

Effects of five-step boxing on physical fitness in elementary students: A SOFIT assessment

JUNHUI ZHU¹; MINGLING ZHAO²; XIN ZHANG³

¹College of Education, Universiti Kebangsaan Malaysia, Sichuan, CHINA

²School of Urban Construction, Chengdu Polytechnic, Sichuan, CHINA

³College of Education, Universiti Kebangsaan Malaysia, Shandong, CHINA

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Abstract:

Traditional martial arts have a long and profound history in China, embodying not only physical techniques but also rich cultural heritage, philosophical values and moral education. Despite these qualities, traditional martial arts are often perceived by modern sports educators as what lacks exercise intensity and fails to attract interest from students, particularly in the context of school-based physical education. These misconceptions have contributed to a decline in their integration into contemporary curricula. In light of this, the present study aims to critically examine such perceptions and provide empirical evidence of the physical benefits created by traditional martial arts for young students. This study adopts a quantitative research approach, focusing on elementary school students as the research subjects. The System for Observing Fitness Instruction Time (SOFIT) assessment tool is employed to monitor and evaluate student activity levels, teaching behaviors and the overall classroom environment. The students are divided into two groups. The experimental group receives instruction in Five-Step Boxing, a foundational routine in traditional Chinese martial arts, while the control group follows a standard physical education curriculum. Observations are conducted using the SOFIT system at three randomly selected time points during the instructional period. The data reveal that students in the experimental group demonstrate significantly higher levels of physical activity intensity and exercise density compared to their peers in the control group. Additionally, these students spend more time performing interactive activities such as games and receive more frequent instructional prompts from teachers. These findings suggest that traditional martial arts, when implemented effectively, can offer a robust and engaging form of physical education for young learners.

Key Words: Traditional martial arts; Primary school; SOFIT evaluation system; Physical fitness; Empirical research

Introduction

An objective database for physical education (PE) is important for policy and practice decisions, and the System for Observing Fitness Instruction Time (SOFIT) has been identified as an appropriate surveillance tool for PE across the nation (T. L. McKenzie & Smith, 2017; Yang et al., 2017). Traditional Chinese martial arts originated from ancient warfare and defense techniques, gradually developing into a form of physical exercise and cultural inheritance. Traditional Chinese martial arts encompass numerous styles and schools, each with its unique techniques, forms, and skills, such as Tai Chi, Shaolin Kung Fu, Xing Yi Quan, Baguazhang, Wing Chun, etc (Jiang et al., 2025; Liang et al., 2021; Mao & Cai, 2020; Ming-Chw et al., 2018; Yanli, 2024; Zhang et al., 2022). Five-step Boxing, as one of the forms of traditional martial arts, with its concise routines and easily understandable combinations, is deemed more suitable for teaching in primary school physical education classes. Through the teaching of Five-step Boxing, not only can students strengthen their muscles and bones, but it also helps cultivate cultural confidence among primary school students (Hart, 2015; Zeng et al., 2021). However, the teaching of traditional martial arts in schools is rare at present. Physical education professionals focus more on popular sports like basketball, soccer and volleyball. They generally believe that teaching traditional martial arts lacks exercise intensity for primary school students, high repetition of movements is involved, and the practice is relatively dull (T. L. McKenzie & Smith, 2017; N. J. Smith et al., 2019;). Therefore, with Five-step Boxing as the starting point, the author uses the SOFIT evaluation system to assess the timeliness of traditional martial arts in the classroom, aiming to integrate more traditional martial arts into primary school physical education classes (Fairclough et al., 2018; Hall-López et al., 2019; Huang et al., 2020; Meng, 2016; Pope, 2000; Xia et al., 2021; Li et al., 2015).

Background of the Study

Conceptual Definition of the SOFIT Evaluation System

SOFIT (System for Observing Fitness Instruction Time) is a system developed by American researchers for evaluating the physical activities and instruction time in physical education classes across schools (Brown & Johnson, 2000; Rodrigues et al., 2024). It is an observation and assessment tool intended to quantitatively

evaluate the physical activities and teaching time in physical education classes across school, helping to understand the allocation of time for students to participate in various activities during physical education classes.

In this study, observations and records are conducted with prompt sounds, with observations made every 10 seconds and records made every 20 seconds. The real-time situations of students' activities, classroom environment, and teacher behaviors are observed and recorded in corresponding positions on the form. This piece of data is then organized and analyzed to evaluate the physical education class.

Contents of SOFIT evaluation system

The SOFIT observation form is an important data collection tool consisting of two parts: Basic Information and Content Records (see Table 1). In this study, the Basic Information section is used to record basic information about the classroom and observed subjects, while the Content Records section is used to detail teacher behaviors, classroom environment and student activities. The first part, namely Basic Information, includes details such as date, class, class size, number of observers, location, teaching instructor, observer, observation times, start time, end time, etc. The second part, namely Content Records, involves three dimensions: student activities, classroom environment and teacher behaviors.

The SOFIT observation form uses the numeric values ranging from 1 to 5 to represent students' body postures and activity levels, enabling the more specific and systematic observation and analysis of students' activities in the classroom (T. McKenzie & SOFIT, 2002). The specific meanings are as follows: 1 represents students lying down, in a static state with the lowest activity level; 2 represents students sitting, in a relatively static state with a low activity level; 3 represents students standing, kneeling, or squatting, with moderate activity levels from stationary movements; 4 represents students walking, in a mobile state with higher activity levels; and 5 represents students running or jumping, in a high-speed mobile state with the highest activity levels.

For classroom environment observation, the SOFIT form uses six letters (M, K, F, S, G, O) to represent different aspects, allowing for the more specific and systematic observation and analysis of time allocation in the classroom. The specific meanings are as follows: M represents Management, indicating non-teaching time including class organization and preparation of classroom materials; K represents Knowledge, indicating time when the teacher verbally teaches technical movements and other knowledge; F represents Physical Activity, indicating time when students engage in physical activities rather than technical learning; S represents Skills, indicating time when students learn skills; G represents Games, indicating time when students participate in games; and O represents Others, indicating time for other activities including breaks.

Teacher behaviors are coded using three letters including I, O and N to accurately and systematically observe and analyze how teachers promote students' physical exercise and skill learning in the classroom. The specific meanings are as follows: I represents teachers verbally or otherwise promoting students' physical exercise and skill learning in the classroom; O represents teachers verbally or otherwise prompting students to exercise and learn skills outside the classroom; and N represents teachers not verbally or otherwise promoting students' physical exercise and skill learning.

Table 1 .SOFIT record sample form

Date	Class					Class size		Number of observed students				Observer			Remark			
Teacher	Place					Number observations		of				Starting time				Ending Time		
Observation object	Student Activities					Classroom Environment					Teacher Behavior							
	1	2	3	4	5	M	K	F	S	G	O	I	O	N				
1																		
2																		
3																		
4																		
5																		
...																		
total																		

The role of SOFIT evaluation system

Assessment of students' physical activity levels

Through the categorization of physical activities in the SOFIT system, the proportion of students engaging in different intensities of physical activity in the Five-Step Boxing classroom can be evaluated. In the SOFIT system, physical activities are divided into different intensity levels, such as moderate physical activity, vigorous physical activity, etc., to describe the extent of students' physical exercise and activity in the classroom (T. L. McKenzie & Smith, 2017). This is conducive to understanding the level of physical activity of students in the Five-Step Boxing classroom and the impact of classroom activities on students' physical health.

Evaluation of teaching quality

The SOFIT assessment system is a comprehensive observational tool used not only to evaluate students' physical activity intensity but also to observe teachers' behaviors and classroom environments. By assessing teachers' guidance and management behaviors in Five-step Boxing classes, as well as observing classroom teaching organization and learning atmosphere, a comprehensive evaluation of the teaching quality in Five-step Boxing classes can be achieved. This facilitates the identification of potential issues in teaching and provides guidance for optimizing teaching methods and classroom environments (N. J. Smith et al., 2019).

Provision of statistical support

The SOFIT evaluation system provides objective data support and it can be used for academic research, sports policy formulation, and physical education reform (Honas et al., 2008). Through this data, a deeper understanding of the actual situation and issues in the Five-step Boxing classroom can be gained to promote the development and improvement in those related fields.

Optimization of the five-step boxing classroom design

By analyzing SOFIT data, educators can understand the distribution of different types of activities in the Five-step Boxing classroom. This contributes to optimizing classroom design, allocating time for different activities reasonably, making the Five-step Boxing class more diverse, and improving student participation and learning outcomes.

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Design of the Study

This study seeks to address the following research question:

How does the integration of traditional martial arts, specifically Five-step Boxing, into regular physical education classes impact elementary school students' physical fitness compared to the students following standard physical education instruction?

Participants

The subjects of this study are Class Five and Class Six of Grade One at Tianfu New District Fifth Primary School in Sichuan. With the use of a natural grouping method, Grade One Class Five was selected as the experimental group, receiving Five-step Boxing instruction during the physical education classes in the second semester of the 2022-2023 academic year, while Grade One Class Six was selected as the control group, receiving regular physical education classes during the same semester. Both classes consist of 45 students each and are taught by the same teacher. Pre-survey results showed no significant differences in speed, flexibility and other physical fitness qualities between the experimental and control groups, making them suitable for comparative research. The detailed information is shown in Table 5.

Research methods

This study adopts the literature research method and consults the theoretical knowledge related to Five-step Boxing and SOFIT to lay a theoretical foundation for research. The experiment method was adopted to establish whether there are improvements in the physical activity levels, engagement in games, teacher prompts, and overall physical fitness of students with Five-step Boxing integrated into PE class compared to the students

following standard physical education instruction. Mathematical statistics were used to analyze the collected data using SPSS26.0, thus providing a quantitative basis for the research results of this study.

Data collection

The experimental research period for this study was from March 1, 2023, to June 30, 2023, totaling four months of teaching. Three testing phases were set up: pre-test, mid-test, and post-test. Using a random selection method, three rounds of SOFIT evaluations were conducted during the experimental phase on April 11, May 18, and June 27, respectively. The evaluation subjects were students from the experimental group and the control group. Process of data collection are as follows.

Step one is to prepare the basic materials including SOFIT recording forms, teaching plans, and observer training. Step two is to collect the "physical fitness ability data" measured at the end of the previous semester for both the experimental and control groups. The items measured at the end of the previous semester include the 50-meter run, 1-minute skipping rope, and sit-and-reach tests.

Step three is to conduct Five-step Boxing classes for the experimental group and regular physical education classes for the control group. The regular physical education curriculum mainly includes track and field along with the three major ball sports. Both classes were evaluated using the SOFIT system on April 11, May 18 and June 27. Step four is to conduct tests at the end of the 2022-2023 academic year for the three items of the 50-meter run, 60-second skipping rope and sit-and-reach test. The testing methods, equipment, location and personnel remain consistent with those of the previous semester.

Results and analysis

Analysis of Student Activities

According to the SOFIT evaluation system, each observation includes 5 students, with one backup student, resulting in 4 actual observed students. Observations are conducted for 10 seconds for observation and 20 seconds for recording. With a class duration of 40 minutes, this totals 320 observation cycles. Considering the muscular endurance required for martial arts footwork and techniques, all skill practice by students is categorized as "running" in this study.

From the results shown in Table 2, it is observed that the standing behavior (3) in the control group is higher than that in the experimental group, with increases by 3.4%, 13.8%, and 8.7%, respectively. Conversely, the running behavior (5) in the experimental group is higher than that in the control group, with increases by 11.8%, 16.0%, and 7.7%, respectively.

Therefore, the use of Five-step Boxing as the teaching content for physical education classes does not reduce the exercise intensity for students compared to regular physical education classes. Instead, it leads to an increase in their physical activity load and practice density. Five-step Boxing requires students to complete multiple actions in a fast-paced sequence, enhancing their cardiorespiratory endurance and muscle strength. It also requires body coordination and balance within a short period, improving overall coordination and flexibility. Furthermore, the quick reactions of students and the precise execution by them are needed to enhance the responsiveness and agility of their nervous system. Overall, the use of Five-step Boxing as teaching content in classes increases the exercise load and practice density of students compared to regular physical education classes.

Table 2.SOFIT student activity analysis table

Rounds	class	Student Activities									
		Lie (1)		Sit (2)		Stand (3)		Walk (4)		Run (5)	
		No of actions	percentage %	No of actions	percentage %	No of actions	percentage %	No of actions	percentage %	No of actions	percentage %
1	Experimental class	0	0	36	11.3	78	24.4	85	26.6	121	37.7
	control class	0	0	54	16.9	89	27.8	94	29.4	83	25.9
2	Experimental class	0	0	35	10.9	49	15.3	89	27.8	147	46.0
	control class	0	0	48	15.0	93	29.1	83	25.9	96	30.0
3	Experimental class	0	0	43	13.4	54	16.9	94	19.4	129	40.3
	control class	0	0	51	15.9	82	25.6	83	25.9	104	32.6

Analysis of Classroom Environment

From Table 3, it can be concluded that the number of knowledge (K) teaching behaviors in the control group is higher than in the experimental group, with increases by 5.7%, 6.9%, and 5.0%, respectively. The number of management (M) behaviors in the control group is also higher than in the experimental group, with increases by 2.1%, 4.1%, and 2.8%, respectively.

However, the number of skill (S) behaviors in the experimental group is higher than in the control group, with increases by 8.2%, 9.1%, and 5.9%, respectively. Similarly, the number of game (G) behaviors in the experimental group is higher than in the control group, with increases by 4.1%, 4.1%, and 3.4%, respectively.

The class using Five-step Boxing as the teaching content spends more time practicing skills compared to regular physical education classes. Due to the unique nature of martial arts, including the complexity and repetition of movements, professional teaching often involves a higher proportion of game elements to enhance the interest and engagement of students (Rodrigues et al., 2024; Van Der Kooi, 2020; Vertonghen & Theeboom, 2010).

Five-step Boxing lays emphasis on the beauty and fluidity of movements, along with its uniqueness in martial arts, which can spark the strong interest of students in this mysterious and intriguing activity. Moreover, focusing on skill practice in teaching allows elementary students to feel achievement and progress in their learning, thus increasing their classroom participation and fostering a passion for sports.

Table 3.SOFIT classroom environment analysis table

Rounds	class	Classroom Environment											
		Management (M)		Knowledge (K)		Physical Activity (F)		Skill (S)		Game (G)		Other (O)	
		No of actions	Percentage %	No of actions	Percentage %	No of actions	Percentage %	No of actions	Percentage %	No of actions	Percentage %	No of actions	Percentage %
1	Experimental class	28	8.8	42	13.1	52	16.3	133	41.6	39	12.2	26	8.0
	control class	35	10.9	60	18.8	55	17.2	107	33.4	26	8.1	37	11.6
2	Experimental class	26	8.1	51	15.9	45	14.1	125	39.1	44	13.8	29	9.0
	control class	39	12.2	73	22.8	38	11.9	96	30.0	31	9.7	43	13.4
3	Experimental class	25	7.8	43	13.4	48	15.0	131	40.9	47	14.7	26	8.2
	control class	34	10.6	59	18.4	42	13.1	112	35.0	36	11.3	37	11.6

Analysis of Teacher Behaviors

From Table 4, it can be observed that the number of teacher behaviors without prompting in-class exercises (N) in the control group is higher than in the experimental group, with increases by 7.2%, 12.4%, and 5.7%, respectively. On the other hand, the number of teacher behaviors prompting in-class exercises (I) in the experimental group is higher than in the control group, with increases by 8.2%, 11.2%, and 6.3%, respectively. Compared to traditional physical education classes, the teaching of Five-step Boxing exhibits more prominent characteristics.

Teachers, when guiding students in in-class exercises, provide instructions more frequently, either verbally or non-verbally, to stimulate the repeated practice by students. Five-step Boxing, as a traditional Chinese martial arts training method, involves unique and specialized movements and techniques, which requires more practice time in teaching to refine and master it.

Achieving a good skill level requires students to practice and improve their movements repeatedly, with teacher guidance and encouragement playing a crucial role in this process. Through verbal prompts, teachers can expound and demonstrate the essentials and correct postures of each movement, imparting key skills and practice methods to students.

Table 4. SOFIT teacher behavior analysis table

Rounds	class	Teacher Behavior					
		Tips for in-class practice (I)		Tips for practice (O)	extracurricular	no prompt (N)	
		Number of actions	percentage%	Number of actions	percentage %	Number of actions	percentage%
1	Experimental class	101	31.6	15	4.7	204	63.7
	control class	75	23.4	18	5.6	227	70.9
2	Experimental class	122	38.1	17	5.3	181	56.6
	control class	86	26.9	13	4.1	221	69.0
3	Experimental class	116	36.3	9	2.8	195	60.9
	control class	96	30.0	11	3.4	213	66.6

Comparison of experimental teaching effects

To better compare the effectiveness of teaching between the experimental and control groups, the scores of two end-of-term assessments were compared in this study. The comparison items include three tests: 50-meter sprint test, 1-minute jump rope test and sit-and-reach test. The average scores achieved before the intervention (X1) and after the intervention (X2) were calculated, while the improvement percentage was determined based on the increase of score.

From Table 5, it can be observed that the experimental group showed a speed improvement percentage 1.9% higher than the control group in the 50-meter sprint test after a semester of Five-step Boxing instruction. In the 1-minute jump rope test, the experimental group exhibited an improvement percentage 11.2% higher than the control group. In the sit-and-reach test, the experimental group showed an improvement percentage 0.1% higher than the control group.

In terms of students' physical fitness teaching outcomes, the PE class using Five-step Boxing as the teaching content demonstrated a certain degree of enhancement. The comprehensive exercise nature of this sport allows students to receive holistic exercise in multiple aspects in class, ranging from squat jumps to balance exercises to arm movements, effectively enhancing the physical fitness of students in various aspects (R. W. Smith, 2002). Moreover, Five-step Boxing poses challenges for students to maintain balance and control in fast-paced movement sequences, which not only promotes physical coordination and flexibility but also improves neural response speed and agility. This type of exercise also challenges the cardiorespiratory endurance of students, contributing to their overall health development.

Table 5. Comparison of final grade differences between experimental and control classes

	category	X1	X2	Improvement	Percentage
Experimental class	50m run	10.7s	10.2s	0.5s	4.7%
	1min skipping rope	86pc	107pc	21pc	24.4%
	Sitting forward bend	10.8cm	11.3cm	0.5cm	4.6%
control class	50m run	10.9s	10.6s	0.3s	2.8%
	1min skipping rope	91pc	103pc	12pc	13.2%
	Sitting forward bend	11.2cm	11.7cm	0.5cm	4.5%

Conclusion

By analyzing the characteristics and effects of Five-step Boxing instruction compared to regular physical education classes, it can be concluded that Five-step Boxing, as a traditional Chinese martial arts training method, plays a significant role in improving the physical fitness of students. In contrast to regular physical education classes, Five-step Boxing instruction increases the exercise load and practice density of students instead of reducing their exercise intensity, providing them with more comprehensive exercise. Due to the specialized nature of Five-step Boxing, the instruction emphasizes skill practice, leading to an increase in practice frequency during class. Teachers effectively stimulate the learning motivation of students through verbal and non-verbal cues, further enhancing their physical fitness levels. Five-step Boxing is taken as part of physical

education instruction to demonstrate educational outcomes in terms of students' physical fitness that are on par with, if not superior to, those of regular physical education classes.

The aim of this exploration is to integrate traditional martial arts more widely into primary school physical education classes, enriching the content of physical education and stimulating the strong interest of students in traditional culture. As an important part of Chinese culture, traditional martial arts not only improve the physical fitness of students but also cultivate their character and willpower.

To promote the teaching of traditional martial arts as well as the physical characteristics and learning needs of students should be carefully considered. Allowing for the age characteristics of primary school students, it is necessary to explore the teaching models suitable for their physiological development, making traditional martial arts teaching more attractive and feasible. Additionally, emphasizing the correctness of movements and health safety through detailed guidance is beneficial for students to develop correct exercise habits and movement skills.

Furthermore, there is a necessity to focus on the practical effects of teaching traditional martial arts in primary school physical education. Introducing the SOFIT evaluation system is a beneficial attempt as it plays a positive role in objectively assessing the quality and effectiveness of teaching (Rowe et al., 2004). Through quantitative data, it is possible to understand the level of student engagement and benefits during the teaching process, thus providing targeted improvement suggestions for teaching.

In conclusion, promoting the teaching of traditional martial arts requires that careful consideration is given to curriculum design, innovative teaching methods, and the evaluation of teaching effectiveness. Only by exploring teaching models suitable for primary school students based on individual differences, and continuously improving through scientific evaluation methods, can traditional martial arts play a greater role in primary school physical education and contribute to the all-round development of students.

Competing Interests Declaration

The author declares that there are no competing interests related to this article.

Funding Declaration

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Ethics Statement

This study was reviewed and approved by the ethics committee of Sichuan Tianfu New District No.5 Primary School. Prior to participation, written informed consent was obtained from all student participants and their legal guardians. All procedures were conducted in accordance with the ethical standards of the Declaration of Helsinki.

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I confirm that anyone listed under the Acknowledgements section of the manuscript has been informed of their inclusion and approves this.

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