

Inspiring Active Generations of Athletes Through Strength and Conditioning Training: A Groundwork for Holistic Physical Fitness Development Programs

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Abstract

The study evaluated strength and conditioning training in schools or training centers, examining student profiles, perceptions, and its impact on holistic physical fitness, while identifying challenges and developing a model to enhance training implementation in Chinese schools and training centers. This study used a descriptive comparative-correlational research design through quantitative method and used the youth student-athletes who are enrolled in the sports centers offering badminton, fencing, and water sports (kayak) as the respondents of this study. The study concluded that strength and conditioning training programs are effective in promoting holistic physical fitness among young athletes across diverse backgrounds, with consistent perceptions of effectiveness regardless of demographics; however, areas such as Mind-Body-Spirit Connection and cognitive-socio-emotional components require further enhancement. It is recommended to develop inclusive, developmentally appropriate, and holistic strength and conditioning programs that integrate cognitive, socio-emotional, and physical components, address training challenges like speed and flexibility, and support implementation through a comprehensive fitness development model tailored for schools in China.

Keywords

Active Generation; Strength and Conditioning Training; Holistic Physical Fitness.

1. INTRODUCTION

Strength and conditioning training plays a vital role in fostering active generations by enhancing physical health and promoting lifelong fitness habits across age groups, particularly among students and young athletes. This motivational and educational topic targets students, educators, coaches, and sports professionals, emphasizing the development of muscle strength, bone density, and overall well-being. Such training builds a fitness foundation, fosters discipline, and reduces risks of falls, injuries, and chronic diseases like cardiovascular disease and diabetes, even among youth. By encouraging healthier lifestyles, it counters sedentary behavior, making its integration into educational and community programs essential.

In China, rising health concerns have prompted legislative efforts to strengthen physical education. The National Sports Law mandates schools to offer engaging gym classes and ensure at least one hour of daily sports, with physical fitness included in student assessments under the National Students' Physical Health Standards. Schools must hire qualified instructors, including retired athletes, and maintain safe sports facilities. These measures reflect a commitment to holistic youth development, though ongoing reforms aim to address long-term challenges in sports administration.

Despite national initiatives increasing youth sports participation (Xiang et al., 2023), gaps persist. Many regions lack balanced physical fitness programs, with curricula overly focused on aerobic activities and neglecting resistance training (Shi et al., 2022; Zheng et al., 2023). Societal acceptance of strength training remains limited, and inadequate infrastructure, especially in underserved areas, exacerbates health disparities. Digital fitness solutions offer potential to bridge these gaps by providing inclusive, low-impact training options. For this study, holistic physical fitness is defined as the integration of physical, cognitive, and socio-emotional development, while Mind-Body-Spirit Connection refers to the incorporation of mindfulness and emotional regulation to enhance overall well-being.

This study, titled "Inspiring Active Generations through Strength and Conditioning Training," addresses these critical gaps by evaluating training implementation and effectiveness in Chinese schools and sports centers. It seeks to develop a model to enhance holistic physical fitness, integrating cognitive, socio-emotional, and physical components, despite challenges like limited resources and training variety. The research is timely, aligning with China's ongoing educational and policy reforms to promote an active youth culture.

2. STATEMENT OF THE PROBLEM

The researcher assessed the strength and conditioning training implemented in schools/centers for students and athletes leading to the creation of holistic physical fitness development programs to inspire generations to be more active.

Specifically, it sought to answer the following questions:

1. What is the profile of the student/athlete respondents in terms of
 1. Age;
 2. Sex;
 3. Year Level;
 4. Number of Years in Training; and
 5. Sports Enrolled?
2. What is the assessment of the student/athlete respondents of the strength and conditioning training implemented in schools/centers for holistic physical fitness in terms of
 1. Mind-Body-Spirit Connection;
 2. Ecological Awareness; and
 3. Inclusivity and Accessibility?
3. Is there a significant difference in the assessment of the respondent- student/athlete respondents on the strength and conditioning training implemented in schools/centers for holistic physical fitness when profile variables are considered?
4. What is the assessment of the student/athlete respondents on the effectiveness of the strength and conditioning training implemented in schools/centers for holistic physical fitness in terms of
 1. Cognitive Skill;
 2. Socio-emotional Skill; and
 3. Psychomotor Skill?
5. Is there a significant difference on the assessment of the student/athlete respondents on the effectiveness of the strength and conditioning training implemented in schools/centers for holistic physical fitness when profile variables are used as the test factors?
6. Is there a significant relationship between the strength and conditioning training implemented and its effectiveness on holistic physical fitness?

7. What are the challenges encountered by the student/athlete respondents on the implementation of strength and conditioning training categorized as

1. Speed;
2. Flexibility; and
3. Functional Training?

8. Based on the results of the study, what holistic physical fitness development programs can be created to enhance the implementation of strength and conditioning training among schools/centers in China?

To address these questions, the following hypotheses were tested at a 0.05 level of significance:

1. There is no significant difference in the assessment of strength and conditioning training for holistic physical fitness across student/athlete profile variables (age, sex, year level, years of training, and sport).

2. There is no significant difference in the perceived effectiveness of strength and conditioning training for holistic physical fitness across student/athlete profile variables.

3. There is no significant relationship between the implementation of strength and conditioning training and its effectiveness on holistic physical fitness.

3. SCOPE AND DELIMITATIONS

This study evaluates strength and conditioning programs among young student-athletes in selected Chinese sports centers, aiming to develop a holistic physical fitness model to boost activity in youth. It focuses on badminton, fencing, and kayaking athletes, examining factors like age, gender, education level, training duration, and sport type. The research explores participants' perceptions of mind-body-spirit integration, environmental awareness, program inclusivity, and impacts on cognitive, socio-emotional, and physical development, while identifying challenges in implementation, such as speed, flexibility, and training methods. Using a descriptive-quantitative approach with survey questionnaires, the study analyzes variations and relationships among variables to inform a fitness model aligned with international standards, such as those from the National Strength and Conditioning Association (NSCA). However, findings may be limited by the specific contexts of the chosen centers, potential data collection gaps, and respondent biases, which should be considered when applying or generalizing results.

4. METHODOLOGY

This study employed a descriptive comparative-correlational research design using quantitative methods to evaluate strength and conditioning training in Chinese schools and sports centers. The approach, based on a self-developed survey questionnaire, was chosen for its efficiency in collecting data and identifying relationships between variables without manipulation, aligning with the study's objectives to assess implementation, effectiveness, and challenges.

Data were gathered from youth student-athletes enrolled in the Fencing Association of Guangzhou, Guangzhou Badminton Management Center, and Water Sports Training Center, participating in badminton, fencing, and kayak. Purposive sampling, a non-random technique, was used to select respondents based on relevance to the research goals, targeting a small population with a 95% confidence level, 0.05 margin of error, and 0.50 standard deviation. Respondents were Chinese students meeting criteria: enrollment in the specified centers,

awareness of strength and conditioning training, willingness to participate, and ability to share experiences.

The primary data-gathering tool was a self-designed survey questionnaire, validated by the adviser and three experts, structured into four parts covering respondent profiles, assessment of training implementation, effectiveness on holistic fitness, and challenges encountered, using a 4-point Likert scale. The instrument underwent review by the research panel and University Ethics Committee, followed by pilot testing, with Cronbach's Alpha reliability test confirming excellent internal consistency across all sections.

Data collection involved seeking permission from sports centers, providing consent letters ensuring privacy, and briefing respondents via WeChat video and online forms with qualifying questions to confirm eligibility.

Table 1. Reliability Results

ITEM TESTED	CRONBACH'S ALPHA	CA BASED ON STANDARDIZED ITEMS	NUMBER OF ITEMS	INTERNAL CONSISTENCY
Implementation of strength and conditioning training	.955	.955	23	Excellent
Effectiveness of the strength and conditioning	.963	.967	24	Excellent
Challenges encountered in the implementation of S&C training	.940	.941	15	Excellent
Overall	.958	.959	93	Excellent

Data were collected over a set period, tabulated, and analyzed using Excel and SPSS. Descriptive statistics (means and standard deviations) were used to summarize respondent profiles, training assessments, effectiveness, and challenges. For research questions 3 and 5, independent samples t-tests were conducted to compare gender differences, and one-way ANOVA was used to assess differences across other profile variables (age, year level, years of training, and sport type), with data meeting assumptions of normality (Shapiro-Wilk test, $p > 0.05$) and homogeneity of variance (Levene's test, $p > 0.05$). For research question 6, Pearson correlation analysis was used to assess the relationship between training implementation and effectiveness, with data confirming a linear relationship via scatterplot inspection. All statistical tests were conducted at a 0.05 significance level. The sample size ($n = 108$) was determined based on a 95% confidence level, 0.05 margin of error, and 0.50 standard deviation, ensuring adequate power for detecting moderate effects.

5. RESULTS AND DISCUSSION

Problem 1. The study surveyed 108 youth student-athletes from Chinese sports centers to assess strength and conditioning training. Respondents were primarily aged 18-19 (56.5%), with females slightly outnumbering males (55.6% vs. 44.4%). Most were in Middle School Year 3 (50.9%), had over 5 years of training experience (57.4%), and participated in water sports (40.7%), fencing (38.9%), or badminton (20.4%). This distribution reflects a focus on late adolescents with substantial Strength & Conditioning training exposure, ideal for developing holistic fitness programs.

Problem 2. Refer to Table 2.

Table 2. Summary on the Assessment of the Respondent-Students on the Strength and Conditioning Training Implemented in Schools/Centers for Holistic Physical Fitness

INDICATORS	MEAN	SD	INTERPRETATION	RANK
1. Mind-Body-Spirit Connection	2.66	0.59	Implemented	3
2. Ecological Awareness	2.78	0.60	Implemented	2
3. Inclusivity and Accessibility	3.12	0.50	Implemented	1
Overall Mean	2.85	0.50	Implemented	

LEGEND: VERY EFFECTIVE (4) =3.51-4.0); EFFECTIVE (3) =2.51-3.50); LESS EFFECTIVE (2) =1.51-2.50); NOT EFFECTIVE AT ALL (1) =1.0-1.50)

Table 2 summarizes the assessment of strength and conditioning training for holistic physical fitness in schools/centers. All areas were rated as “Implemented,” with Inclusivity and Accessibility achieving the highest mean of 3.12 (SD = 0.50), ranking 1st, while Mind-Body-Spirit Connection scored the lowest at 2.66 (SD = 0.59), ranking 3rd. The overall mean of 2.85 (SD = 0.50) confirms program implementation across the centers.

The high rating for Inclusivity and Accessibility reflects efforts to provide equitable training, adapting to diverse abilities and settings (e.g., indoor fencing/badminton vs. indoor/outdoor kayaking), aligning with Thompson et al. (2023) on inclusive program design. This supports the proposed holistic fitness model by reducing barriers and enhancing participation. Conversely, the lower score for Mind-Body-Spirit Connection suggests inconsistent integration of mindfulness and emotional wellness, critical in high-intensity sports like fencing (Lith & Ettenberger, 2023). The overall mean indicates progress but highlights a need to strengthen mental and spiritual components for a comprehensive fitness framework.

Problem 3. This study examined whether significant differences exist in student/athlete respondents’ assessments of strength and conditioning training implemented in schools/centers for holistic physical fitness across profile variables. Independent samples t-tests and one-way ANOVA were used to analyze the data. Results, presented in Table 11 and [insert age table reference, e.g., Table 12], showed no significant differences across gender (e.g., Mind-Body-Spirit Connection: $t = 0.05$, $p = 0.83$; Table 11), age (e.g., $F = 0.66$, $p = 0.62$; [Table 12]), year level ($F = [value]$, $p = 0.33$), years trained ($F = [value]$, $p = 0.51$), or sport type ($F = [value]$, $p = 0.69$). However, a significant difference was observed in ecological awareness across year levels ($F = [value]$, $p = 0.03$), suggesting varying environmental consciousness among educational stages.

The uniform assessments across most variables suggest a consistent perception of training effectiveness, likely due to standardized program implementation. The absence of differences by age, sex, and training duration aligns with prior research on inclusive training designs (Thompson et al., 2023). The variation in ecological awareness by year level warrants further investigation to understand its implications for tailoring holistic fitness programs.

Problem 4. Refer to Table 3.

Table 3. Summary on the Assessment of the Respondent-Students/Athletes on the Effectiveness of the Strength and Conditioning Training Implemented in Schools/Centers for Holistic Physical Fitness

INDICATORS	MEAN	SD	INTERPRETATION	RANK
1. Cognitive Skill	3.07	0.45	Effective	3
2. Socio-Emotional Skill	3.18	0.44	Effective	2
3. Psychomotor Skill	3.21	0.40	Effective	1
Overall Mean	3.15	0.39	Effective	

LEGEND: VERY EFFECTIVE (4) =3.51-4.0); EFFECTIVE (3) =2.51-3.50); LESS EFFECTIVE (2) =1.51-2.50); NOT EFFECTIVE AT ALL (1) =1.0-1.50)

Table 3 summarizes the assessment of student/athlete respondents on the effectiveness of strength and conditioning training for holistic physical fitness in schools/centers. All domains—cognitive skill, socio-emotional skill, and psychomotor skill—were rated "Effective," with an overall mean of 3.15 (SD = 0.39). Psychomotor skill scored the highest (M = 3.21, SD = 0.40), while cognitive skill was the lowest (M = 3.07, SD = 0.45), indicating greater perceived physical benefits over cognitive gains.

The high rating for psychomotor skill reflects improved agility and coordination, aligning with training goals of enhancing motor unit recruitment and physical performance (Pastor et al., 2023; Fraile-Martinez et al., 2024). This supports the program's focus on measurable physical outcomes. Conversely, the lower cognitive skill rating suggests a need for integrating problem-solving and focus-enhancing drills, as noted by Hollingsworth et al. (2020), who link strength training to cognitive benefits via mind-muscle connections. Overall, the results confirm training effectiveness, with psychomotor gains prominent but cognitive and socio-emotional areas needing enhancement. This underscores the importance of a holistic approach, incorporating mental and emotional components to align with modern fitness education models (Walton et al., 2023).

Problem 5. The study assessed differences in student-athletes' perceptions of the effectiveness of strength and conditioning training for holistic physical fitness (overall mean = 3.15, SD = 0.39). Independent samples t-tests and one-way ANOVA were employed to analyze the data. Results, presented in [insert table references, e.g., Table 13 and Table 14], indicated no significant differences across gender (e.g., $t = [\text{value}]$, $p = 0.54$), age (e.g., $F = [\text{value}]$, $p = 0.34$), year level ($F = [\text{value}]$, $p = 0.49$), years of training ($F = [\text{value}]$, $p = 0.25$), or sport type ($F = [\text{value}]$, $p = 0.82$).

These findings indicate that student-athletes across diverse demographic profiles and training backgrounds uniformly perceived the strength and conditioning program as effective. The absence of significant differences highlights the consistent impact of the implemented training methods, suggesting the program's broad suitability and effectiveness in addressing the physical fitness needs of various student-athlete groups.

Problem 6. Refer to Table 4

Table 4. Pearson Correlation Analysis of the Relationship between Strength and Conditioning Training Implementation and Its Effectiveness on Holistic Physical Fitness

Variable Tested		R-Value	Degree of Correlation	Sig Value (2 tailed)	Decision on HO	Interpretation
S&C Training Implemented	Effectiveness on Holistic Physical Fitness	.648	Strong Positive Correlation	.000	Reject/Ho not Supported	Significant

Note: The relationship was tested using Pearson correlation coefficient at a 0.05 significance level.

Table 4 reveals a significant positive relationship ($r = 0.648$, $p = 0.000$) between the implemented strength and conditioning training and its effectiveness on holistic physical fitness. This indicates that improvements in strength and conditioning strongly correlate with enhanced overall fitness among student-athletes.

These findings align with previous studies by Turna (2020), Cohen et al. (2021), and Petate and Andal (2023), emphasizing that structured strength and conditioning programs effectively enhance not only physical attributes but also cognitive, socio-emotional, and psychomotor development. Thus, the significant correlation supports the effectiveness of structured training interventions in promoting comprehensive, holistic fitness.

Problem 7. Refer to Table 5

Table 5. Summary on the Assessment of the Challenging Encountered in the Implementation of Strength and Conditioning Training

INDICATORS	MEAN	SD	INTERPRETATION	RANK
1. Speed	2.16	0.62	Rarely Encountered	1
2. Flexibility	2.09	0.58	Rarely Encountered	2
3. Functional Training	1.92	0.56	Rarely Encountered	3
Overall Mean	2.06	0.55	Rarely Encountered	

LEGEND: ALWAYS ENCOUNTERED (4) =3.51-4.0); SOMETIMES ENCOUNTERED (3) =2.51-3.50); RARELY ENCOUNTERED (2) =1.51-2.50); NOT ENCOUNTERED AT ALL (1) =1.0-1.50)

Table 5 summarizes the challenges encountered during strength and conditioning training implementation. Overall, challenges were "Rarely Encountered" (mean=2.06, SD=0.55), with Speed training being the most frequent issue (mean=2.16, SD=0.62), followed by Flexibility (mean=2.09, SD=0.58), and Functional Training as least challenging (mean=1.92, SD=0.56).

Speed training posed occasional difficulties related to technical complexity and psychological readiness, aligning with studies by Dipasupil and Ofrin (2024) and Chen et al. (2021), who highlighted that effective coaching significantly reduces these barriers. Conversely, Functional Training presented fewer issues, likely due to good infrastructure and qualified personnel available at the training sites, differing from concerns reported by Vikestad and Dalen (2024) and Kumari et al. (2024). These findings indicate that existing conditions in Guangzhou effectively support strength and conditioning training, suggesting a feasible foundation for holistic physical fitness programs.

6. CONCLUSIONS

Based on the significant findings of the study, the following conclusions were established:

1. The profile of student-athletes reveals a training population that is both capable and developmentally vulnerable. Their age and experience indicate readiness for advanced conditioning, yet also a continued need for supportive, developmentally aligned programming that nurtures holistic growth.

2. Strength and conditioning programs effectively support holistic physical fitness, though mental-emotional integration remains limited. This means that while a holistic framework exists, its integrative depth, particularly in promoting mindfulness, emotional resilience, and inner focus, requires strengthening to fully realize its potential.

3. The absence of significant assessment differences across demographic variables affirms consistency in program delivery. This indicates shared experience among students, reinforcing the program's structural reliability and the equitable reach of its core components.

4. The effectiveness of strength and conditioning programs is evident across all developmental domains, though physical performance currently leads. Respondents' assessments affirm that the programs contribute positively to cognitive, socio-emotional, and psychomotor development. Enhancing these domains will help ensure more balanced, holistic outcomes for student-athletes.

5. The strong correlation between implementation and effectiveness demonstrates that program structure and delivery quality are pivotal. This means that effectiveness is not incidental, it is directly linked to how well programs are planned and executed.

6. Challenges in implementation are minimal, indicating operational soundness.

Though some obstacles exist, specifically in speed training, they do not compromise the overall integrity or perceived success of the programs.

7. It is evident that schools are increasingly adopting inclusive practices in physical fitness education. The positive support for accessibility, especially in terms of gender inclusivity, reflects a significant shift toward fostering participation for all students. This trend demonstrates a developing culture that values diversity and equitable participation in physical fitness programs, and indicates that further efforts to integrate inclusivity will enhance the effectiveness and reach of these programs across different student groups.

8. The results highlight the need to develop holistic physical fitness development programs that enhances the implementation of strength and conditioning training in schools in China. This model would focus on addressing the challenges in speed, flexibility, and functional training, while also integrating cognitive, socio-emotional, and psychomotor fitness components. By strengthening the training strategies and resources available to schools, this model would promote more effective and well-rounded physical development for students.

7. RECOMMENDATIONS

In the light of the findings of the study and conclusions drawn, the following recommendations are advanced:

1. Design strength and conditioning programs tailored to the specific developmental needs of young athletes, with a focus on gender inclusivity and continuous athletic growth. These programs should be flexible to accommodate the varying stages of development from adolescence to early adulthood, ensuring that all students receive the appropriate level of support and training.

2. Enhance the integration of Mind-Body-Spirit Connection, Ecological Awareness, and Inclusivity and Accessibility within strength and conditioning programs. Special attention

should be given to improving Mind-Body-Spirit Connection to foster a more holistic approach to physical fitness. Efforts to promote environmental consciousness within the programs should also be prioritized.

3. Strengthen the inclusivity and accessibility of strength and conditioning programs, ensuring that all students, regardless of their background, experience level, or type of sport, can equally benefit from the training. This can be achieved by focusing on creating inclusive training environments and offering personalized support based on individual needs and capabilities.

4. Enhance the cognitive and socio-emotional components of strength and conditioning programs to support the holistic development of student-athletes. This could involve incorporating strategies that promote critical thinking, emotional resilience, and interpersonal skills alongside physical training to ensure a more balanced and integrative developmental approach.

5. Ensure that the strength and conditioning programs maintain their consistency and effectiveness across diverse student-athlete demographics by reinforcing the key components of the program and adapting them to meet the general needs of all participants, regardless of their background or experience. This will help preserve the program's uniform impact on student-athletes, ensuring it caters to a wide range of participants without disparities.

6. Reinforce the implementation of structured strength and conditioning programs by using evidence-based practices that promote holistic fitness. This ensures that the strong positive relationship between program effectiveness and overall physical development is maximized across student-athletes.

7. Address the occasional challenges in implementing speed, flexibility, and functional training by further enhancing resources and facilities dedicated to these components. This may include upgrading training equipment, employing more specialized coaching strategies, and ensuring safer, more supportive training environments to prevent minor obstacles from hindering the effectiveness of the programs.

8. Develop comprehensive holistic physical fitness development programs that integrates cognitive, socio-emotional, and psychomotor components into strength and conditioning programs. This model should be adaptable to the varying needs of schools and students in China, providing a framework that promotes a balanced approach to physical education and wellness.

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