East African Scholars Journal of Psychology and Behavioural Sciences
Abbreviated Key Title: EAS J Psychol Behav Sci
ISSN 2663-1865 (Print) | ISSN 2663-6751 (Online)
Published By East African Scholars Publisher, Kenya
Volume-8 | Issue-4 | Oct-Dec-2026 | DOI: https://doi.org/10.36349/easjpbs.2026.v08i04.004

OPEN ACCESS

Original Research Article

Physical Exercise, Self-Control, and Smartphone Dependence among Chinese College Students: The Mediating Role of Self-Control

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Article History
Received: 17.09.2026
Accepted: 09.11.2026
Published: 11.11.2026

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: ***Background*:** Smartphone dependence is increasingly prevalent among Chinese college students and has been linked to poorer sleep, reduced academic engagement, and elevated emotional symptoms. Physical exercise is frequently proposed as a protective behavioural factor, yet most studies report only direct associations and leave the underlying mechanism unexamined. ***Objective*:** This study tested whether self-control mediates the association between physical exercise and smartphone dependence among Chinese college students. ***Methods:*** A cross-sectional survey was conducted with 400 Chinese undergraduates recruited through stratified cluster sampling. Physical exercise was assessed with the International Physical Activity Questionnaire–Short Form, self-control with the Brief Self-Control Scale, and smartphone dependence with the Smartphone Addiction Scale–Short Version. Hypotheses were tested with hierarchical regression and a bootstrapped mediation model (PROCESS Model 4, 5,000 resamples). ***Results*:** Physical exercise negatively predicted smartphone dependence ($\beta = -0.27$, $p < .001$) and positively predicted self-control ($\beta = 0.30$, $p < .001$). The indirect effect of exercise on smartphone dependence through self-control was −1.12 (95% CI [−1.60, −0.70]), accounting for 40.9% of the total effect. The direct effect remained significant after self-control was entered ($\beta = -0.16$, $p = .001$). ***Conclusion*:** Physical exercise was associated with lower smartphone dependence partly through higher self-control. The cross-sectional design precludes causal inference; longitudinal and intervention designs are needed to confirm the direction of these associations.

Keywords: Physical Exercise, Self-Control, Smartphone Dependence, College Students, Mediation.

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1. INTRODUCTION

The smartphone has become the dominant interface through which Chinese college students study, socialise, and consume entertainment. Surveys of mainland undergraduates consistently report several hours of daily use, and prevalence estimates for smartphone addiction in this population are high enough to make the pattern a public health concern rather than a curiosity (Li *et al*., 2022; Wang & Abdullah, 2026). This pattern is commonly described as smartphone dependence, a behavioural syndrome characterised by loss of control over use, withdrawal when devices are unavailable, tolerance reflected in escalating use, and functional impairment across academic and interpersonal domains (Billieux, 2012). Cross-sectional and longitudinal evidence links such dependence to poorer sleep quality, lower academic engagement, and elevated symptoms of anxiety and depression in student populations (Elhai *et al*., 2017; Zhang & Wu, 2020). Because these correlates overlap with the core concerns of university counselling services, identifying modifiable behavioural factors that protect against smartphone dependence has practical value.

Physical exercise is one candidate. Regular moderate-to-vigorous activity is associated with better mood regulation, higher self-efficacy, and more structured daily routines, all of which could plausibly displace or buffer excessive device use. Consistent with this reasoning, studies of adolescents and young adults have reported inverse associations between physical activity volume and problematic smartphone use, including in Chinese college samples, and intervention trials targeting sedentary behaviour sometimes report incidental reductions in screen time (Eime *et al*., 2013; Liu *et al*., 2025; Lubans *et al*., 2016; Zhu *et al*., 2023).

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However, the great majority of this work reports bivariate correlations or direct effects in regression models. Whether exercise is associated with smartphone dependence *because* it alters some intermediate psychological process, rather than merely competing for leisure time, remains largely untested. Without evidence on mechanism, recommendations to "exercise more" rest on an underspecified rationale and offer little guidance on what an intervention should actually target. A further complication is that exercise has been operationalised inconsistently across studies—as session frequency, total volume, or participation in organised sport—and these indicators need not behave alike, which makes the absence of mechanistic evidence harder to interpret than it first appears.

Self-control is a plausible intermediate process. Two literatures converge here. First, low self-control is among the most robust correlates of behavioural addictions: individuals who struggle to override impulses report more frequent and less controlled phone checking, and experimental work shows that depleted self-regulatory resources increase habitual device engagement (Baumeister *et al*., 2007; Billieux, 2012; Ding *et al*., 2022). Second, exercise may itself function as self-regulatory training. The strength model treats self-control as a capacity that responds to repeated exertion, and sustained exercise requires precisely the components that model identifies—setting goals, delaying gratification, and tolerating discomfort (Muraven & Baumeister, 2000; Tangney *et al*., 2004). Exercise is also associated with better executive function, including inhibitory control, in both cross-sectional and intervention studies (Diamond & Ling, 2016; Ludyga *et al.,* 2022; Zhou *et al*., 2026). If exercise strengthens self-control, and self-control in turn constrains compulsive device use, then self-control should carry part of the association between exercise and smartphone dependence. This chain implies a specific, testable prediction: the association between exercise and device use should attenuate once individual differences in self-control are statistically accounted for, and the size of that attenuation indexes how much of the relationship the regulatory pathway explains.

The present study examined this proposition in a sample of Chinese undergraduates. We proposed three hypotheses: **H1**, physical exercise negatively predicts smartphone dependence; **H2**, physical exercise positively predicts self-control; and **H3**, self-control mediates the association between physical exercise and smartphone dependence. The conceptual model is presented in Figure 1. Gender, academic year, discipline, and daily screen time were included as covariates because each has been associated with both exercise participation and device use in prior student samples.

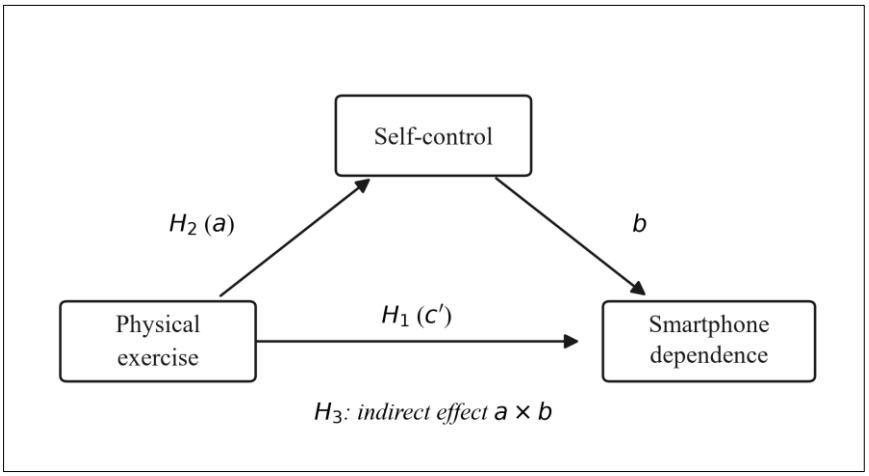


Figure 1: Conceptual model of the hypothesised mediating role of self-control

2. METHODS

2.1 Design

This was a cross-sectional, correlational study. Physical exercise served as the predictor, self-control as the mediator, and smartphone dependence as the outcome. Gender, academic year, discipline, and self-reported daily screen time were treated as covariates throughout.

A cross-sectional design was chosen because the primary aim was to establish whether the hypothesised mechanism is present at all, not to estimate causal effects. Demonstrating that self-control carries a non-trivial share of the exercise–dependence association is a precondition for the considerably more expensive longitudinal and intervention work discussed later, and a cross-sectional test can rule the mechanism out cheaply even though it cannot rule it in definitively.

2.2 Participants

Participants were full-time undergraduates at Chinese universities. Sampling proceeded in two stages: institutions were selected to represent comprehensive, normal, and applied types, and within each institution intact classes were drawn from each academic year, yielding a stratified cluster sample. The sampling frame was stratified by institution type and academic year so that no single discipline or year group would dominate

the sample, since both exercise participation and device use vary systematically across these categories. Data were collected between April and June 2026.

The target sample size was determined a priori for a bootstrapped mediation model with a medium-sized indirect effect, power of .80, and α = .05, which required approximately 200 participants. A total of 432 questionnaires were distributed and 400 valid responses were retained, giving a valid response rate of 92.6%.

The discrepancy between distributed and retained questionnaires arose from absence at the scheduled session, withdrawal after beginning, and questionnaires returned with substantial item-level incompleteness.

Inclusion criteria were full-time undergraduate status and provision of informed consent. Exclusion criteria were: enrolment in a physical education or sports science major, because structured training would confound the exercise measure; a current psychiatric diagnosis or psychotropic medication; completion time below 300 seconds, which indicates insufficient attention; and straight-line or patterned responding across the full questionnaire. Demographic characteristics of the retained sample are reported in Table 1.

2.3 Measures

Physical Exercise

Exercise volume over the preceding seven days was assessed with the Chinese version of the International Physical Activity Questionnaire–Short Form (IPAQ-SF; Craig *et al.*, 2003). The instrument contains seven items covering vigorous activity, moderate activity, walking, and sitting. Weekly volume was computed according to the official scoring protocol, assigning 8.0, 4.0, and 3.3 METs to vigorous, moderate, and walking activity respectively, and summed into MET-minutes per week. Individual activity bouts shorter than ten minutes were excluded from the calculation. Because the resulting distribution was positively skewed, MET-minutes per week were natural-log transformed before analysis; the untransformed median was 2,290 MET-min/week (IQR 1,470–3,747). The instrument yields a volume rather than a pattern measure: it captures how much activity students accumulate but not how regularly they accumulate it, a limitation revisited in the Discussion.

Self-Control

Trait self-control was measured with the Brief Self-Control Scale (BSCS; Tangney *et al*., 2004), a 13-item unidimensional instrument covering impulse control, resistance to temptation, and maintenance of goal-directed behaviour. Items are rated on a five-point scale from 1 (*not at all like me*) to 5 (*very much like me*). Reverse-scored items were recoded before averaging, and the mean item score was used as the indicator. Scores are interpreted as the degree to which respondents endorse statements describing successful regulation of impulse and goal pursuit; higher scores indicate greater trait self-control. Internal consistency in the present sample was α = .886 and ω = .905.

Smartphone Dependence

Smartphone dependence was assessed with the Smartphone Addiction Scale–Short Version (SAS-SV; Kwon *et al*., 2013), a 10-item instrument covering daily-life disturbance, withdrawal, cyberspace orientation, tolerance, and overuse. Items are rated on a six-point scale from 1 (*strongly disagree*) to 6 (*strongly agree*), and the total score ranges from 10 to 60. The Chinese version has been validated in mainland student samples. Scores are interpreted dimensionally rather than diagnostically: the scale indexes the severity of dependence-related experiences, and the gender-specific cut-offs proposed by the developers are used only in the supplementary analysis, never as a case definition. Internal consistency in the present sample was α = .842 and ω = .876.

All three instruments were administered in their published Chinese versions. Permission for use was obtained where required by the original developers.

2.4 Procedure

Questionnaires were administered in classroom settings by trained research assistants using a standardised instruction script. Participation was voluntary and anonymous; students generated a self-chosen code so that no identifying information was recorded. Respondents were informed of the purpose of the study, told that they could withdraw at any point without consequence, and asked to provide written informed consent before beginning.

To reduce common method variance at the administration stage, the three instruments were presented in a fixed but non-adjacent order, the response format was varied between five- and six-point scales, and the stated purpose of the study was kept general, without naming the hypothesised mediator (Podsakoff *et al*., 2003). Research assistants were instructed not to answer questions about the meaning of individual items and to refer such queries to the investigator.

2.5 Data Analysis

Analyses were conducted in SPSS 26.0 with the PROCESS macro, version 4.1 (Hayes, 2022). Data screening proceeded in three steps. Missing data were examined first; items missing for fewer than 5% of respondents were replaced by the sample mean for that item, and cases missing more than 20% of items were excluded. Univariate outliers were identified as values beyond ±3 SD from the mean and winsorised rather than deleted, to preserve sample size. Reverse-scored BSCS items were recoded before scale construction.

Common method bias was assessed with Harman's single-factor test, supplemented by a parallel exploratory analysis examining the number of factors with eigenvalues above one. Descriptive statistics and Pearson correlations were computed for all study variables. Hypotheses were tested in two stages: hierarchical regression entering covariates in Step 1 and exercise in Step 2, followed by a mediation model specifying exercise as the predictor, self-control as the mediator, and smartphone dependence as the outcome (PROCESS Model 4). Indirect effects were estimated with 5,000 bias-corrected bootstrap resamples, and an effect was judged significant when the 95% confidence interval excluded zero. All tests were two-tailed with $\alpha = .05$.

Regression assumptions were examined before hypothesis testing. Residuals were inspected for normality and homoscedasticity, and the Durbin–Watson statistic was used to check the independence of errors (obtained value 1.87). No violation was severe enough to require a change of estimator.

3. RESULTS

3.1 Common Method Bias and Descriptive Statistics

Harman's single-factor test extracted three factors with eigenvalues greater than one, and the first unrotated factor accounted for 30.80% of the variance, below the 40% threshold conventionally taken to indicate serious common method bias. That three factors emerged also matches the number of constructs measured, providing preliminary evidence that the scales were distinguishable.

Table 1 summarises the demographic composition of the sample. Table 2 reports descriptive statistics, reliability coefficients, and correlations. Distributions of self-control and smartphone dependence were approximately symmetric (skewness 0.074 and 0.121; kurtosis −0.428 and −0.350), whereas exercise volume remained mildly skewed even after log transformation (skewness −0.175), as is typical of self-reported activity data.

Self-control averaged 3.07 (SD = 0.63) on the five-point scale, and smartphone dependence averaged 31.44 (SD = 6.95) out of a possible 60. The three focal correlations were all in the hypothesised direction. Physical exercise was negatively correlated with smartphone dependence ($r = -.320$, $p < .001$) and positively correlated with self-control ($r = .342$, $p < .001$). Self-control was negatively correlated with smartphone dependence ($r = -.438$, $p < .001$). Among covariates, daily screen time was positively associated with smartphone dependence ($r = .335$, $p < .001$) and was the strongest covariate in the matrix, which is consistent with the scale's focus on time-based overuse but also raises the possibility of criterion contamination; this is addressed in the limitations. Male respondents reported higher exercise volume than female respondents, $t(398) = 6.11$, $p < .001$, $d = 0.62$.

Table 1: Demographic characteristics of the sample ($N = 400$)

Characteristic	Category	*n*	%
Gender	Male	178	44.5
	Female	222	55.5
Academic year	First	128	32.0
	Second	101	25.3
	Third	94	23.5
	Fourth	77	19.3
Discipline	Humanities and social sciences	159	39.8
	Sciences and engineering	150	37.5
	Medicine and others	91	22.8
Daily screen time	< 3 h	82	20.5
	3–5 h	185	46.3
	> 5 h	133	33.3

Table 2: Descriptive statistics, reliability, and correlations among study variables

Variable	*M*	*SD*	α	ω	1	2	3
1. Physical exercise (log MET-min/wk)	7.74	0.67	—	—	1		
2. Self-control	3.07	0.63	.886	.905	.342***	1	
3. Smartphone dependence	31.44	6.95	.842	.876	−.320***	−.438***	1

Note: $N = 400$. ** p* < .001.

3.2 Regression Analyses

Hierarchical regression results are presented in Table 3. In Model 1, the covariate block accounted for 13.7% of the variance in smartphone dependence ($R^2 = .137$, adjusted $R^2 = .121$). Adding physical exercise in Step 2 produced a significant increment in explained variance ($\Delta R^2 = .061$, F change = 29.59, $p < .001$), and exercise negatively predicted smartphone dependence ($\beta = -0.266$, $b = -2.746$, $SE = 0.505$, $p < .001$). Among the covariates, daily screen time was the only consistent

predictor across models (β = 0.271 in Model 3, $p < .001$); gender and discipline were not significant in any model, and of the year contrasts only the fourth-year versus first-year comparison reached significance (Model 1: b = 2.495, SE = 0.908, p = .006; Model 3: b = 1.914, SE = 0.847, p = .024). H1 was supported.

In Model 2, physical exercise positively predicted self-control after adjustment for covariates (β = 0.301, b = 0.283, SE = 0.048, $p < .001$, $\Delta R^2 = .078$, F change = 35.44, $p < .001$). Male respondents also scored modestly higher on self-control (b = 0.137, SE = 0.063, p = .030). H2 was supported.

In Model 3, self-control was added to the prediction of smartphone dependence. Self-control was negatively associated with the outcome (β = −0.362, b = −3.971, SE = 0.499, $p < .001$), and the coefficient for physical exercise decreased from −2.746 to −1.623 but remained significant (β = −0.157, p = .001). The full model explained 30.9% of the variance in smartphone dependence ($R^2 = .309$, F = 19.41, $p < .001$). Variance inflation factors ranged from 1.06 to 1.36 and tolerance values from 0.74 to 0.94, indicating no problematic multicollinearity.

Table 3: Hierarchical regression predicting self-control and smartphone dependence

Predictor	Model 1: Smartphone dependence	Model 2: Self-control	Model 3: Smartphone dependence
	b (*SE*)	*b* (*SE*)	*b* (*SE*)
Gender (male)	0.020 (0.666)	0.137 (0.063)*	0.563 (0.622)
Year 2 vs 1	0.824 (0.840)	−0.158 (0.079)*	0.195 (0.784)
Year 3 vs 1	0.719 (0.857)	−0.108 (0.081)	0.289 (0.797)
Year 4 vs 1	2.495 (0.908)**	−0.146 (0.085)	1.914 (0.847)*
Discipline 1 vs 3	1.033 (0.719)	−0.037 (0.068)	0.887 (0.668)
Discipline 2 vs 3	0.692 (0.828)	−0.105 (0.078)	0.274 (0.771)
Daily screen time	0.960 (0.157)***	−0.012 (0.015)	0.912 (0.146)***
Physical exercise (log MET)	−2.746 (0.505)***	0.283 (0.048)***	−1.623 (0.490)**
Self-control	—	—	−3.971 (0.499)***
R^2	.197	.144	.309
Adjusted R^2	.181	.126	.293
F	12.01***	8.24***	19.41***

Note: N = 400. Standardised coefficients for the focal predictors are reported in the text.
p < *.05*. p < *.01*. * p* < .001.

3.3 Mediation Analysis

The bootstrapped mediation model is summarised in Table 4 and Figure 2. Physical exercise was negatively associated with smartphone dependence in the total-effect model (c = −2.746, SE = 0.505, $p <$ .001). The a path from exercise to self-control was 0.283 (SE = 0.048, $p < .001$), and the b path from self-control to smartphone dependence was −3.971 (SE = 0.499, $p <$ .001). The indirect effect through self-control was −1.123 (BootSE = 0.229, 95% CI [−1.604, −0.705]), with the confidence interval excluding zero. The direct effect of exercise on smartphone dependence was −1.623 (SE = 0.490, 95% CI [−2.586, −0.660], p = .001).

Because both the indirect and the direct effects were significant, self-control partially mediated the association between physical exercise and smartphone dependence, accounting for 40.9% of the total effect. The standardised total effect corresponds to a change of −0.266 standard deviations in smartphone dependence per one-unit increase in logged exercise volume. H3 was supported.

Table 4: Decomposition of the total effect of physical exercise on smartphone dependence

Effect	Estimate	BootSE	95% CI	Proportion of total effect
Total effect (c)	−2.746	0.505	[−3.737, −1.755]	—
Direct effect (c')	−1.623	0.490	[−2.586, −0.660]	59.1%
Indirect effect via self-control ($a \times b$)	−1.123	0.229	[−1.604, −0.705]	40.9%

Note: N = 400. CIs for the total and direct effects are conventional OLS intervals; the CI for the indirect effect is bias-corrected and based on 5,000 bootstrap resamples.

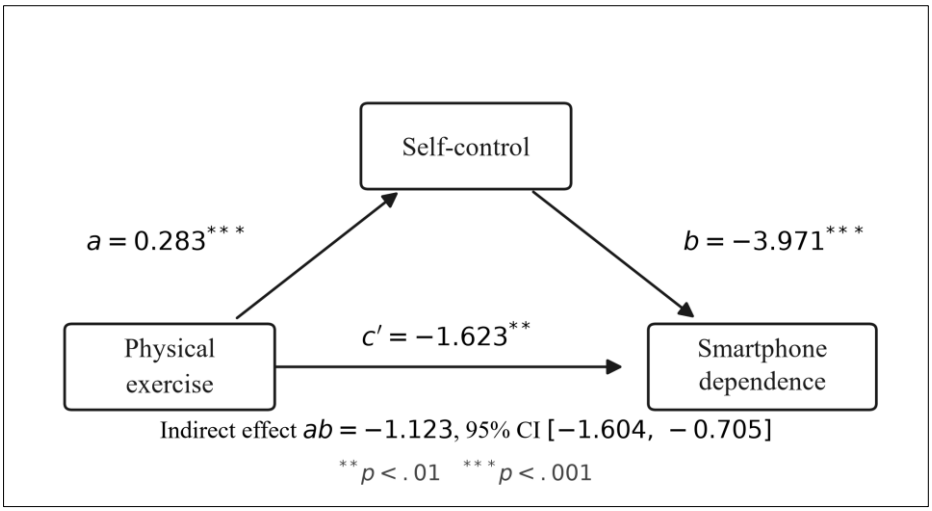


Figure 2: Path coefficients for the mediation model. Values are unstandardised regression coefficients

3.4 Supplementary Analyses

Two supplementary analyses examined the robustness of the mediation result. First, the model was re-estimated separately by gender. The indirect effect was −1.438 among men (n = 178) and −0.905 among women (n = 222); both estimates were negative and of comparable magnitude, and the difference should be treated as descriptive because measurement invariance across groups was not tested. Second, smartphone dependence was dichotomised at the gender-specific cut-off proposed by Kwon *et al*., (2013), which classified 195 respondents (48.8%) as exceeding the threshold, and the model was re-estimated with logistic regression. Exercise remained negatively associated with caseness (β = −0.436, SE = 0.197, p = .027, OR = 0.65), as did self-control (β = −1.290, SE = 0.174, p < .001, OR = 0.28). The direction and significance of the focal coefficients were therefore unchanged under a different scoring of the outcome.

4. DISCUSSION

4.1 Principal Findings

This study examined whether self-control accounts for part of the association between physical exercise and smartphone dependence among Chinese undergraduates. All three hypotheses were supported. Exercise was associated with lower smartphone dependence and with higher self-control, and self-control carried a statistically significant share of the exercise–dependence association. The pattern is consistent with the view that exercise is not merely a competing use of leisure time but may operate through self-regulatory processes.

4.2 Interpretation of Findings

Exercise and Smartphone Dependence

The inverse association between exercise volume and smartphone dependence can be read in several ways. The most straightforward is temporal displacement: time spent in structured physical activity is time not spent on the device, and students with regular exercise routines typically report more segmented and less fragmented daily schedules. A second reading concerns affect regulation. Smartphone overuse is frequently motivated by the desire to escape negative affect, and exercise produces acute improvements in mood that may reduce reliance on device-based avoidance. A third concerns reward substitution: exercise supplies achievement experiences—meeting training targets, improving performance—that compete with the intermittent reinforcement delivered by social media and short-form video. These explanations are not mutually exclusive, and the present data cannot adjudicate among them; what the mediation result does suggest is that a purely temporal account is incomplete, because the association persisted, in attenuated form, after self-control was taken into account.

Exercise and Self-Control

The positive association between exercise and self-control is consistent with the strength model's claim that self-regulatory capacity responds to repeated exertion (Muraven & Baumeister, 2000). Sustained exercise requires the same operations that laboratory tasks use to index self-control: forming a goal, monitoring progress against it, and overriding the impulse to stop when effort becomes aversive. Over months, these operations are rehearsed under increasingly demanding conditions. The result also aligns with evidence that physical activity is associated with better inhibitory control and executive function (Diamond & Ling, 2016; Ludyga *et al*., 2022; Zhou *et al*., 2026), although the cross-sectional design means that selection effects—students with higher self-control may be more likely to sustain an exercise routine—cannot be ruled out and are, in fact, equally plausible.

The Mediating Role of Self-Control

The mediation result reframes a familiar recommendation. "Exercise more" is a behavioural prescription; "exercise in ways that build self-regulatory capacity" is a mechanistic one, and the latter implies different design choices. The finding is consistent with

the broader claim that low self-control is a transdiagnostic risk factor for behavioural addictions (Billieux, 2012; Ding *et al*., 2022), and it extends that claim by identifying a modifiable antecedent. Where the present results diverge from some prior work is in the size of the indirect effect; differences in sample composition, in the instruments used to operationalise exercise, and in cultural norms around both physical activity and device use are all plausible sources of discrepancy.

The pattern also speaks to a broader question in the behavioural-addiction literature: whether behavioural substitutes are interchangeable. If any absorbing activity could displace device use, the mechanism would be temporal and the specific activity would matter little. The mediation result argues against that view, because the association survived adjustment for self-control only in part—which is what one would expect if exercise contributes something that passive alternatives such as television or gaming do not. Exercise demands sustained effort against an aversive gradient, and it is that demand, rather than the mere occupation of time, that the self-regulatory account picks out. The interpretation is speculative given the design, but it generates a clear prediction: substitutes that impose self-regulatory demands should show larger indirect effects than substitutes that do not.

4.3 Practical Implications

Three implications follow, each of which is actionable within existing university structures. First, smartphone-dependence interventions should treat physical activity as a component rather than an afterthought. Programmes that rely exclusively on screen-time restriction or digital-detox education address the symptom while leaving the underlying regulatory deficit untouched; pairing restriction with structured exercise offers a route to the mechanism identified here. Second, physical education curricula can be designed to do more than produce fitness gains. Embedding explicit goal-setting, self-monitoring, and progress review into course requirements turns a PE class into a self-regulation practice environment, which is precisely the ingredient the mediation model implicates. Third, student support services can use exercise-based behavioural contracts—weekly activity targets with self-recorded adherence—as a low-cost adjunct to counselling for problematic device use, particularly for students who are reluctant to engage with conventional mental health services. A fourth, institutional lever is the design of campus space: walkable routes, accessible sports facilities, and evening activity programmes lower the fixed cost of exercise and may shift the default behaviour of students who are otherwise well intentioned but poorly served by existing provision.

4.4 Limitations and Future Directions

Four limitations qualify these conclusions. First, the cross-sectional design cannot establish temporal order. The hypothesised path runs from exercise through self-control to smartphone dependence, but the reverse is equally consistent with the data: students who are heavily dependent on their devices may sleep less, feel more fatigued, and therefore exercise less, and the association with self-control could reflect the same displacement. Second, both exercise and smartphone dependence were self-reported. Exercise volume is subject to recall and social-desirability bias, and self-reported dependence is only a proxy for actual device use; objective measures such as accelerometry and device-logged screen time would strengthen future work. Third, the sample was drawn from a limited number of institutions using cluster sampling, which limits generalisability to the national undergraduate population and may inflate design effects relative to simple random sampling. Because measurement invariance across gender and discipline was not tested, the supplementary group comparison should be read as descriptive rather than definitive. Fourth, several plausible confounders were not measured, including sleep quality, depressive symptoms, peer norms around device use, and family socioeconomic status; each is associated with both exercise and smartphone dependence and could account for part of the observed associations.

Future research should address these limits directly. A cross-lagged panel design with at least three waves would allow the reciprocal paths between exercise, self-control, and smartphone dependence to be estimated rather than assumed. A randomised or quasi-experimental trial in which one group receives a twelve-week structured exercise programme and a comparison group receives standard health education would provide a stronger test of the causal chain, with self-control measured at multiple points to establish whether change in self-control precedes change in device use.

5. CONCLUSION

Among Chinese college students, physical exercise was associated with lower smartphone dependence, and part of this association was carried by self-control. The finding matters less for what it says about exercise than for what it says about mechanism: if self-regulation is the pathway, then interventions can be designed to target it directly, and exercise becomes one feasible means of doing so rather than a general prescription to be more active. Within the limits of a cross-sectional design, these results suggest that programmes combining structured physical activity with explicit self-regulatory training may be more effective than screen-restriction efforts alone, and they provide a rationale for testing that proposition in longitudinal and intervention studies.

Three qualifications should travel with that conclusion. The association was modest in size, consistent with the modest effects reported elsewhere in the exercise–device-use literature. The causal ordering

remains unresolved, and the reciprocal path is at least as plausible on theoretical grounds. And self-control was measured as a trait rather than as a state, so the analysis speaks to stable individual differences rather than to the short-term fluctuations that may drive a given evening's device use. Each qualification points towards the same next step: designs that measure all three constructs repeatedly, and can therefore distinguish selection between persons from change within them.

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Cite This Article: Pan, Y. (2026). Physical Exercise, Self-Control, and Smartphone Dependence among Chinese College Students: The Mediating Role of Self-Control. *EAS J Psychol Behav Sci, 8*(4), 178-186. https://doi.org/10.36349/easjpbs.2026.v08i04.004