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The effects of a blended learning model on the physical fitness of Chinese university students: a cluster randomized controlled trial in basketball education

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Abstract

Objective The university period is a critical stage of personal development, and improving the physical fitness of university students is crucial to their academic performance, quality of life, and future. However, in recent years, the physical fitness level of Chinese university students has shown a decreasing trend. This study aimed to investigate the effects of a blended learning model on the physical fitness of Chinese university students through a 16-week intervention.

Methods A total of 78 first-year students from a public university in Henan Province were recruited for this study via a cluster randomized controlled trial (CRCT) design. The participants were divided into an experimental group (blended learning) and a control group (traditional learning). The intervention lasted for 16 weeks, and physical fitness indices such as body mass index (BMI), lung capacity, sit and reach, pull-ups/sit-ups, standing long jumps, 50-meter runs, and 1000/800-meter runs were measured before and after the intervention. Statistical analyses were conducted via generalized estimating equation (GEE) modeling, with the significance level set at $P < 0.05$.

Results Both learning models significantly improved students' physical fitness after 16 weeks. However, the blended learning model resulted in more significant improvements in lung capacity, sit and reach, pull-ups/sit-ups, standing long jumps, and 50-meter runs ($P < 0.05$). No significant differences were found between the two groups in terms of BMI or 1000/800-meter run.

Conclusions The 16-week blended learning model effectively promoted physical fitness among university students, especially in terms of their lung capacity, flexibility, strength and speed.

Keywords Blended learning, Physical fitness, University students, Basketball teaching, Physical education

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Introduction

The university period is a critical stage in personal development, and the physical fitness of university students is not only related to their academic performance and quality of life but also has a far-reaching impact on social development and the future of the country [1]. However, in recent years, the overall physical fitness level of university students has generally shown a downward trend, with the proportions of overweight and obese individuals continuing to rise [2, 3]. According to the Ministry of Education in 2020, the physical fitness failure rate among Chinese university students is as high as 30%, which is significantly higher than that among elementary, middle, and high school students. In addition, compared with 2016, only 49.57% of university students exercise for more than one hour each day, a decrease of 8.37% [4]. Studies have shown that scientific and active physical exercise has a positive effect on the physical health of university students and can effectively reduce the risk of chronic diseases such as cardiovascular diseases [2, 5].

Physical education is a primary means of enhancing students' exercise awareness, physical activity, and physical fitness [4, 6]. However, with the advancement of society and the rapid development of information technology, physical education in Chinese universities is facing numerous challenges [7]. First, the majority of universities still employ traditional physical education teaching methods. This teacher-centered approach results in students passively receiving knowledge and skills, which diminishes their interest in physical activity and reduces their motivation to actively exercise outside of class [4, 8]. Second, traditional teaching methods neglect students' differences, and due to limited classroom time, it is difficult for teachers to achieve differentiated teaching and fail to meet students' diverse needs [9]. In addition, the traditional teaching model relies on teachers' teaching ability and limited teaching resources, making it difficult to meet the increasingly diverse learning needs of modern students [10]. Moreover, the evaluation system of traditional PE teaching is also obviously insufficient, with a single assessment method, ignoring the importance of process evaluation and making it difficult to comprehensively and objectively reflect students' learning outcomes [4]. Research shows that effective teaching methods, such as BMI, lung capacity, speed, and endurance levels, can significantly improve university students' physical fitness [2, 11].

Blended learning (BL), as a new learner-centered teaching model, is increasingly adopted by higher education institutions worldwide [12, 13]. Blended learning is defined as "a thoughtful integration of traditional face-to-face teaching with online resources" [14]. This learning approach combines the advantages of both online and face-to-face learning, giving full play to the teacher's leading role in the teaching process while emphasizing students' autonomy and creativity in the learning process [15]. In the blended learning model, students can choose the most suitable learning methods, adjust their learning pace independently, and watch online learning resources repeatedly [16, 17]. Additionally, the blended learning model provides students with more opportunities to communicate with teachers and peers, thereby enhancing their learning experience [18, 19]. Research shows that shifting from a traditional teaching model to a learner-centered blended learning model helps students engage more actively in learning, improves their knowledge mastery and application abilities, and enhances learning outcomes [20, 21].

At present, blended learning has been widely applied in Chinese university physical education courses, such as basketball, soccer, badminton, and swimming [22–25]. In blended physical education, students can learn independently according to their own learning pace through various forms, such as videos and online quizzes. Offline practice, on the other hand, promotes skill mastery and physical fitness through targeted instruction, individual practice, and group practice [26]. Studies have shown that blended learning can effectively improve students' exercise attitudes, satisfaction, motor skills, and learning outcomes [27–29]. However, there is limited research on the effects of blended learning on the physical fitness of Chinese university students. Therefore, this study aims to explore the effects of the blended learning model on the physical fitness of Chinese university students through experimental investigation.

Methods

Participants

This study followed the CONSORT statement and adopted a cluster randomized controlled trial (CRCT) design. Sample size calculations were based on G-Power 3.1 software [30], with the effect size determined from previous studies (effect size = 0.20). With a Type I error (α) of 0.05 and a power (1 - β) of 0.80, the minimum sample size should be 52 students. Considering the design effect of cluster randomization and an expected dropout rate of 20%, the total sample size for this study should be 78 students, with 39 students in each group.

The researchers recruited 83 volunteers from a first-year basketball class at a public university in Henan Province. The exclusion criteria were as follows: a history of medical conditions or long-term medication use (e.g., heart disease, respiratory disorders, or bone or muscular injuries); recent (i.e., within the past year) experience with a similar blended learning intervention; recent (i.e., within the past year) participation in other exercise interventions or training, or a habit of playing basketball; and unexplained withdrawal from the experiment.

Figure 1 shows the study protocol. A total of 78 students met the criteria and were assigned to the experimental and control groups. Four participants in the control group and 5 participants in the experimental group withdrew from the experiment. Therefore, data from 34 participants in the experimental group and 35 participants in the control group were analyzed. All the students voluntarily participated in the study and provided informed consent, and the study was approved by the Ethics Committee of Universiti Putra Malaysia (Approval No. JKEUPM 2022–030).

Intervention

The experimental group and the control group were taught from 10:00 to 11:30 a.m. every Monday and Tuesday, respectively, with the teaching experiment lasting for 16 weeks. The same teacher instructed both groups, and in addition to the teaching methods, the teaching content, process, and requirements were kept consistent (see Table 1). Both groups included three main phases: preclass, during-class, and afterclass, with in-class instructions consisting of a 20-minute preparation session, a 60-minute basic session, and a 10-minute conclusion session (see Table 2).

The control group adopted a traditional learning model, where students relied primarily on the teacher's explanations and demonstrations during class. Preclass preparation and afterclass review were dependent mainly on students' self-discipline, without any additional structured guidance or supervision. In contrast, the experimental group implemented a blended learning model. Students in the experimental group watched instructional videos provided by the teacher through MOOC learning platform before class. These videos were recorded by experienced coaches or physical education experts, with each video lasting less than 10 min, making it easy for students to watch and understand at any time.

In addition, the discussion forum on the MOOC platform allows students to share and discuss technical difficulties in videos with their classmates or the instructor, helping them to better engage in learning and deepen their understanding. Since students had a preliminary understanding of the new content before class, more time in the experimental group's classroom instruction could be devoted to skill and physical fitness training, enabling

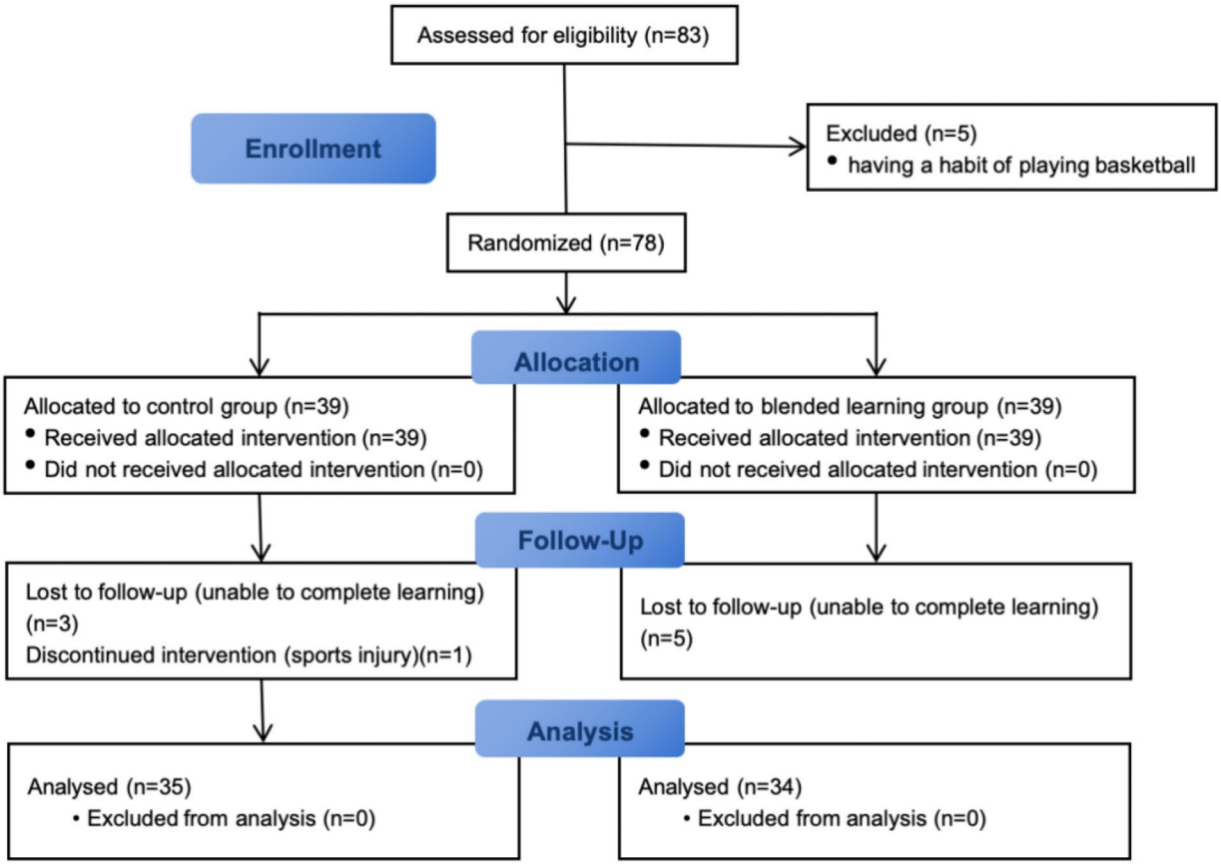

Fig. 1 CONSORT flow diagram

Table 1 Basketball teaching plan

Week	Teaching Content	Teaching Methods	
		TL	BL
1	Basketball Basic Knowledge、Preparation Stance、Stationary Ball Drills	Explanation Demonstration	Online Video Explanation Demonstration Online test
2	Review previous lesson content Offensive Movement Techniques (Basic stance、Starting techniques、Quick stop techniques) Physical Fitness (jogging/sprint/push-up 10 reps x 2 sets)	Explanation Demonstration	Online Video Explanation Demonstration Online test
3	Review previous lesson content Defensive Movement Techniques (lateral step、retreat step) Physical Fitness (vertical jump 20 reps x2 sets、push-up 10 reps x2 sets)	Explanation Demonstration	Online Video Explanation Demonstration Online test
4	Review previous lesson content One-handed Chest Pass、Two-handed Chest Pass Physical Fitness (Squat 15 reps x2 sets、Push-ups 15 reps x2 sets)	Explanation Demonstration	Online Video Explanation Demonstration Online test
5	Review previous lesson content Stationary Dribbling、Dribbling Physical Fitness (frog jump 15mx2 sets、sprint x2 sets)	Explanation Demonstration Group exercises	Online Video Explanation Demonstration Group exercises Online test
6	Review previous lesson content Standing One-handed Shoulder Shot(Chest Pass for female) Physical Fitness (vertical jump 20 reps x2 sets、push-up 10 reps x2 sets)	Explanation Demonstration Group exercises	Online Video Explanation Demonstration Group exercises Online test
7	Review Dribbling Review Two-handed Chest Pass Review Standing One-handed Shoulder Shot(Chest Pass for female) Physical Fitness (half-court shuttle run x2 sets、full-court sprints x2 sets)	Explanation Demonstration Group exercises	Online Video Explanation Demonstration Group exercises Online test
8	Review previous lesson content Running One-handed Underhand Layup Physical Fitness (Four-lane round trip x2 sets)	Explanation Demonstration Group exercises	Online Video Explanation Demonstration Group exercises Online test
9	Review Standing One-handed Shoulder Shot(Chest Pass for female) Review Running One-handed Underhand Layup Physical Fitness (Push-ups 15 reps x3 sets、Jumping Jacks 15 reps x3 sets) Teaching competition (half-court 3V3 or 4V4)	Explanation Demonstration Group exercises	Online Video Explanation Demonstration Group exercises Online test
10	Review Running One-handed Underhand Layup One-handed Expert Shooting on the Move Physical Fitness (4*10 m round trip x3 sets)	Explanation Demonstration Group exercises	Online Video Explanation Demonstration Group exercises Online test
11	Review Running One-handed Underhand Layup and One-handed Expert Shooting on the Move PF (1-min jump rope x5 sets) Teaching competition (half-court 3V3 or 4V4)	Explanation Demonstration Group exercises	Online Video Explanation Demonstration Group exercises Online test
12	Review previous lesson content Stationary Dribbling Techniques (crossover step、layup)、dribbling technique in transition Physical Fitness (Squat 15 reps x2 sets、Push-ups 15 reps x2 sets)	Explanation Demonstration Group exercises	Online Video Explanation Demonstration Group exercises Online test
13	Review Running One-handed Underhand Layup and One-handed Expert Shooting on the Move Review Basketball Breakthrough Techniques Physical Fitness (1-min jump rope x5 sets)	Explanation Demonstration Group exercises	Online Video Explanation Demonstration Group exercises Online test
14	Review previous lesson content Half-court Dribbling and Shooting、Rebounding Techniques Physical Fitness (half-court shuttle run x2 sets、full-court sprints x2 sets)	Explanation Demonstration Group exercises	Online Video Explanation Demonstration Group exercises Online test
15	Revise for the Test Physical Fitness (speed, agility, muscular endurance, muscular strength, power, coordination, balance, and flexibility)		
16	Physical Fitness Test		

the teacher to provide personalized guidance to more students.

After class, the students in the experimental group were required to complete an automatically graded quiz through the online platform, which provided the correct answers and explanations to help them promptly correct mistakes. The quiz consisted of only six multiple-choice questions designed to reinforce learning outcomes. In addition, the experimental group enhances the learning experience through the establishment of WeChat groups,

Table 2 Basketball teaching implementation

		Control Group	Experimental Group
Preclass	5–10 min	1. Preview the new learning content	1. Watching online videos independently 2. Online assignments/discussion
During-class	Preparation Section (20 min)	1. Procedures (Check Attendance/Learning content and goals/Learning requirements) 2. Warm Up	1. Procedures(Check Attendance/Learning content and goals/Learning requirements) 2.Warm Up
	Basic Section (60 min)	1. Review previous learning content 2. Explaining and demonstrating new basketball skills 3. Individual/group exercises 4. Physical Fitness/Teaching Competition	1. Review previous learning content 2. Explaining and demonstrating new basketball skills (Focus on explaining doubts and difficulties) 3. Individual/group exercises 4. Physical Fitness/Teaching Competition
	Conclusion Section (10 min)	1.Cool down 2. Class Summary	1.Cool down 2.Class Summary
After-class	1–3 min	1. Review the learning content	1. Reflection and summary 2. Online test

where teachers release learning videos and task requirements two days before class to remind students to preview, and through instant interaction. Online learning logs and attendance records were used to track student learning and participation. All students are encouraged to follow a daily routine and are required to inform the instructor of any changes in exercise habits.

Evaluation

The teaching effectiveness was assessed by an experienced fitness expert via a double-blind method, and the subjects were tested in strict accordance with the "National Student Physical Health Standard (2014 Revised)" (see Table 3). The NSPHS (2014 Revision), issued by the Ministry of Education of China, is a standard for individual assessment of students' physical fitness in terms of physical morphology, physical function, and physical fitness (strength, speed, endurance, flexibility, and agility). The NSPHS (2014 revision) is a well-established and validated physical fitness measurement tool that has been widely used in Chinese universities [3, 31, 32].

Body mass index (BMI) = weight (kg)/ [height (m)]^2 was used as the indicator of body shape; lung capacity was used as the indicator of physical function; and physical fitness was used as the indicator of 50-meter run, standing long jump, sit-and-reach, sit-ups (females), pull-ups (males), 800-meter run (females), and 1000-meter run (males). Each subject was tested once before and once after the intervention, with the same evaluator conducting both tests, following a fixed order of the items (as mentioned above), and using fixed instruments (specialized instruments for the National Student Physical Health Test). Each item was scored out of a maximum of 100 points.

Statistics

In this study, data were recorded using a spreadsheet program (Excel). The assumptions of normality and homogeneity of variances were preliminarily assessed via the skewness and kurtosis test and Levene's test. To determine the effects of the intervention, a generalized estimating equation (GEE) model was used for data analysis. The effect size was determined on the basis of common criteria (d = 0.2 indicates a small effect; d = 0.5 indicates a medium effect; d = 0.8 indicates a large effect) [33]. Finally, the data were statistically processed via SPSS 26.0 software, with differences considered statistically significant at $P < 0.05$.

Results

The effects of the two learning models on university students' physical fitness are summarized in Table 4. Overall, after 16 weeks of instruction, both models significantly improved the physical fitness of the university students; however, the blended learning model had a significant effect ($p < 0.05$) on the enhancement of students' lung capacity, sit-and-reach, pull-ups/sit-ups, standing long jump, and 50-meter run.

Specifically, for the time effect, after 16 weeks, the traditional basketball learning model had a smaller effect on the improvement in university students' physical fitness for all the tested indicators. In contrast, the blended basketball learning model had a small effect on the 1000/800-meter run but a moderate effect on lung capacity, sit-and-reach, standing long jump, and 50-meter run and a large effect on BMI and pull-ups/sit-ups.

For the group effect, the 16-week blended learning model had a moderate effect on sit-and-reach, pull-up/sitting-up, standing long jump, and 50-meter runs and a small effect on BMI, lung capacity, and the 1000/800-meter run compared with traditional learning.

Discussion

The study demonstrated that after 16 weeks of the blended learning intervention, students' BMI, lung capacity, sit-and-reach, pull-up/sit-up, standing long jump, 50-meter run, and 1,000/800-meter run improved

Table 3 National student physical health standard (2014)

Score	BMI		Lung capacity (ml)		50-meter run (s)		Sit and Reach (cm)		Standing long jump (cm)		1-min Pull-up (number of times)		1000-meter run (m·s)	800-meter run (m·s)
	M	F	M	F	M	F	M	F	M	F	M	F	M	F
100	17.9–23.9	17.2–23.9	5040	3400	6.7	7.5	24.9	25.8	273	207	19	56	3′17″	3′18″
95			4920	3350	6.8	7.6	23.1	24.0	268	201	18	54	3′22″	3′24″
90			4800	3300	6.9	7.7	21.3	22.2	263	195	17	52	3′27″	3′30″
85			4550	3150	7.0	8.0	19.5	20.6	256	188	16	49	3′34″	3′37″
80	≤ 17.8; 24.0-27.9	≤ 17.1; 24.0-27.9	4300	3000	7.1	8.3	17.7	19.0	248	181	15	46	3′42″	3′44″
78			4180	2900	7.3	8.5	16.3	17.7	244	178		44	3′47″	3′49″
76			4060	2800	7.5	8.7	14.9	16.4	240	175	14	42	3′52″	3′54″
74			3940	2700	7.7	8.9	13.5	15.1	236	172		40	3′57″	3′59″
72			3820	2600	7.9	9.1	12.1	13.8	232	169	13	38	4′02″	4′04″
70			3700	2500	8.1	9.3	10.7	12.5	228	166		36	4′07″	4′09″
68			3580	2400	8.3	9.5	9.3	11.2	224	163	12	34	4′12″	4′14″
66			3460	2300	8.5	9.7	7.9	9.9	220	160		32	4′17″	4′19″
64			3340	2200	8.7	9.9	6.5	8.6	216	157	11	30	4′22″	4′24″
62			3220	2100	8.9	10.1	5.1	7.3	212	154		28	4′27″	4′29″
60	≥ 28.0	≥ 28.0	3100	2000	9.1	10.3	3.7	6.0	208	151	10	26	4′32″	4′34″
50			2940	1960	9.3	10.5	2.7	5.2	203	146	9	24	4′52″	4′44″
40			2780	1920	9.5	10.7	1.7	4.4	198	141	8	22	5′12″	4′54″
30			2620	1880	9.7	10.9	0.7	3.6	193	136	7	20	5′32″	5′04″
20			2460	1840	9.9	11.1	-0.3	2.8	188	131	6	18	5′52″	5′14″
10			2300	1800	10.1	11.3	-1.3	2.0	183	126	5	16	6′12″	5′24″

Note: M: male; F: female

Table 4 Effects of blended learning on physical fitness

Variables	Time	Measurement		Between-group		Within-group			
						TL		BL	
		TL	BL	*p*	d	*p*	d	*p*	d
BMI	T0	78.9(14.5)	79.4(13.5)	0.867	0.04	< 0.001*	0.48	< 0.001*	0.91
	T16	85.7(14.2)	91.2(12.3)	0.082	0.41				
Lung Capacity	T0	73.7(7.7)	73.5(9.7)	0.929	0.02	< 0.001*	0.19	< 0.001*	0.68
	T16	75.4(10.2)	80.5(10.9)	0.042*	0.48				
Sit and Reach	T0	71.9(8.8)	71.7(11.4)	0.913	0.03	< 0.001*	0.29	< 0.001*	0.70
	T16	74.6(9.2)	79.9(12.0)	0.035*	0.50				
Pull-up/Sit-up	T0	37.1(34.1)	38.7(29.4)	0.839	0.05	< 0.001*	0.44	< 0.001*	1.04
	T16	51.0(29.0)	63.3(15.7)	0.026*	0.51				
Standing Long Jump	T0	53.0(29.0)	54.9(25.2)	1.000	0.07	0.022*	0.40	< 0.001*	0.74
	T16	61.9(12.1)	69.8(12.8)	0.046*	0.63				
50-meter Run	T0	66.5(19.7)	67.9(20.6)	0.761	0.07	0.111	0.22	< 0.001*	0.56
	T16	69.7(8.2)	77.2(11.1)	< 0.001*	0.77				
1000/800-meter Run	T0	57.3(16.6)	58.9(13.0)	0.663	0.10	0.040*	0.09	< 0.001*	0.30
	T16	58.7(14.7)	62.8(13.5)	0.217	0.29				

Note: TL: traditional learning; BL: blended learning; T0: preintervention test; T16: 16-week postintervention test; *: the mean difference is significant at the 0.05 level

significantly. These results are consistent with those of previous studies, which also revealed significant improvements in BMI [34], lung capacity [34], sit-and-reach [35, 36], 1-minute sit-up/pull-up [35–37], standing long jump [35–37], 50-meter run [37], and 1000/800-meter run [37]. The findings can be explained by the fact that the blended learning model, by integrating online resources and offline instruction, not only provides students with a flexible and personalized learning experience but also ensures adequate training time and instruction in the classroom, which results in a more effective improvement in their physical fitness.

In addition, the results revealed differences between the experimental group and the control group in the posttest for lung capacity, sit-and-reach, pull-ups/sit-ups, standing long jump, and the 50-meter run. Several studies are in line with the above findings: Al Qudah et al. (2018) explored the effects of a 14-week blended learning intervention on the elements of physical fitness of Jordanian sixth-grade students [38]. The results showed that blended learning had a positive and significant effect on students' physical fitness scores. Similarly, Mischenko et al. (2020) explored the effect of a blended learning model on the physical fitness of 30 12-year-old girls and reported that speed, strength, coordination, endurance, and flexibility were greater in the blended learning model than in the traditional learning model [35]. Similarly, Yin and Hu (2021) reported that, compared with traditional learning, a 16-week blended learning intervention significantly improved students' physical fitness [34]. However, studies have reported opposite results for sit-and-reach and 50-meter runs [39]. It is challenging to draw definitive conclusions on the effects of blended learning on physical fitness due to differences in intervention duration and measures. Due to differences in intervention duration and measures, it is challenging to draw a definitive conclusion on the effects of blended learning on physical fitness. Therefore, more research is needed to compare the effects of blended learning and traditional learning on physical fitness.

This study revealed that there was no significant difference in body mass index (BMI) between blended learning and traditional learning models, and a study supported these results [40]. BMI is a widely used international standard for assessing body fat and overall health status [41]. University students' BMI is influenced by various factors, including sedentary behavior, screen time, dietary habits, genetics, psychological state, and physical activity [42–45]. Among these factors, increased sedentary behavior and screen time reduce physical activity, negatively affecting students' physical fitness [46]. In addition, the frequent consumption of takeout is also an important factor affecting Chinese university students' BMI, with data showing that 64% of them order takeout more than three times a week and order fast food, dessert, and milk tea more frequently [39]. More importantly, although exercise intervention is an important means of weight loss, it usually needs to be combined with dietary intervention to achieve significant results [32]. Since no dietary intervention was conducted in this study, the change in BMI may not have been significant. Furthermore, although the blended learning and traditional learning methods differ in terms of teaching methods, the teaching content and frequency were the same under both models, which could also be a reason for the insignificant change in BMI.

In the 1000/800-meter run, the difference in effectiveness between blended learning and traditional

teaching models was also not significant. Three studies reported the same results [36, 39, 47]. Muscular endurance refers to the ability of a muscle or muscle group to perform repeated contractions over an extended period under resistance [48]. The lack of significant differences between the two groups may be because the improvement in muscular endurance requires specific load and intensity stimuli, which gradually allow the muscles to adapt to external resistance [49, 50]. However, the frequency of only one PE session per week, whether blended learning or traditional teaching models, is not sufficient to provide enough physiological stimuli to effectively induce these adaptive changes. In addition, students' muscular endurance struggles to improve significantly because of the lack of rationalization between the training load of each class and the subsequent recovery process. This suggests that it is difficult to achieve the desired physical fitness enhancement effects by relying solely on the existing teaching arrangement and that the curriculum design may need to be adjusted to increase the training frequency and optimize load management.

In conclusion, this study provides strong evidence that a 16-week blended learning model effectively promotes university students' physical fitness. However, this study has the following limitations: first, the sample was only from the basketball class at a public university in Henan Province, which is small and may limit the generalization of the results; second, the 16-week intervention period and 90-minute weekly class frequency may not be sufficient to significantly improve certain fitness indicators; in addition, variables that may affect the results, such as the students' dietary habits and lifestyles, were not controlled; another limitation is that the study was restricted to the basketball program and did not cover other sports programs; and lastly, the lack of comparative gender analysis is an important limitation due to the mixed sample of participants. This may have masked potential differences in male and female students' responses to the interventions, which are critical for fully understanding the effects of educational interventions. Therefore, future research should consider expanding the sample size, extending the intervention duration, controlling for additional variables, and incorporating gender-specific analyses. These steps would help to explore the effects of blended learning in various physical education programs more comprehensively, thereby enhancing the applicability and relevance of the findings.

Abbreviations

BL	Blended learning
BMI	Body mass index
CRCT	Cluster randomized controlled trial
F	Female
GEE	Generalized estimating equation
M	Male
MOOC	Massive open online course
NSPHS	National Student Physical Health Standard
TL	Traditional learning

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Author contributions
CW: Conceptualization, Data curation, Formal analysis, Methodology, Writing – original draft, Writing – review & editing. YY: Conceptualization, Data curation, Formal analysis, Writing – review & editing. XJ: Methodology, Writing – review & editing.

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This study was conducted in accordance with the Declaration of Helsinki and approved by the Ethics Committee of Universiti Putra Malaysia (Approval No. JKEUPM 2022–030). All the students voluntarily participated in the study and provided informed consent.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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