

A Study on the Impacts of High-school Students' Sports Participation on Their Academic Performance and Time Allocation

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Abstract

To investigate the relationships among senior high-school students' sports participation, academic performance and daily time allocation, this paper conducted a questionnaire survey among students from two local ordinary senior high schools, and 400 valid questionnaires were collected. Taking weekly sports participation duration as the core independent variable and students' academic performance as the outcome variable, this study incorporated time indicators including study, leisure and sleep into time-allocation analysis. After controlling for gender, grade, boarding status and family learning atmosphere, descriptive statistics, inter-group difference tests, correlation and regression analyses as well as mediating-effect tests were adopted. The results revealed significant differences across sports-participation groups in daily study, leisure and sleep hours as well as average academic scores. The moderate-participation group obtained higher average scores and longer daily study hours with relatively less leisure time, whereas the high-participation group reported fewer study and sleep hours. An inverted-U trend was observed between sports participation and academic performance. Nevertheless, as this is a cross-sectional survey, such trend only reflects correlation patterns within the sample instead of establishing direct causal effects of sports participation on academic achievement. Further mediating-effect analysis indicated that time allocation exerted a certain mediating effect between sports participation and academic performance. The findings suggest that reasonably arranged physical activity does not necessarily create a simple trade-off against study time; moderate participation may be accompanied by more organized daily time use. Corresponding suggestions are put forward from school, family and student perspectives accordingly.

Keywords

Senior high-school students, Sports participation, Academic performance, Time-allocation, Mediating effect

Introduction

Against the backdrop of integrated physical education and academic education, the role of physical education within the school education system extends far beyond physical fitness training. Senior high school features heavy academic workloads and fast-paced curricula. How students allocate time among studying, exercising, resting and leisure activities constitutes a critical factor shaping their daily learning status. A prevalent real-world perception holds that physical activity directly squeezes time for academic study, so students tend to reduce or even eliminate after-school exercise [1]. However, existing research and educational practice demonstrate that the relationship between sports participation and academic performance is not a simple zero-sum game. Regular and moderate physical activity

may help improve physical and mental conditions as well as attention spans. Yet potential benefits diminish once excessive exercise substantially cuts into study or sleep time. Therefore, rather than merely debating “whether to take exercise”, it is more necessary to examine degrees of sports participation alongside accompanying differences in time configuration.

Existing studies have largely focused on correlations between physical activity and academic scores, yet insufficient attention has been paid to disparities across participation levels and the potential role of time allocation. For senior high-school students, sports participation does not occur in isolation. Together with studying, leisure and sleep, it forms the configuration of limited daily time. Increased sports participation may

prompt students to adjust leisure hours to preserve study schedules, or excessive exercise may compress study or sleep time. Hence, a non-linear relationship may exist between sports participation and academic performance, with time allocation serving as a key connecting link. Based on this logic, this paper targets senior high-school students, explores disparities in time allocation and academic performance across groups with different weekly sports-participation durations, and further tests the mediating role of time allocation between sports participation and academic performance. Instead of simply labelling sports participation as “beneficial” or “harmful”, this study analyses differentiated outcomes under varied participation levels, providing empirical references for reconciling study and exercise time amid integrated physical-academic education.

Literature review

Core variables covered in this paper include sports participation, academic performance and time allocation. Sports participation refers to students’ overall engagement in in-school physical education classes, after-school independent exercise and special training. This paper adopts total weekly participation duration as the primary measurement indicator and divides respondents into distinct participation groups.

To avoid overlapping group boundaries, participants are categorized into the low-participation group (<2 h/week), moderate-participation group (2-6 h/week), and high-participation group (≥ 6 h/week). Academic performance is measured by scores from unified school examinations, supplemented by excellent and pass-rate indicators [2]. Time allocation focuses on students’ daily hours spent studying, doing sports, engaging in leisure-recreational activities and sleeping. Rationality of time arrangement is evaluated based on questionnaire-based time-use indicators.

This study draws mainly upon three theoretical perspectives: cognitive development, time management, and stress relief. The cognitive-development perspective emphasises that moderate physical activity can create favourable conditions for learning by improving arousal levels, attentional states and physical-mental wellbeing. From the time-management perspective, fixed exercise schedules compel students to reallocate limited time, which may motivate them to cut down low-efficiency leisure activities. The stress-relief perspective points out

that moderate exercise can ease emotional tension amid heavy senior-high-school academic pressure and sustain stable learning states. It should be noted that these theories serve to explain potential action pathways. Cross-sectional data from this study cannot directly verify causal mechanisms [3]. Accordingly, interpretations of results emphasise “correlation”, “prediction” and “plausible mediating pathways”, avoiding misinterpreting statistical associations as definitive causal effects.

Previous research has found positive or non-linear correlations between adolescent physical activity and academic performance. Yet findings diverge due to differences in samples, measurement approaches and definitions of physical activity. Domestic studies, grounded in integrated physical-academic education and school-sports practice, concentrate on impacts of physical activity on adolescents’ physical-mental health, learning states and holistic development. Nevertheless, room for refinement remains in existing literature. First, some studies treat sports participation as a binary “participation or non-participation” variable while neglecting differences in participation duration. Second, sports participation, time configuration and academic performance are often discussed separately. Systematic examinations of transmission relationships among the three are scarce. Third, many studies rely solely on single academic indicators and fail to reflect disparities in students’ daily time use.

This paper therefore conducts analysis from the dual dimensions of participation duration and time configuration, supplemented by mediating-effect analysis to enhance explanatory power.

Research design

Adopting cluster sampling, this research selected Grade 10, Grade 11 and Grade 12 students from two local public ordinary senior high schools, covering respondents of diverse genders, grades and boarding statuses.

A total of 420 questionnaires were distributed. After discarding forms with substantial missing answers or obviously abnormal responses, 400 valid questionnaires were obtained, yielding an effective response rate of 95.20%. It should be noted that the sample was drawn exclusively from two schools. Findings describe relationships within this sample and cannot be

generalized to all senior high-school students [4].

Key research variables include sports participation, academic performance, time allocation and control variables. Sports participation is measured by total weekly participation duration, categorized into low-participation (<2 h/week), moderate-participation (2-6 h/week) and high-participation (≥ 6 h/week) groups based on weekly hours. These groups reflect time investment instead of strict physiological exercise intensity. Academic performance is based on unified midterm and final exam scores; we report excellent and pass rates to reduce single-indicator bias. Time allocation records students' daily average hours spent on study, physical activity, recreation and sleep. Table 2 presents study, leisure and sleep indicators. Gender, grade, boarding status and family learning atmosphere are included as controls to attenuate confounding individual background differences.

The self-designed Questionnaire on Senior High-School Students' Sports Participation and Time Allocation served as the research instrument. We conducted a pre-survey and reliability-validity tests. Cronbach's $\alpha > 0.80$, showing satisfactory internal consistency, and validity outcomes met preset criteria. Academic scores were retrieved from official school datasets to reduce self-reported grade measurement errors [5].

After data cleaning, Statistical Package for the Social Sciences (SPSS) 26.0 was adopted for sequential statistical analyses: descriptive statistics, inter-group comparison, Pearson correlation, regression and mediation tests. Grouping results and trend charts identified the non-linear association between sports participation and academic performance. For rigorous evidence of the inverted-U pattern, we further report regression coefficients and confidence intervals of the quadratic term for continuous sports-participation duration [6]. Hence, this paper describes observed patterns as an "inverted-U trend", instead of confirming

a definitive quadratic function relationship merely based on group mean values.

Based on theoretical analysis and research objectives, the following hypotheses are proposed:

H1: A non-linear correlation may exist between sports-participation duration and academic performance. The moderate-participation group achieves better academic performance than both the low-participation and high-participation groups.

H2: Students with different sports-participation levels differ in time allocation for study, leisure and sleep. Moderate participation correlates with more organized time configuration.

H3: After controlling relevant background variables, time allocation exerts a mediating effect between sports participation and academic performance. That is, variations in sports-participation-related time configuration are further correlated with academic performance.

Research results

Analysis was performed on 400 valid questionnaires. This section first describes sample demographics as well as time-allocation and academic-performance profiles across sports-participation groups, followed by correlation, regression and mediating-effect analyses exploring relationships among variables. Given the cross-sectional nature of this survey, results reveal statistical correlations within the sample and shall not be interpreted directly as causal effects.

Table 1 shows fairly balanced sample distributions across gender and grade. Sample sizes for the three sports-participation groups are 148, 164 and 88 respectively. Each group is sufficient size to support, subsequent inter-group comparisons. Nevertheless, since data are sourced from merely two schools and the high-participation group accounts for a relatively small proportion, findings require further verification using larger-scale samples.

Table 1. Demographic characteristics of the sample.

Basic information	Category	Number of samples	Percentage (%)
Gender	Male	196	49.0
	Female	204	51.0
Grade	Grade 10	132	33.0
	Grade 11	136	34.0
	Grade 12	132	33.0
Sports participation level	Low-participation	148	37.0
	Moderate-participation	164	41.0
	High-participation	88	22.0

Table 2 demonstrates prominent inter-group differences in average daily hours for study, leisure and sleep. The moderate-participation group has an average of 7.56 daily study hours. This figure is higher than that of the low-participation group (6.82 h) and the high-participation group (5.93 h). Meanwhile, the moderate group records the lowest average daily leisure time

(2.28 h) across the three groups. The moderate-participation group also reports 7.32 hours of sleep per day, exceeding the low-participation group (6.95 h) and high-participation group (6.61 h). It can be observed that the moderate-participation group combines longer study and sleep hours with less leisure time, reflecting relatively compact time configuration.

Table 2. Comparison of time allocation among students with different sports-participation levels (M±SD).

Sports-participation group	Average daily study hours (h)	Average daily leisure hours (h)	Average daily sleep hours (h)
Low-participation (<2 h/week)	6.82±0.52	3.15±0.48	6.95±0.36
Moderate-participation (2-6 h/week)	7.56±0.45	2.28±0.32	7.32±0.28
High-participation (≥6 h/week)	5.93±0.61	2.86±0.41	6.61±0.42

As shown in Table 3, the moderate-participation group achieves an average score of 78.92 points, outperforming the low-participation group (72.36 points) and the high-participation group (69.58 points). Excellent rates and pass rates follow identical patterns. Inter-group

comparisons based on mean values and standard deviations reveal statistically significant differences in average scores across sports-participation groups. Group means presenting an inverted-U pattern with higher values in the middle and lower values at both ends.

Table 3. Academic performance of students with different sports-participation levels.

Sports-participation group	Average score	Excellent rate (%)	Pass rate (%)
Low-participation (<2 h/week)	72.36±6.25	28.38	82.43
Moderate-participation (2-6 h/week)	78.92±5.18	45.12	94.68
High-participation (≥6 h/week)	69.58±7.32	22.73	76.14

Figure 1 plots weekly sports-participation hours on the horizontal axis and average academic scores on the vertical axis. Academic performance peaks at moderate participation levels and gradually declines with

insufficient or excessive exercise. This graphical trend aligns closely with inter-group differences shown in Table 3 and provides intuitive supplementary evidence for the proposed non-linear correlation.

Average student score · Weekly sports hours

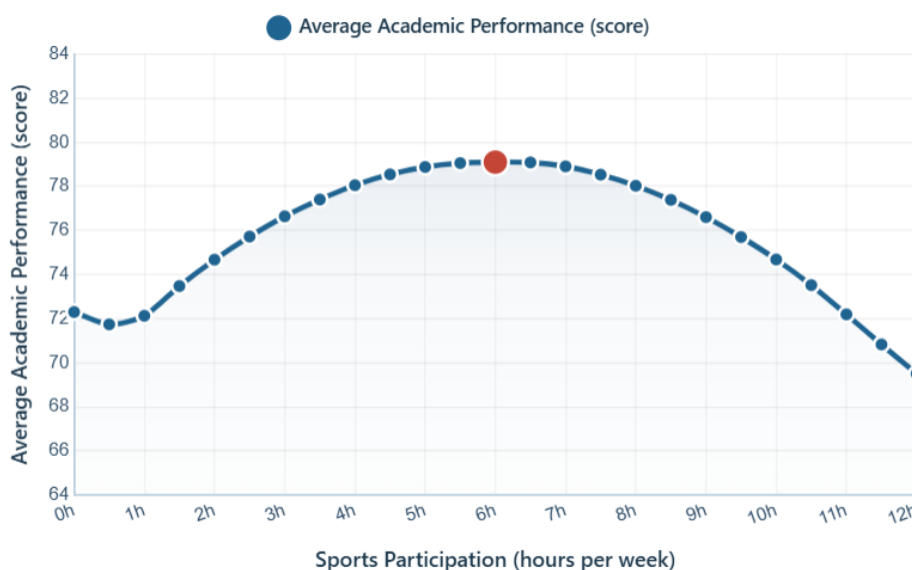


Figure 1. Correlation trend of sports participation intensity and academic performance.

Figure 2 illustrates disparities in allocation ratios for study, leisure and sleep across sports-participation groups. The moderate-participation group allocates more time to studying, less time to ineffective leisure, and maintains relatively sufficient sleep duration. This result suggests there is no simple substitution relationship between sports participation and time use. Moderate exercise may coincide with better-organized daily schedules.

Results from regression and mediating-effect analyses show statistically significant associations of sports participation and time-allocation indicators with students' academic performance. Time allocation exhibits a measurable mediating effect between sports participation and academic performance, lending solid empirical support to our Hypothesis 3. This finding clarifies how sports participation shapes academic outcomes via time-use patterns.

Comparison of time proportion across four activity categories by intensity group

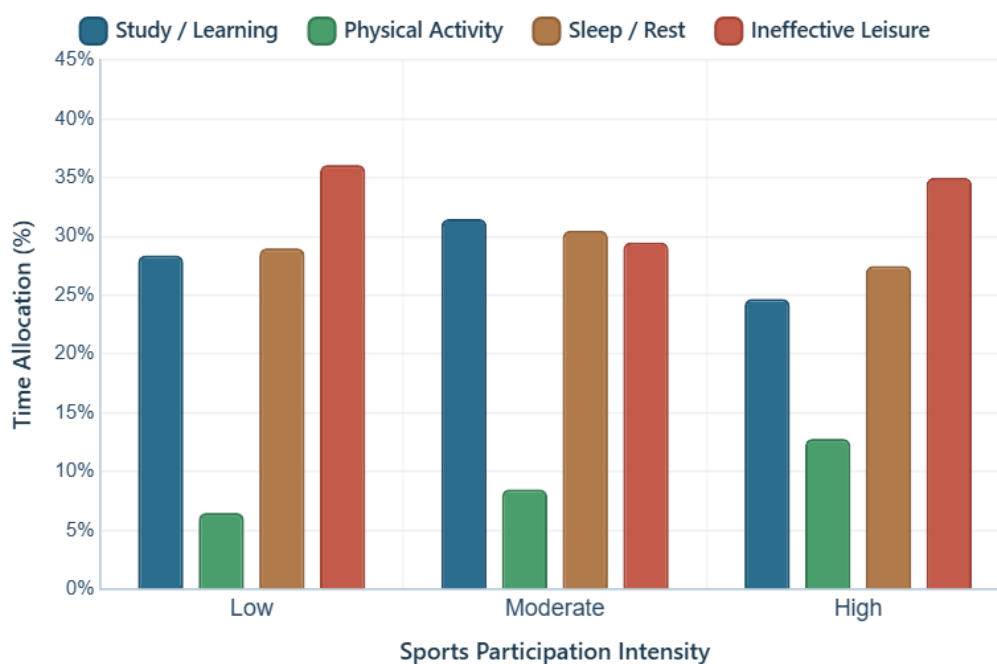


Figure 2. Time allocation structure of students with different sports participation levels.

Discussion

Synthesized results reveal clear correlation patterns among sports participation, time configuration and academic performance. First, average scores rank highest for the moderate-participation group, followed by the low-participation group and then the high-participation group [7]. This indicates more exercise does not guarantee better academic outcomes. Students with insufficient physical activity may experience prolonged sedentary behaviour and poorly structured after-school time.

By contrast, excessive sports participation may compress study and sleep hours. The moderate-participation group records longer study and sleep hours than the other two groups, implying that moderate exercise may accompany well-organized time configuration. Nevertheless, such

gaps could also stem from variations in self-discipline, prior academic foundation and family support [8]. It can therefore conclude that moderate sports participation correlates strongly with favourable time configuration and academic performance, rather than confirming that exercise directly improves grades.

From the perspective of time configuration, physical activity consumes time, yet increased exercise time does not necessarily reduce study time proportionally. As shown in Table 2, the moderate-participation group reports longer study and sleep hours alongside the least leisure time compared with other groups. This suggests some students accommodate physical activity by cutting down low-value leisure time.

Meanwhile, reduced study and sleep hours among the high-participation group signal tangible time-cost risks

once exercise investment exceeds a certain threshold [9]. Accordingly, a balancing range exists for sports participation and time management. Since this study lacks continuous tracking of daily time use and does not directly measure changes in time-management competence, longitudinal research is required to further validate this mechanism.

Findings highlight potential synergies between school sports arrangements and students' time management. Treating physical activity merely as a competitor for class-learning time may prompt students to give up exercise amid heavy academic pressure. Conversely, without reasonable boundaries for exercise duration and recovery time, some students may overinvest in sports. Schools should therefore pursue holistic coordination of physical activity with studying and sleep, offering flexible arrangements tailored to grade levels and academic loads.

Families ought to reject oversimplified oppositions between sports and grades and instead focus on whether children maintain stable, sustainable daily rhythms. For individual students, the priority is not maximizing exercise duration, but establishing relatively stable schedules balancing studying, sports and rest [10].

Several limitations constrain this research. First, the sample originates exclusively from two local senior high schools; external validity for broader populations needs further testing. Second, data on sports-participation duration and partial time-use indicators rely on questionnaire self-reports, susceptible to recall bias and social desirability bias. Future research may adopt cross-validation via activity trackers, mobile-phone usage logs or time-diary methods. Third, this study does not differentiate sport types, exercise frequency, single-session duration or actual physical intensity. Distinct forms of physical activity may generate varied effects on learning and time allocation. Follow-up studies should improve upon these aspects.

Conclusion

Based on questionnaire data from students of two senior high schools, this paper analyses relationships among sports participation, time allocation and academic performance. Significant inter-group differences are identified in daily study, leisure and sleep hours as well as average academic scores. The moderate-participation group attains relatively higher average grades, longer

study hours and longer sleep hours, together with less leisure time. Overall sample patterns demonstrate an inverted-U trend for sports participation against academic performance. Mediating-effect analysis further suggests that time allocation constitutes one plausible transmission pathway linking sports participation and academic achievement, supplementing evidence for understanding relationships among the three variables.

According to these findings, schools should integrate physical-activity planning with students' daily time arrangements. On the premise of guaranteeing compulsory physical-education classes, short-duration regular extracurricular activities can mitigate prolonged sedentary behaviour, while blind pursuit of longer exercise hours should be avoided. Families should abandon mindsets that pit sports against academic success and pay attention to stable rhythms covering studying, exercise and sleep. Students are advised to arrange physical activity rationally according to personal academic workload and rest schedules, rejecting the oversimplified principle that "more exercise is always better".

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Conflicts of Interest

The authors declare no conflict of interest.

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