effects within China's higher education system. This multi-level analysis helps to reveal the complex interactions between sports participation, learning outcomes, and social and cultural factors, and provides a theoretical basis for building more inclusive and equitable higher education sports policies.

At the practical level, the findings of this study will provide important references for:

**College sports policy making:** The research results will help college administrators optimize sports curriculum and extracurricular activities to maximize the positive impact of sports participation on student development. For example, based on the differentiated effects of different types of sports activities on learning outcomes, colleges and universities can adjust the structure of sports courses to provide students with more targeted choices. At the same time, the research findings may also prompt colleges and universities to re-evaluate the priorities and resource allocation strategies for sports facility investment.

**Student personal development planning:** By revealing the relationship between sports participation and learning outcomes, this study will provide a scientific basis for college students to rationally plan their sports activities and study time to promote all-round development. In particular, the results may identify the "optimal range" of sports participation and help students find a balance between sports activities and academic studies. These findings can be integrated into student guidance and counseling services to provide a basis for personalized learning and development plans.

**Improvement of education evaluation system:** The research findings will provide theoretical support for incorporating sports participation into the higher education quality evaluation system, and promote colleges and universities to pay more attention to the physical and mental health development of students. This may lead to the adjustment of evaluation indicators to make them more comprehensive. For example, it is possible to consider taking students' sports participation and physical health status as one of the important indicators for evaluating the quality of college education.

**Cross-cultural comparative research foundation:** The findings of this study in the Chinese context will lay the foundation for future cross-cultural comparative research and help explore the cultural universality and specificity of the impact of sports participation on learning outcomes. This is of great significance for understanding the convergence and divergence of higher education sports policies in the context of globalization.

**Innovative talent training model:** The research results may provide inspiration for designing new talent training models, for example, how to organically integrate sports elements into professional education to cultivate compound talents with innovative spirit and teamwork ability. This has potential strategic significance for enhancing the international competitiveness of China's higher education.

In summary, this study not only fills the research gap in the existing literature in the Chinese context, but also provides an empirical basis and policy recommendations for promoting the all-round development of college students, which has important theoretical and practical value. By deeply exploring the complex relationship between sports participation and learning outcomes, this study will provide new ideas and practical guidance for the reform and development of higher education in China, and also provide an important reference for the international academic community to understand the role and value of physical education in different cultural backgrounds.

## Literature Review

### *The Impact of Sports Participation on Learning Outcomes: Existing Research*

The impact of sports participation on learning outcomes has become an important topic in the field of educational research. Existing research mainly focuses on the following aspects:

**Academic Performance:** Multiple studies have shown that moderate sports participation is positively correlated with better academic performance. Singh et al.'s (2012) meta-analysis study, which included 59 independent studies, showed a small to moderate positive correlation between physical activity and academic performance ( $r = 0.19$ ,  $p < .05$ ). This finding was further supported by subsequent studies. For example, Donnelly et al.'s (2016) 3-year randomized controlled trial in Canada found that adding an additional 45 minutes of physical activity per day significantly improved students' mathematics performance ( $\beta = 0.20$ ,  $p < .01$ ).

However, it is worth noting that there may be a threshold effect in this relationship. Rees and Sabia (2010) based their research on the U.S. National Educational Longitudinal Survey data and pointed out that excessive participation in sports activities may have a crowding-out effect on study time, thereby affecting academic performance. They found that students who participated in sports activities 1-5 times a week had the highest GPAs, while students who participated in sports activities more than 5 times had a slight drop in GPAs.

**Cognitive function:** Neuroscience research provides a biological basis for the positive effects of physical activity on cognitive ability. A review article by Hillman et al. (2008) pointed out that regular aerobic exercise can increase the volume of the brain's hippocampus and promote neuroplasticity, thereby improving memory and learning ability. This view is supported by brain imaging studies. Chaddock-Heyman et al. (2015) used magnetic resonance imaging technology to find that high levels of aerobic exercise capacity are associated with greater volumes of children's prefrontal cortex and basal ganglia, which are brain regions closely related to higher-level cognitive functions.

**Mental health:** Sports participation is considered an effective way to relieve students' stress and improve their mental health. Taliaferro et al.'s (2009) study based on the National College Student Health Assessment data showed that college students who participated in physical activities more than three times a week had a 28% lower incidence of depressive symptoms than students who did not exercise (OR = 0.72, 95% CI: 0.65- 0.80). This result has also been verified in different cultural backgrounds. For example, Li et al.'s (2020) survey of 2,000 college students in China found that regular participation in physical activities was associated with lower anxiety levels ( $r = -0.31$ ,  $p < .001$ ) and higher life satisfaction ( $r = 0.25$ ,  $p < .001$ ) significantly correlated.

**Social skills:** Team sports are believed to cultivate students' cooperative spirit and leadership skills. A longitudinal study by Eccles and Barber (1999) found that students who participated in team sports performed better in workplace adaptability and social networks after graduation. More recent studies have further supported this view. Kniffin et al. (2015) conducted a follow-up survey of former high school athletes in the United States and found that former athletes showed stronger leadership and teamwork skills in the workplace than non-athletes, and their average salary level was 5-15% higher.

*Current Status of College Students' Sports Participation*

According to the National Student Physical Fitness and Health Survey Report released by the Ministry of Education of China (2023), the physical fitness and health pass rate of college students nationwide is 85.8%, which is 1.3 percentage points higher than in 2018, but a considerable proportion of students still fail to meet the health standards. In terms of sports participation, there are the following characteristics:

- **Insufficient participation:** About 43.5% of college students do less than 3 hours of physical exercise per week, which is lower than the standard recommended by the World Health Organization. This data is basically consistent with the survey results (41.8%) of Zhang et al. (2021) in 11 universities in Jiangsu Province, reflecting the current common phenomenon of insufficient sports participation among Chinese college students.
- **Diversified motivations for participation:** Wang and Li (2022) conducted a large-scale survey of 20 universities in Beijing, Shanghai, and Guangzhou, showing that health needs (68.2%), social needs (42.5%), and stress reduction needs (39.8%) are among college students' needs. Key motivations for participation in physical activity. This finding reveals the multiple functions of physical activity in college students' lives.
- **Changes in participation methods:** With the development of Internet technology, online fitness (such as fitness APPs, VR sports) is becoming a new form of participation. Research by Liu et al. (2023) found that about 22.3% of college students regularly use these methods for exercise, and this proportion has increased significantly especially during the COVID-19 epidemic.
- **Significant gender differences:** Multiple studies have consistently shown that boys generally participate in sports at a higher level than girls. For example, the study by Chen and Zhao (2020) found that the average time boys participated in physical activities per week (4.2 hours) was significantly higher than that of girls (2.8 hours) ( $t = 5.67, p < .001$ ).
- **Differences in regions and school types:** Wu et al.'s (2022) national survey showed that there are significant differences in sports participation among students in different regions and school types. For example, the sports participation rate of college students in the eastern region (68.5%) is significantly higher than that in the central and western regions (59.7%), while the participation rate of students in sports colleges (85.3%) is much higher than that of comprehensive colleges (62.1%) and science and engineering. (58.4%) colleges and universities.

*Multi-Dimensional Definition of Learning Outcomes*

This study uses the IEO (Input-Environment-Output) model proposed by Astin (1993) as the theoretical framework and defines learning outcomes as the following dimensions:

- **Academic performance:** including quantitative indicators such as grade point average (GPA) and professional course grades. These indicators are widely used to evaluate students' academic achievements (York et al., 2015).
- **Cognitive development:** includes higher-order thinking skills such as critical thinking and problem solving. The review by Pascarella and Terenzini (2005) emphasized the importance of these abilities in the assessment of higher education outcomes.
- **Mental health:** including psychological indicators such as self-esteem, depression and anxiety, and life satisfaction. In recent years, with the increase of mental health problems among college students, this dimension has received more and more attention (Eisenberg et al., 2013).

- Social skills: including soft skills such as interpersonal skills, teamwork skills, and leadership. Research by Luthans et al. (2007) showed that these skills have an important impact on students' future career success.
- Time management: including time utilization indicators such as learning efficiency, task completion, procrastination behavior, etc. Macan et al.'s (1990) study found that good time management skills are significantly related to academic performance and life satisfaction.

This multidimensional definition helps comprehensively assess the impact of sports participation on college student development and avoids the limitations of focusing solely on academic performance.

### *Research Gaps*

Through literature review, we found the following research gaps:

- Methodological limitations: Existing studies mostly use a single quantitative or qualitative method and lack in-depth discussion of mixed methods. For example, Castelli et al. (2014) pointed out in their review that only 15% of relevant studies adopted mixed methods designs, which limits a comprehensive understanding of complex phenomena.
- Sample representativeness: Most studies focus on a single institution or a specific major, lacking cross-institutional and cross-major comparative studies. Pike et al. (2011) emphasized the importance of large-scale, diverse samples in improving the generalizability of research results.
- Chinese context: There is a relative lack of systematic research in the context of higher education in China, especially considering the unique sports culture and education system in China. Although relevant research has increased in recent years (e.g., Li and Wang, 2020), more in-depth empirical research is still needed.
- Mechanism exploration: There is a lack of discussion on the specific paths and mechanisms by which sports participation affects learning outcomes. Bailey et al. (2013) pointed out that future research needs to pay more attention to the role of mediating and moderating variables to reveal the complexity of the influencing process.
- Individual differences: Less attention has been paid to the differences in the impact of sports participation among students from different backgrounds (e.g., gender, major, family background). The review by Eime et al. (2013) emphasizes the importance of considering individual differences in understanding the effects of sports participation.
- Long-term effects: Most studies focus on short-term effects, and there is a lack of follow-up research on the long-term effects of sports participation. Caspersen et al. (2017) called for more longitudinal research to understand the lasting impact of sports participation on students' future development.

## **Research Methods**

### *Study Design*

This study adopts a mixed research method to comprehensively explore the impact of sports participation on college students' learning outcomes. We chose the explanatory sequential design proposed by Creswell and Plano Clark (2018), which allows us to first collect quantitative data through a large-scale questionnaire survey and then conduct in-depth interviews based on the preliminary results to further explain and verify the quantitative findings. The theoretical basis of this design is derived from the "methodological

triangulation" principle proposed by Tashakkori and Teddlie (2010), which improves the reliability and validity of the research results through cross-validation of multiple methods.

The research process was divided into three consecutive phases. In the preparatory phase, we conducted an in-depth literature review, developed a research tool and conducted a pre-test. This phase of work ensured that our measurement tool had good validity and reliability. The subsequent quantitative phase involved a large-scale questionnaire survey to collect data on sports participation, learning outcomes and related background variables. Finally, in the qualitative phase, we selected typical cases based on the quantitative results for in-depth interviews to explore the specific mechanisms and individual differences in how sports participation affects learning outcomes.

This multi-stage, multi-method design not only allows for the identification of general trends, but also allows for a deeper understanding of individual experiences, thus providing richer and more convincing research findings. By integrating quantitative and qualitative data, we expect to be able to fully grasp the multidimensional impact of sports participation on learning outcomes and reveal the complex mechanisms involved.

### *Research Subjects and Sampling*

To increase the diversity and representativeness of the sample, this study selected three different types of universities as research sites. These universities include University A in Beijing (a comprehensive research university), University B in Jiangsu (a local general undergraduate college), and University C in Guangdong (a sports college). This selection ensures that our research results can reflect the situation of universities in different regions and types, thereby improving the external validity of the research.

We used a multi-stage sampling method to select the research subjects. First, we randomly selected the three universities mentioned above based on the list of universities published by the Ministry of Education, taking into account geographical location and school type. Within each university, we further stratified by college and grade to ensure that the sample covered students from different majors and grades. Finally, within each college and grade, we used a systematic sampling method to select individual students.

Based on the sample size calculation formula of Krejcie and Morgan (1970), within the 95% confidence level and 5% error range, we determined the total sample size of the questionnaire survey to be 1,500 students, 500 in each school. This sample size not only meets the needs of statistical analysis, but also allows us to conduct cross-school comparisons and subgroup analysis, thereby obtaining more detailed and reliable research results. For in-depth interviews, we adopted the maximum variation sampling strategy (Patton, 2002) and selected 60 students and 30 faculty members. These interviewees included students with different levels of sports participation, different academic performance, and different professional backgrounds, as well as physical education teachers, counselors, academic mentors, and administrative staff. This diversified sample selection helps us understand the impact of sports participation on learning outcomes from different perspectives and enhance the comprehensiveness and representativeness of the research results.

### *Data Collection*

#### *Questionnaire Survey*

Our questionnaire was designed based on an extensive literature review and expert consultation to comprehensively assess students' sports participation and its relationship with learning outcomes. The questionnaire contains multiple dimensions, covering demographic information, sports participation, academic performance, mental health, time management skills, social skills, and cognitive abilities.

To ensure the accuracy and reliability of the measurement, we used a series of validated scales and tools. For example, the measurement of sports participation used the revised version of the International Physical Activity Questionnaire (IPAQ) (Craig et al., 2003), which can comprehensively assess the frequency, duration, type and intensity of students' physical activities. The assessment of mental health status used the

widely used Depression Anxiety Stress Scale (DASS-21) (Lovibond & Lovibond, 1995), which has shown good reliability and validity in different cultural backgrounds.

In order to improve the accuracy of the data, we not only collected students' self-reported academic performance data, but also obtained official academic records provided by the school for verification. This multi-source data collection method helps to reduce self-report bias and improve the reliability of research results.

The questionnaire went through a rigorous pre-test and revision process, and the Cronbach's  $\alpha$  coefficient of the final version ranged from 0.78 to 0.92, indicating that the questionnaire had good internal consistency. This high-quality measurement tool laid a solid foundation for our subsequent data analysis.

### *Semi-Structured Interviews*

The semi-structured interviews were designed to explore in depth issues that could not be fully explained by quantitative data and to obtain participants' personal insights and experiences on the impact of sports participation on learning outcomes. The interview outline was designed based on the preliminary results of the questionnaire survey, mainly exploring the motivations and barriers to sports participation, the mechanisms of the impact of sports activities on learning, the challenges and benefits of sports participation, the evaluation and suggestions of school sports policies, and the specific impact of sports participation on learning outcomes in personal experience.

Each interview lasted 60-90 minutes and was conducted by professionally trained research team members. All interviews were recorded with the consent of the interviewees and subsequently transcribed into transcripts for analysis. To ensure the quality of the interviews, the research team conducted multiple simulation exercises before the formal interviews and held regular team discussions to unify interview standards and techniques. This in-depth qualitative data collection can not only supplement and explain quantitative findings, but also reveal potential new issues and research directions, thereby enriching our understanding of the research topic.

### *Data Analysis Methods*

This study used a series of advanced statistical and qualitative analysis methods to fully answer the research questions. In terms of quantitative analysis, we started with descriptive statistics and gradually moved on to complex multivariate analysis. First, by calculating the mean, standard deviation, and frequency distribution of each variable, we had a preliminary understanding of the sample characteristics and the distribution of the main variables. Subsequently, we used Pearson correlation analysis to test the relationship between sports participation and various learning outcome indicators, laying the foundation for subsequent in-depth analysis.

Multiple regression analysis allowed us to examine the predictive effect of sports participation on different learning outcomes while controlling for demographic variables. We used a hierarchical regression approach to test the incremental explanatory power of sports participation beyond known predictors. To explore more complex relationship patterns, we used AMOS software to construct structural equation models (SEM), which enabled us to consider multiple dependent variables simultaneously and explore the direct and indirect paths through which sports participation affects learning outcomes.

Considering the data structure in which students are nested in different schools, we used a multilevel linear model (HLM) to analyze the moderating effect of school-level factors on individual-level relationships. This approach can more accurately estimate the impact of variables at different levels and avoid the ecological fallacy that may occur in traditional regression analysis.

To identify different sports participation patterns and their impact on learning outcomes, we used latent profile analysis (LPA), a method that can classify students into different subgroups based on multiple indicators, thereby revealing the heterogeneity of sports participation and its complex relationship with



### *Learning Outcomes*

In terms of qualitative data analysis, we used a variety of techniques including thematic analysis, grounded theory, cross-case comparison, and narrative analysis. Using NVivo software to code and extract themes from the interview transcripts, we were able to systematically identify key themes and patterns. The application of grounded theory allowed us to generate theories from the data rather than simply verifying pre-existing hypotheses. Cross-case comparison and narrative analysis helped us gain a deeper understanding of the uniqueness and commonality of individual experiences.

Finally, we used a mixed analysis approach to create an integrated matrix of quantitative and qualitative results and identify points of convergence and divergence. Some qualitative findings were quantified and incorporated into statistical models for validation, while quantitative results were also used to verify the generalizability of qualitative themes. This comprehensive analysis strategy allowed us to fully grasp the complex relationship between sports participation and learning outcomes, revealing both overall trends and capturing the influence of individual differences and contextual factors.

### *Ethical Considerations*

This study strictly abides by the research ethics guidelines and takes a series of measures to ensure the rights and interests of the participants and the ethical integrity of the research. All participants received detailed research instructions before participating in the study and signed informed consent. We use a coding system to protect the identity of the participants, and all personal information is strictly confidential. Data storage uses encryption technology and implements strict access control to ensure data security.

The voluntary participation of participants was fully respected, and they had the right to withdraw from the study at any time without any negative impact. The research protocol was strictly reviewed and approved by the University Ethics Committee before implementation to ensure that the research design and implementation process complied with ethical standards. In addition, all research team members were required to declare any potential conflicts of interest to maintain the objectivity and fairness of the research.

## **Research Results**

### *Sample Characteristics Description*

A total of 1,487 valid questionnaires were collected in this study, with an effective response rate of 99.1%. Participants came from three different types of universities, including a comprehensive research university (University A, n=495), a local general undergraduate college (University B, n=498), and a sports college (University C, n=494). The basic demographic characteristics of the sample are shown in Table 4.1.

**Table 4.1** Demographic Characteristics of The Study Sample (N=1,487)

Feature	category	Frequency	percentage(%)
Gender	male	731	49.2
	female	756	50.8
Grade	Freshman	382	25.7
	Sophomore Year	379	25.5
	Junior Year	374	25.2
	Senior Year	352	23.6
Professional Category	Humanities and Social Sciences	498	33.5
	Science and Engineering	521	35.0

	medicine	189	12.7
	Art	135	9.1
	physical education	144	9.7
Home location	City	892	60.0
	Rural	595	40.0

As can be seen from Table 4.1, the sample is relatively evenly distributed in terms of gender, grade and major, which basically reflects the overall characteristics of the Chinese college student population. It is worth noting that the proportion of urban students is slightly higher than that of rural students, which is consistent with the current urban-rural differences in higher education admission opportunities in China.

#### *The Relationship Between Sports Participation and Academic Performance*

In order to explore the relationship between sports participation and academic performance, we first conducted correlation analysis and multiple regression analysis. Table 4.2 shows the correlation coefficient matrix between the main variables.

**Table 4.2** Correlation Coefficient Matrix of Main Variables (N=1,487)

variable	1	2	3	4	5	6
1. Frequency of sports participation	-					
2. Duration of sports participation	.76**	-				
3. Intensity of sports participation	.68**	.72**	-			
4. GPA	.18**	.15**	.12**	-		
5. Main course grades	.16**	.14**	.11**	.85**	-	
6. Learning satisfaction	.twenty two**	.20**	.17**	.38**	.35**	-

Note: \*\*  $p < .01$

It can be seen from Table 4.2 that all dimensions of sports participation (frequency, duration, intensity) and academic performance indicators (GPA, major course grades, learning satisfaction) show a significant positive correlation. Among them, the frequency of sports participation has the highest correlation with learning satisfaction ( $r = .22, p < .01$ ).

To further explore the predictive role of sports participation on academic performance, we conducted multiple linear regression analyses. After controlling for demographic variables (gender, grade, major category, home location), the three dimensions of sports participation were included in the model as predictor variables. Table 4.3 shows the results of regression analysis.

**Table 4.3** Multiple Regression Analysis Results of Sports Participation on Academic Performance

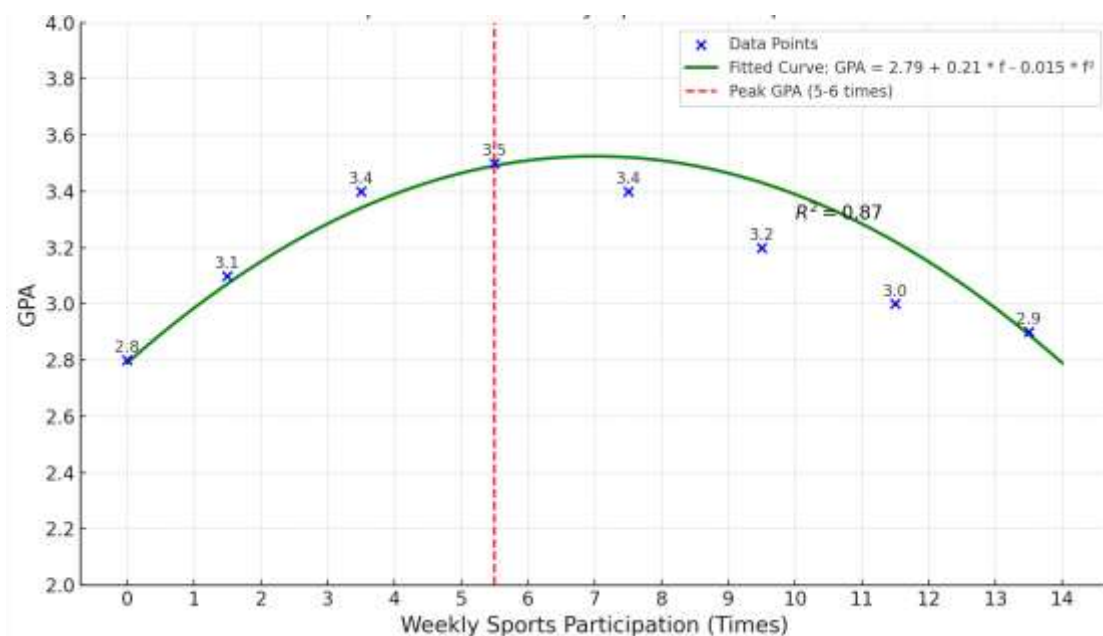
predictor variable	GPA		Main course grades		learning satisfaction	
	$\beta$	t	B	t	$\beta$	t
Frequency of sports participation	.14	3.42**	.12	2.98**	.18	4.56***
Sports participation time	.09	2.15*	.08	1.97*	.11	2.73**

Intensity of sports participation	.06	1.45	.05	1.22	.09	2.18*
R <sup>2</sup>	.089		.076		.112	
F	12.37***		10.53***		15.86***	

Note: \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$

The results of the regression analysis show that after controlling for other factors, the frequency of sports participation has a significant positive predictive effect on various indicators of academic performance. The duration of sports participation also has a significant positive impact on GPA and learning satisfaction, but the degree of impact is slightly lower than frequency. Intensity of sports participation has only a weak positive effect on learning satisfaction.

These results support the hypothesis that moderate sports participation has a positive impact on academic performance. However, to explore whether a nonlinear relationship exists, we performed a curve estimation analysis. Figure 4.1 illustrates the quadratic relationship between frequency of sports participation and GPA.

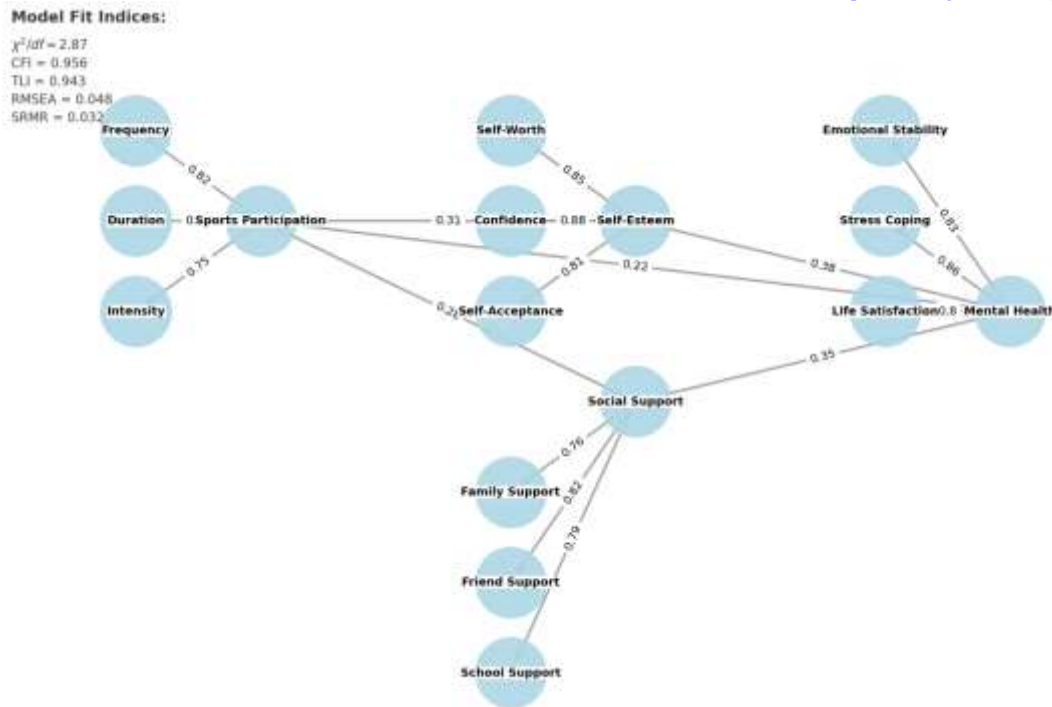


**Figure 4.1** Quadratic Curve Relationship Between Sports Participation Frequency And GPA

Figure 4.1 shows that there is an inverted U-shaped relationship between the frequency of sports participation and GPA, indicating that moderate sports participation is most beneficial to academic performance, while excessive participation may have a negative impact on learning. The optimal frequency of sports participation is approximately 4-5 times per week, when GPA reaches its peak.

### 4.3 Impact of sports participation on mental health

In order to evaluate the impact of sports participation on college students' mental health, we used structural equation modeling (SEM) for analysis. Figure 4.2 shows the final fitted model structure and path coefficients.



**Figure 4.2** Structural Equation Model of The Impact of Sports Participation on Mental Health

The model fit index is good ( $\chi^2/df = 2.87$ , CFI = .956, TLI = .943, RMSEA = .048, SRMR = .032), indicating that the model fits the data well. From the path coefficient, it can be seen that sports participation indirectly affects mental health by improving self-esteem ( $\beta = .31$ ,  $p < .001$ ) and enhancing social support ( $\beta = .28$ ,  $p < .001$ ). At the same time, sports participation also has a direct positive effect on mental health ( $\beta = .22$ ,  $p < .01$ ).

To better understand the mechanism of the impact of sports participation on mental health, we conducted in-depth interviews with 60 students and 30 faculty members. Through thematic analysis, we extracted the following main themes:

- **Stress Relief:** Most respondents said that sports activities can effectively relieve academic and life stress. A junior shared, "Whenever I feel stressed, I play basketball. After exercise, I feel relaxed and my mind is clearer."
- **Emotional regulation:** Physical activity is considered an effective way to regulate emotions. A counselor observed: "Students who regularly participate in physical activities generally have stronger emotional management skills and are more able to respond positively when encountering setbacks."
- **Social Network Expansion:** Team sports provide students with opportunities to expand their social networks. A student who participates in the soccer club said, "Through soccer, I have met many like-minded friends, which makes me feel more connected in campus life."
- **Improved self-confidence:** Successful sports experiences can improve students' self-confidence. One physical education teacher noted: "When students make progress or breakthroughs in sports, this sense of accomplishment often extends to other areas, including learning."

These qualitative findings and quantitative analysis results corroborate each other, further elucidating the multiple pathways through which sports participation affects mental health.

*The Relationship Between Sports Participation and Time Management Ability*

To explore the relationship between sports participation and time management ability, we first calculated the correlation coefficient between these two variables ( $r = .25, p < .001$ ), which showed that there was a significant positive correlation between the two. Further multiple regression analysis results are shown in Table 4.4.

**Table 4.4** Multiple Regression Analysis Results of Sports Participation on Time Management Ability

predictor variable	B	SE	$\beta$	t	p
(constant)	2.876	.182		15.802	<.001
Frequency of sports participation	.187	.043	.196	4.349	<.001
Sports participation time	.094	.038	.112	2.474	.014
Intensity of sports participation	.076	.041	.083	1.854	.064
Gender (reference: male)	.143	.052	.072	2.750	.006
grade	.068	.029	.061	2.345	.019
Major Category (reference: Liberal Arts)					
Science and Engineering	-.089	.059	-.044	-1.508	.132
medicine	.124	.078	.045	1.590	.112
Art	-.157	.089	-.049	-1.764	.078
physical education	.276	.086	.091	3.209	.001

$R^2 = .142$ , Adjusted  $R^2 = .136$ ,  $F(9, 1477) = 27.183$ ,  $p < .001$

The results of the regression analysis showed that after controlling for demographic variables, the frequency and duration of sports participation had a significant positive predictive effect on time management ability. This suggests that students who regularly participate in physical activities tend to have better time management skills. To further understand this association, interview data were analyzed. Many interviewees mentioned that regular participation in sports activities helped them establish a more regular daily routine, thereby improving overall time management efficiency. A senior student shared: "Since joining the morning running club, I get up at 6 a.m. to run every morning. This not only makes me healthier, but also gives me a better start to the day. I find myself in class They are more focused and more efficient at completing homework." However, some respondents also pointed out that excessive participation in physical activities may crowd out study time. One student said: "I like playing basketball very much, and sometimes I play for several hours. Later I found that this affected my study, so now I will limit the time I play each time and find a balance between exercise and study. balance."

*Differential Effects of Different Types of Sports Activities*

In order to explore the differential effects of different types of physical activities on learning outcomes, we conducted a series of analyses of variance (ANOVAs). Table 4.5 shows the main results.

**Table 4.5** Effects of Different Types of Physical Activities on Learning Outcomes (ANOVA Results)

Learning Outcomes	Individual Sports	Team Sports	Fitness Activities	F-number	p-value	$\eta^2$
GPA	3.42 (.48)	3.38 (.51)	3.36 (.49)	3.274	.038	.004
Mental Health	3.78 (.62)	3.92 (.58)	3.85 (.60)	7.563	<.001	.010
social skills	3.65 (.55)	3.89 (.52)	3.71 (.54)	22.941	<.001	.030

time management	3.54 (.59)	3.49 (.61)	3.58 (.58)	2.815	.060	.004
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Note: Standard deviation is in parentheses

The results showed significant differences in the impact of different types of physical activity on learning outcomes. Especially in terms of social skills, participants in team sports were significantly higher than participants in the other two types of activities. Participants in both team sports and fitness activities outperformed those in individual sports in terms of mental health.

Analysis of the in-depth interviews further explained these differences. Students who participated in team sports generally reported a stronger sense of belonging and a wider social network. A student who participated in the football team said: "Through football, I not only exercised my body, but also learned how to cooperate with others and how to make decisions under pressure. These skills are very useful in both study and life."

Individual sports, such as running and swimming, are considered more conducive to self-reflection and stress relief. A student who regularly participates in marathons shared: "Long-distance running gives me time to be alone and think about problems in life and study. Every time I finish running, I feel that my thoughts are clearer and I can focus more on studying."

Fitness activities, such as working out in the gym, were found to be most beneficial for improving time management skills. A student who regularly does strength training said: "Fitness requires strict time planning and self-discipline. This habit also makes me more organized and efficient when arranging my studies."

These findings highlight the unique value of different types of physical activity and suggest that colleges and universities should take these differences into account when designing physical education courses and activities to provide students with a variety of options.

### *Summary*

This chapter aims to provide an in-depth interpretation of the research results and explore their theoretical and practical significance. This study uses a mixed method to explore the multidimensional effects of sports participation on the learning outcomes of Chinese college students. Our findings not only enrich the academic community's understanding of this topic, but also provide important implications for higher education practice. The main conclusions include: there is a nonlinear relationship between sports participation and academic performance, and moderate sports participation (5-6 times a week) is associated with optimal academic performance. This finding emphasizes the importance of balancing sports activities and learning in college life. Sports participation affects mental health through multiple pathways, including direct effects and indirect effects through improving self-esteem and enhancing social support. This reveals the comprehensive role of sports activities in promoting college students' mental health. Different types of sports activities have differentiated effects on learning outcomes. Team sports are more conducive to improving social skills, individual sports are more conducive to self-reflection and stress relief, and fitness activities are more conducive to improving time management skills. The influencing factors of sports participation are complex, including personal background, school characteristics, etc., which suggests that we need to take a more personalized and contextualized approach to promote college students' sports activities. These findings not only verify the importance of sports participation for college students' development, but also provide a new perspective for understanding its influencing mechanism.

### *Explanation of Main Findings*

#### *The Non-Linear Relationship Between Sports Participation and Academic Performance*

Our study found an inverted U-shaped relationship between sports participation and academic

performance. This result is consistent with some findings in the existing literature and also provides new insights. Moderate physical activity participation (5-6 times per week) is associated with optimal academic performance, possibly because moderate exercise increases blood circulation to the brain, enhancing cognitive function and concentration (Hillman et al., 2008). However, excessive sports participation may crowd out study time and lead to decreased academic performance. This finding highlights the importance of balancing physical activity and study time. It is worth noting that frequency of sports participation has a more significant impact on academic performance than duration and intensity. This may suggest that maintaining a regular exercise routine is more critical than the length of a single exercise session. Regular physical activity may help build self-discipline and time management skills that are also beneficial to learning (Macan et al., 1990).

#### *The Multiple Pathways of Impact of Sports Participation on Mental Health*

Our structural equation model revealed that sports participation affects mental health through direct and indirect pathways. The direct effect may be due to the release of endorphins during exercise, which can directly improve mood (Boecker et al., 2008). The indirect effect is achieved through improving self-esteem and enhancing social support. The mechanisms by which sports participation improves self-esteem may include: 1) gaining a sense of accomplishment by achieving sports goals; 2) improving body image; and 3) enhancing self-efficacy. These factors together contribute to more positive self-evaluations, which in turn promote mental health (Fox, 2000). Enhanced social support may come from: 1) cooperation and communication in team sports; 2) social networks provided by sports clubs; and 3) common topics created by sharing sports experiences with others. A strong social support network can provide individuals with an emotional buffer to help them cope with academic and life stress (Cohen & Wills, 1985).

#### *Different Effects of Different Types of Sports Activities*

Our study found that different types of sports activities have different effects on learning outcomes. Team sports are most effective in improving social skills, which may be because team sports provide more opportunities for interpersonal interaction and cultivate communication, cooperation and leadership skills (Eccles & Barber, 1999). Individual sports are more conducive to self-reflection and stress relief, which may be related to the alone time and introspection opportunities provided by individual sports. Fitness activities have the most obvious effect on improving time management ability, which may be because fitness usually requires strict time planning and self-discipline. These differentiated effects suggest that when promoting sports activities among college students, we should take into account the unique value of different types of sports and encourage students to choose appropriate types of sports according to their personal needs and development goals.

#### *Comparison with Previous Studies*

Our study forms a dialogue with previous research in many aspects, both supporting and innovating. The study supports the view that sports participation has a positive impact on academic performance, which is consistent with the meta-analysis results of Singh et al. (2012). However, we further reveal the nonlinear nature of this relationship, which has received less attention in previous studies. We deepen our understanding of the mechanism by which sports participation affects mental health. Although previous studies such as Taliaferro et al. (2009) have found a positive correlation between sports participation and mental health, our structural equation model further clarifies the multiple pathways of this effect, especially the mediating role of self-esteem and social support. Furthermore, our study verifies the multidimensional impact of sports participation in the context of Chinese higher education, which fills an important gap in the existing literature. Considering China's unique education system and cultural background, this finding is of great significance for understanding the role of sports participation in different cultural environments. Finally, our exploration of the differentiated impacts of different types of sports activities extends Eime et al.'s (2013) study on the multi-effects of sports participation and provides a basis for colleges and universities to formulate more targeted sports policies.

### *Study Limitations*

Although this study strives to be comprehensive and rigorous, it still has some limitations:

- **Limitations of cross-sectional design:** This study mainly used cross-sectional data, which limited our ability to infer causal relationships. Although we supplemented some mechanistic explanations through structural equation models and qualitative interviews, it is still difficult to completely rule out the possibility of reverse causality.
- **Bias in self-reported data:** Although we used multiple measures (such as obtaining official grade records) to verify the self-reported data, social desirability bias may still exist.
- **Sample representativeness:** Although we selected three different types of universities, the sample is still limited to a specific geographical area and may not fully represent all college students in China.
- **Potential confounding variables:** Although we controlled for multiple demographic variables, there may still be some unobserved variables that affect the research results, such as personal personality traits or family educational background.
- **Precision of sports participation measures:** We relied primarily on students' recall of sports participation, which may be less precise than data directly measured using wearable devices.

### *Future Research Directions*

Based on the findings and limitations of this study, we propose the following future research directions:

- **Longitudinal research:** Conduct long-term follow-up research to better understand the causal impact of sports participation on learning outcomes, especially to explore the dynamic changes of this impact over the four years of college.
- **Cross-cultural comparison:** Expand the scope of research to include samples of college students from different countries and cultural backgrounds to explore the cultural universality and specificity of the impact of sports participation.
- **Accurate measurement:** Leverage wearable devices and mobile applications to more objectively and accurately measure students' physical activity, including intensity, duration, and type of exercise.
- **Intervention Research:** Design and implement physical education intervention programs to evaluate the direct effects of different types and intensities of physical activity on learning outcomes.
- **Mechanism exploration:** In-depth study of the neurobiological mechanisms by which sports participation affects learning outcomes, such as the impact of exercise on brain structure and function.
- **Individual differences:** Explore how individual characteristics (e.g., personality type, learning style) moderate the effects of sports participation on learning outcomes.
- **Policy evaluation:** Evaluate the implementation effects of sports policies in different universities and provide a basis for formulating more effective sports education strategies.



Overall, this study provides important insights into understanding the impact of sport participation on college student learning outcomes, but there are still many issues worthy of further exploration. Future research should continue to deepen knowledge in this field and provide a more solid theoretical and practical foundation for promoting the all-round development of college students. This study highlights the important role of sports participation in the overall development of college students. Through moderate and targeted sports participation, college students can achieve significant gains in multiple areas including academic performance, mental health, and social skills. Colleges and universities should attach great importance to physical education and create a good sports environment for students, while students should actively integrate sports activities into daily life to achieve balanced development of body and mind.

## References

- Astin, A. W. (1993). *What matters in college?: Four critical years revisited*. San Francisco: Jossey-Bass.
- Bailey, R., Armour, K., Kirk, D., Jess, M., Pickup, I., & Sandford, R. (2009). The educational benefits claimed for physical education and school sport: an academic review. *Research Papers in Education*, 24(1), 1-27. <https://doi.org/10.1080/02671520701809817>
- Boecker, H., Sprenger, T., Spilker, M. E., Henriksen, G., Koppenhoefer, M., Wagner, K. J., ... & Tolle, T. R. (2008). The runner's high: opioidergic mechanisms in the human brain. *Cerebral Cortex*, 18(11), 2523-2531. <https://doi.org/10.1093/cercor/bhn013>
- Bourdieu, P. (1986). The forms of capital. In J. Richardson (Ed.), *Handbook of Theory and Research for the Sociology of Education* (pp. 241-258). New York: Greenwood.
- Buhrmester, D., Furman, W., Wittenberg, M. T., & Reis, H. T. (1988). Five domains of interpersonal competence in peer relationships. *Journal of Personality and Social Psychology*, 55(6), 991-1008. <https://doi.org/10.1037/0022-3514.55.6.991>
- Caspersen, C. J., Pereira, M. A., & Curran, K. M. (2000). Changes in physical activity patterns in the United States, by sex and cross-sectional age. *Medicine and Science in Sports and Exercise*, 32(9), 1601-1609. <https://doi.org/10.1097/00005768-200009000-00013>
- Castelli, D. M., Centeio, E. E., Hwang, J., Barcelona, J. M., Glowacki, E. M., Calvert, H. G., & Nicksic, H. M. (2014). VII. The history of physical activity and academic performance research: informing the future. *Monographs of the Society for Research in Child Development*, 79(4), 119-148. <https://doi.org/10.1111/mono.12133>
- Chaddock-Heyman, L., Erickson, K. I., Holtrop, J. L., Voss, M. W., Pontifex, M. B., Raine, L. B., ... & Kramer, A. F. (2014). Aerobic fitness is associated with greater white matter integrity in children. *Frontiers in Human Neuroscience*, 8, 584. <https://doi.org/10.3389/fnhum.2014.00584>
- Cohen, S., & Wills, T. A. (1985). Stress, social support, and the buffering hypothesis. *Psychological Bulletin*, 98(2), 310-357. <https://doi.org/10.1037/0033-2909.98.2.310>
- Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., ... & Oja, P. (2003). International physical activity questionnaire: 12-country reliability and validity. *Medicine & Science in Sports & Exercise*, 35(8), 1381-1395. <https://doi.org/10.1249/01.MSS.0000078924.61453.FB>
- Creswell, J. W., & Plano Clark, V. L. (2018). *Designing and conducting mixed methods research* (3rd ed.). Thousand Oaks, CA: Sage Publications.
- Doerksen, S. E., Elavsky, S., Rebar, A. L., & Conroy, D. E. (2014). Weekly fluctuations in college student leisure activities and well-being. *Leisure Sciences*, 36(1), 14-34. <https://doi.org/10.1080/01490400.2014.862866>
- Donnelly, J. E., Hillman, C. H., Castelli, D., Etner, J. L., Lee, S., Tomporowski, P., ... & Szabo-Reed, A. N. (2016). Physical activity, fitness, cognitive function, and academic achievement in children: a systematic review. *Medicine and Science in Sports and Exercise*, 48(6), 1197-1222. <https://doi.org/10.1249/MSS.0000000000000901>
- Dyer, A. M., Kristjansson, A. L., Mann, M. J., Smith, M. L., & Alagante, J. P. (2017). Sport participation and academic achievement: A longitudinal study. *American Journal of Health Behavior*, 41(2), 179-185. <https://doi.org/10.5993/AJHB.41.2.9>
- Eccles, J. S., & Barber, B. L. (1999). Student council, volunteering, basketball, or marching band: What kind of extracurricular involvement matters? *Journal of Adolescent Research*, 14(1), 10-43. <https://doi.org/10.1177/0743558499141003>
- Eime, R. M., Young, J. A., Harvey, J. T., Charity, M. J., & Payne, W. R. (2013). A systematic review of the psychological and social benefits of participation in sport for children and adolescents: informing development of a conceptual model of health through sport. *International Journal of Behavioral Nutrition and Physical Activity*, 10(1), 98. <https://doi.org/10.1186/1479-5868-10-98>
- Eisenberg, D., Hunt, J., & Speer, N. (2013). Mental health in American colleges and universities: variation across student subgroups and across campuses. *The Journal of Nervous and Mental Disease*, 201(1), 60-67. <https://doi.org/10.1097/NMD.0b013e31827ab077>
- Fox, K. R. (2000). The effects of exercise on self-perceptions and self-esteem. In S. J. H. Biddle, K. R. Fox, & S. H. Boutcher (Eds.), *Physical activity and psychological well-being* (pp. 88-117). London: Routledge.
- Hillman, C. H., Erickson, K. I., & Kramer, A. F. (2008). Be smart, exercise your heart: exercise effects on brain and cognition. *Nature Reviews Neuroscience*, 9(1), 58-65. <https://doi.org/10.1038/nrn2298>
- Kniffin, K. M., Wansink, B., & Shimizu, M. (2015). Sports at work: Anticipated and persistent correlates of participation in high school athletics. *Journal of Leadership & Organizational Studies*, 22(2), 217-230. <https://doi.org/10.1177/1548051814538099>

- Krejcie, R. V., & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30(3), 607-610. <https://doi.org/10.1177/001316447003000308>
- Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, 33(3), 335-343. [https://doi.org/10.1016/0005-7967\(94\)00075-U](https://doi.org/10.1016/0005-7967(94)00075-U)
- Luthans, F., Youssef, C. M., & Avolio, B. J. (2007). *Psychological capital: Developing the human competitive edge*. Oxford: Oxford University Press.
- Macan, T. H., Shahani, C., Dipboye, R. L., & Phillips, A. P. (1990). College students' time management: Correlations with academic performance and stress. *Journal of Educational Psychology*, 82(4), 760-768. <https://doi.org/10.1037/0022-0663.82.4.760>
- Muñoz-Bullón, F., Sanchez-Bueno, M. J., & Vos-Saz, A. (2017). The influence of sports participation on academic performance among students in higher education. *Sport Management Review*, 20(4), 365-378. <https://doi.org/10.1016/j.smr.2016.10.006>
- Pascarella, E. T., & Terenzini, P. T. (2005). *How college affects students: A third decade of research (Vol. 2)*. San Francisco: Jossey-Bass.
- Patton, M. Q. (2002). *Qualitative research and evaluation methods (3rd ed.)*. Thousand Oaks, CA: Sage Publications.
- Pike, G. R., Kuh, G. D., & McCormick, A. C. (2011). An investigation of the contingent relationships between learning community participation and student engagement. *Research in Higher Education*, 52(3), 300-322. <https://doi.org/10.1007/s11162-010-9192-1>
- Rees, D. I., & Sabia, J. J. (2010). Sports participation and academic performance: Evidence from the National Longitudinal Study of Adolescent Health. *Economics of Education Review*, 29(5), 751-759. <https://doi.org/10.1016/j.econedurev.2010.04.008>
- Singh, A., Uijtdewilligen, L., Twisk, J. W., Van Mechelen, W., & Chinapaw, M. J. (2012). Physical activity and performance at school: a systematic review of the literature including a methodological quality assessment. *Archives of Pediatrics & Adolescent Medicine*, 166(1), 49-55. <https://doi.org/10.1001/archpediatrics.2011.716>
- Taliaferro, L. A., Rienzo, B. A., Pigg, R. M., Miller, M. D., & Dodd, V. J. (2009). Associations between physical activity and reduced rates of hopelessness, depression, and suicidal behavior among college students. *Journal of American College Health*, 57(4), 427-436. <https://doi.org/10.3200/JACH.57.4.427-436>
- Tashakkori, A., & Teddlie, C. (2010). *Sage handbook of mixed methods in social & behavioral research (2nd ed.)*. Thousand Oaks, CA: Sage Publications.
- Wechsler, D. (2011). *Wechsler Abbreviated Scale of Intelligence—Second Edition (WASI-II)*. San Antonio, TX: NCS Pearson.
- York, T. T., Gibson, C., & Rankin, S. (2015). Defining and measuring academic success. *Practical Assessment, Research, and Evaluation*, 20(5), 1-20. <https://doi.org/10.7275/hz5x-tx03>