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Systematic Review

Effects of Blended Learning in Physical Education among University Students: A Systematic Review

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Abstract: (1) Background: Blended learning (BL) models have attracted the attention of university teachers and students worldwide in recent years. However, systematic reviews related to the effectiveness of BL in university physical education are lacking. (2) Purpose: Therefore, this study aimed to evaluate the effects of BL in physical education among university students. (3) Methods: Searches were conducted in the following five databases: Web of Science, Scopus, PubMed, EBSCOhost (SPORTDiscus), and China National Knowledge Infrastructure (CNKI), and 18 articles met the inclusion criteria and were selected. The PEDro scale was used to assess the methodological quality of the selected studies and the quality of this study was fair (range 4–5). (4) Results: All reported sports included basketball (n = 6), badminton (n = 3), dance (n = 3), volleyball (n = 1), yoga (n = 1), aerobics (n = 1), Taiji (n = 1), swimming (n = 1), and tennis (n = 1). Seventeen studies described the effect of BL on students' motor skills, and the results showed that BL had a greater effect on basic skills, but the improvement was not significant for combination techniques. There were three studies related to physical fitness. Studies have observed significant effects on lung capacity (n = 1), sit and reach (n = 1), pull-ups (n = 1), 1000 m (n = 3), and 800 m (n = 1). However, there was no significant difference in body weight (n = 1) or standing long jump (n = 1). In addition, two articles examined the impact of BL on sitting up, but the findings were the opposite. Six studies reported on exercise attitude and the results demonstrated that BL can significantly improve students' learning attitude, target attitude, behavioral cognition, and emotional experience. However, the two articles produced different results in behavioral habits. Other results, such as satisfaction and interest in learning, were also popular topics regarding BL and were found to have improved significantly.

Keywords: blended learning; physical education; sports

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1. Introduction

Physical education has been designed to teach students knowledge, attitudes, and behaviors that are necessary for them to promote health and fitness [1]. At present, the majority of teachers in university physical education still adopt the traditional teaching method [2]. In class, an instructor conducts the explanation and action demonstration and then requires the students to acquire motor skills through imitation and repeated physical exercises [3]. In addition, the teacher-centered teaching model requires the same learning pace throughout the class [4]. Nevertheless, this is in spite of the fact that each student does not have the same level of understanding of the learning content at the same time and students' lack of access to the teacher's instruction beyond the class. Limited class time makes the teaching difficult in terms of catering to students' differences, and restricts the opportunities for teachers to provide individual guidance and attention [5,6]. Furthermore, physical education is practice-oriented and many teachers place less emphasis on theoretical learning and the cultivation of spirit and emotion [7,8]. Although students can acquire

certain sports abilities, students only passively receive the knowledge provided in the classroom, which may reduce their enthusiasm, engagement, and lifelong physical exercise consciousness [7–9]. However, there is a positive relationship between active learning and academic performance [10,11]. Some researchers point out that students that are eager to actively acquire knowledge can better enhance their sports knowledge and skills [12,13]. In addition, the advent of ICTs has positively influenced education [14,15]. To address the above-mentioned common teaching problems in physical education, the educators are now seeking a more effective and flexible teaching model with the assistance of advanced web technologies to overcome the constraints of conventional practices and to provide all students with access to novel and profound learning experiences and better learning effects [16].

Computer network technology has created new opportunities for teaching and learning in higher education [17,18]. Furthermore, ICT learning is not only considered a provider of learning benefits as well as FTF teaching, but also as a complement to the traditional sessions [19]. BL, also known as hybrid learning, is a new learner-centered teaching and learning model, which incorporates the advantages of online learning and face- to-face learning to support educational differentiation [20]. It is worth noting that BL is not only the integration of learning methods but also the combination of teaching methods, teaching resources, teaching environments, teaching objectives, and other teaching elements [21]. For online sections, it requires careful planning to maximize the use of active learning strategies based on an analysis of the learner's needs, the learning content, and the learning environment [22]. Learning platforms, such as MOODLE, and learning videos provided by teachers are the main forms of learning materials in the online section. Furthermore, massive open online courses (MOOCs) have been adopted as part of face-to-face formal university courses as a new type of blended learning. The flipped classroom is a form of BL, where learning content traditionally conducted in the classroom is delivered online prior to class time, and activities traditionally considered homework become in-class activities [23,24]. In other words, in a flipped classroom, the course requires students to learn completely on their own by watching videos or browsing materials before class, so the instructor has more time during class to discuss with students, address student questions, and guide them to practice and apply their knowledge, thus increasing student engagement and learning. All forms of BL promote a learner-centered and active learning strategy, which means that the learners can decide their pace of learning. Researchers have noted that by shifting from traditional teaching models into problem-based BL, students could develop higher-level cognitive processes [25], the ability of knowledge mastery and application [26], engagement [27], and active learning [28]. Some scholars have also recognized the higher potential of BL in translating the content of the lesson into practice [29].

BL has been applied to plenty of courses, for example, psychology [30], business [31,32], dance [33], mathematics [34,35], nursing [36,37] and English learning [38–40]. With the BL movement, many researchers are comparing the learning effects between traditional and BL methods. Several publications have confirmed that BL can increase students' academic performance [33,34], satisfaction [41–43], physical skill development [44,45], problem-solving capability and high-level thinking capability [46]. Previous research on the impact of BL on certain disciplines is encouraged, but systematic reviews exploring the effectiveness of BL in university physical education are lacking. Therefore, this systematic review aimed to evaluate the effects of BL in physical education among university students. In this study, we believed that BL employs a combination of online and face-to-face teaching, which includes all possible synonyms for blended, hybrid, flipped classrooms, MOOCs, and learning platforms, such as MOODEL. In addition, for a more comprehensive search of the sports-related literature, keywords related to motor skills, attitudes, and physical fitness were added.

2. Materials and Methods

This study was conducted according to the PRISMA statement and was registered on the International Prospective Register of Systematic Reviews (CRD42022319534). In-

terventionary studies involving animals or humans, and other studies that require ethical approval, must list the authority that provided approval and the corresponding ethical approval code.

2.1. Eligibility Criteria

The PICOS (population, intervention, comparison, outcome, and study design) criteria were used as the inclusion criteria for this review and are shown in Table 1. In addition, studies had to meet the following inclusion criteria: (1) a full-text that explored the effects of BL in physical education among university students had to be included. (2) In this study, a BL intervention was used in the experimental group. (3) Traditional classroom learning was used as a control group in the two or more groups, while pre-test scores were used in a single-group trial. (4) The scores relate to any of the three items of motor skills, learning/exercise attitude, and physical fitness. (5) Two group-controlled trials (randomized/non-randomized)/single-group trial (pre-test/post-test) were included in the studies. Studies were excluded if they met the following exclusion criteria: (1) no full-text published journal articles. (2) Non-empirical studies. (3) BL was not the intervention. (4) The experimental subjects were not university students.

Table 1. PICOs (population, intervention, comparison, outcome, study design).

Items	Inclusion Criteria
Population	University students (male/female)
Intervention	BL
Comparison	Traditional classroom learning was used as a control group in the two-arm study, while pre-test scores were used in the one-arm study
Outcome	Motor skills, learning/exercise attitude, and physical fitness
Study design	Two-group controlled trials (randomized/non-randomized)/single-group trial (pre-test/post-test)

2.2. Data Sources and Research

We conducted a systematic search between 1 April and 30 April 2022, allowing us to include all publications on the effects of BL in physical education among university students published before March 2022. The search was carried out in the following five main databases: Web of Science, Scopus, PubMed, EBSCOhost (SPORTDiscus), and China National Knowledge Infrastructure (CNKI), as these databases cover most of the sports-related high-quality articles. In each database, the literature was searched by title, using the predefined combination of the following keywords: ("blended learning" OR "blended course" OR "blended education" OR "B-learning" OR "hybrid learning" OR "hybrid course" OR "hybrid education" OR "flipped learning" OR "flipped classroom" OR "MOOC" OR "MOODLE" OR "learning strategy") AND ("physical fitness" OR "health-related fitness" OR "fitness element" OR "body composition" OR "flexibility" OR "muscular strength" OR "muscular endurance" OR "cardiorespiratory" OR "balance" OR "learning outcomes" OR "academic performance" OR "learning attitude" OR "attitude" OR "motor skills" OR "physical education" OR "sports" OR "physical activity") AND ("university students" OR "college students" OR "undergraduates" OR "undergraduate students" OR "higher education"). We also searched Google Scholar and the reference list of the selected studies for additional literature that may not have been included in the search results of the five databases.

2.3. Study Selection and Data Extraction

Figure 1 shows the study selection process. This study identified 143 articles through the selected database search and the results are as follows: Web of Science (n = 68), SCOPUS (n = 52), CNKI (n = 18), EBSCOhost (SPORT Discus) (n = 5), PubMed (n = 0), and additional articles identified through the reference list of studies (n = 2) and Google Scholar (n = 5). After duplicates (n = 5), the articles' titles and abstract (n = 145) were assessed for eligibility. After deleting 73 articles at the title and abstract level, the remaining 72 articles

were then read. Subsequently, 18 articles met the inclusion criteria and were selected for this systematic review. To avoid duplication, retrieved studies were replicated into the Mendeley reference management system. First, an experienced librarian helped with the search process. Second, two reviewers independently screened the article titles and abstracts against the predetermined inclusion criteria, followed by the full text. If there were any disputes, the third reviewer would participate in the discussion. Data that were extracted included (1) author and publication year; (2) research design; (3) course name; (4) population characteristics; (5) intervention characteristics (duration time, frequency, and length); (5) main content, and (6) outcomes.

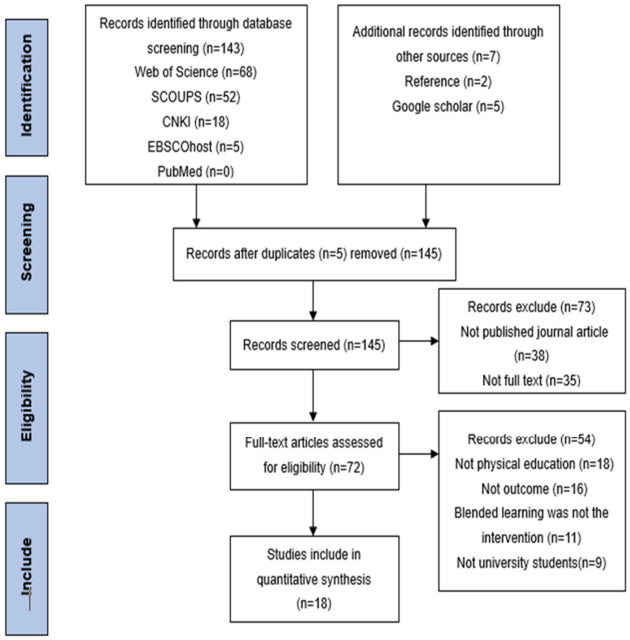

Figure 1. PRISMA flow chart of the study selection process [47].

2.4. Quality Assessment

The PEDro scale was used to assess the methodological quality of the selected studies (Foley et al. 2006). This tool contains 11 items to evaluate 4 key methodological features of the study, namely random process, blinding technique, group comparison, and data analysis. Two well-trained, independent reviewers were involved in assessing the methodological quality to limit bias, and any disagreements were addressed through discussion with the third reviewer. Scores of each item are based on the extent to which the criteria are satisfied (yes = 1, no = 0). Notably, the eligibility criteria were not regarded in the overall score, as it relates to external validity. Therefore, the total score that can be received for a study varies from 0 to 10, and the higher the score, the better the methodological quality. A total PEDro score of less than 4 is considered to be of poor quality, 4–5 is considered to be "fair", while studies with a score of 6–8 indicate good quality, and 9–10 is considered "excellent" [48].

The quality of the study is shown in Table 2. The PEDro scale scores ranged from 3 to 6 (mean = 4.6; median = 5; mode = 5), indicating fair study quality. Among them, 4 studies scored below 4, while the remaining studies (n = 14) scored 4 and above. The year of publication was not directly related to the quality of the study, as the 4 low-quality studies were published in 2016, 2018, and 2019, respectively, while the 3 high-quality studies were published between 2018 and 2019. The majority of the criteria met included the eligibility criteria (n = 18), group similar at baseline (n = 16), follow-up (n = 15), between-group comparison (n = 17) and point measure and variability (n = 14). None of the articles related to concealed allocation, blind therapist, blind assessor, or intention-to-treat analysis, except for 3 articles that satisfied random allocation [2,49,50], and only 1 article involved a blind subject [50] (see Table 2).

Table 2. Summary of methodological quality assessment scores.

No.	Study	Eligibility Criteria	Random Allocation	Concealed Allocation	Group Similar at Baseline	Blind Subject	Blind Therapist	Blind Assessor	Follow-Up	Intention-to-Treat Analysis	Between Group Comparison	Point Measure and Variability	PEDro Score
1	Zhao et al. [51]	1	0	0	1	0	0	0	1	0	1	1	5
2	Al-Hadidi [52]	1	0	0	1	0	0	0	1	0	1	1	5
3	Papastergiou and Gerodimos [53]	1	0	0	1	0	0	0	1	0	1	1	5
4	Peng and Yang [54]	1	0	0	1	0	0	0	1	0	1	0	4
5	Feng [55]	1	1	0	1	0	0	0	1	0	0	0	4
6	Lu [49]	1	0	0	1	0	0	0	1	0	1	1	5
7	Zhao et al. [56]	1	0	0	1	0	0	0	1	0	1	1	5
8	Jia [50]	1	1	0	0	1	0	0	1	0	1	1	6
9	Chiang et al. [1]	1	0	0	1	0	0	0	1	0	1	1	5
10	Lin et al. [2]	1	1	0	1	0	0	0	1	0	1	1	6
11	Xiang et al. [57]	1	0	0	0	0	0	0	1	0	1	1	4
12	Li et al. [58]	1	0	0	1	0	0	0	0	0	1	0	4
13	Bayyat [59]	1	0	0	1	0	0	0	0	0	1	1	4
14	Zhang and Liao [60]	1	0	0	1	0	0	0	1	0	1	1	5
15	Yuan et al. [61]	1	0	0	1	0	0	0	1	0	1	1	5
16	Gao [62]	1	0	0	1	0	0	0	1	0	1	1	5
17	Chao et al. [63]	1	0	0	1	0	0	0	1	0	1	1	5
18	Blinded for peer-review [64]	1	0	0	1	0	0	0	1	0	1	0	4

3. Results

3.1. Population Characteristics

The population characteristics of the 18 included studies were shown in Table 3 according to the following aspects: (1) grade level. Among the included studies, nine articles only reported university students but did not illustrate the students' grade levels [1,2,49,51,52,54,56,59,63] and other articles reported the level of grade, including freshmen [53,60,61], sophomores [55,58,62,64], and a mixture of freshmen and sophomores [50,57]. (2) Sample size. The sample size ranged from 24 [50,60] to 326 [1] participants, with a median of 80 [54]. (3) Gender. Two articles focused on female students [56,59], four articles focused on a mixture of female and male students [1,53,57,60] and none of the remaining articles showed gender [2,49–52,54,55,58,61–64]. (4) Age. Most articles did not report the students' ages, except for six studies [1,2,52,53,59,63]. Among them, the students' ages ranged from 17 years to 21 years. (5) Body mass index. Only two articles reported the students' height and weight [52,56]. According to the following BMI calculation formula:

$$\text{BMI} = \text{weight (kg)}/\text{height}^2\ \text{(m)}, \text{ the BMI of students ranged from 16 to 31.3 kg/m}^2.$$

3.2. Intervention Characteristics

The intervention characteristics of all the included studies were reported based on the following parts: (1) course. Of the 18 studies included, a total of 9 types of courses were reported, including basketball [1,49,53,58,61,62], badminton [50,51,55], dance [2,59,63], volleyball [52], yoga [56], aerobics [64], Taiji [60], swimming [54], and tennis [57]. (2) Study design. Most studies utilized two or three group-controlled trials, while one study employed a single-group trial [55]. (3) Training length. The shortest length of all the studies was 3 weeks [52], the longest length was 26 weeks [49] and the mode of length was 16 weeks [50,54,55,57,65]. (4) Training duration. Eight studies did not report the training duration [49,51,54–56,58,60,64], while the others ranged from 50 min [52] to 120 min [53,63]. (5) Training frequency. A total of 16 articles illustrated the frequency of training, which ranged from 1 time/week to 3 times/week. Of these, 11 articles had a training frequency of 1 time/week [1,2,50,51,55–58,61,63,64]. (6) Intervention and control groups. Most researches used BL as the intervention group and traditional teaching as the control group [49,51–54,57–62,64], while one article reported BL as an intervention group and no control group (Feng, 2018). Five studies included two intervention groups. Of these, two studies included both flipped classrooms and BL as intervention groups [56,63], and the rest articles reported on other intervention groups besides BL, including the online platform (MOOC) [50], flipped classroom and physical activity [2], and projecting teaching [1].

3.3. Effect of Blended Learning on Motor Skills

Seventeen studies described the effect of BL on students' motor skills [1,2,49–52,54–64]. All reported sports included basketball [1,49,58,61,62], badminton [50,51,55], dance [2,59,63], volleyball [52], yoga [56], aerobics [64], Taiji [60], swimming [54], and tennis [57]. Among them, most research indicated that BL has a significant impact on motor skills, while three studies did not find any significant improvements in badminton combination techniques [51], tennis forehand stroke [57], or ballet skills [59].

Table 3. Characteristics of studies examined in the present review.

No.	Author(s)	Year	Design	Course	Population Characteristics	Intervention	Main Content	Outcomes
1	Zhao et al. [51]	2010	Pre-post	Badminton	University students; EG = 66; CG = 68	Frequency: 1 time/week; Time: NR; Length: 12 weeks	EG = BL CG = CT	Learning interest ↑, Target attitude ↑, Behavioral habits ↓, Technical results (serve/lob shot) ↑, Emotional experience ↑, Behavioral cognition ↑, Combination techniques ↔
2	Al-Haddidi [52]	2013	Pre-post/ within group	Volleyball	University students; EG = 24 (Age: 19.76 ± 1.55; HT:177.81 ± 8.56; WT: 67.19 ± 11.70); CG = 21(Age: 19.25 ± 1.45; HT:174.71 ± 6.09; WT: 71.67 ± 17.54)	Frequency: 3 times/week; Time: 50 min; Length: 3 weeks	EG = BL CG = CT	Under hand passing skill ↑
3	Lu [49]	2018	Pre-post	Basketball	University students; EG = CG = 80	Frequency: 1–2 times/week; Time: NR; Length: 26 weeks	EG = FL CG = CT	Basketball skills (1-min jump shot/change-of-direction dribble/full court lay-up/classic footwork/crossover/backhand layup) ↑, Knowledge application (basic and defensive techniques) ↑, Learning attitude ↑
4	Feng [55]	2018	Pre-post	Public badminton course	Sophomores; EG =75	Frequency: 1 time/week; Time: NR; Length: 16 weeks	EG = BL	Theoretical knowledge ↑, Action knowledge ↑, Learning efficiency (skills/course/general) ↑, Motor skills (net shot, smash shot) ↑
5	Zhao et al. [56]	2019	Pre-post	Yoga	University students (F); EG = 1 = EG2 = CG = 28; HT: 162.05 ± 5.453; WT: 51.97 ± 4.665	Frequency: 1 time/week; Time: NR; Length: 12 weeks	EG1 = FL EG2 = BL CG = CT	Weight ↔, Sit-up ↔, Attendance ↑, Yoga skills ↑, Mobile learning ↑, Exercise habits ↑, EG1: Sit and reach ↑, Cooperative learning ↑; EG2: Lung capacity ↑
6	Gao [62]	2021	Pre-post	Basketball	Sophomores; EG = CG = 30	Frequency: 2 times/week; Time: 90 min; Length: 12 weeks	EG = BL CG = CT	Pull-up ↑; 1000-m run ↑; 800-m run ↑; Basketball skills (set shot) ↑; Learning interest ↑; Learning ability ↑; Sport participants ↑
7	Jia [50]	2019	Pre-post	Badminton	Freshmen and sophomores; EG1 = EG2 = CG = 8	Frequency: 1 time/week; Time: 90 min; Length: 16 weeks	EG1 = BL EG2 = MOOCs CG = CT	EG1: Theoretical knowledge ↑; Lob shot ↑; Forehand serve ↑; Net shot ↑
8	Blinded for peer-review [64]	2016	Pre-post	Aerobics	Sophomores; EG = CG = 40	Frequency: 1 time/week; Time: NR; Length: 18 weeks	EG = BL CG = CT	Learning interest ↑; Learning attitude ↑; Learning satisfaction ↑; Aerobics skills ↑
9	Lin et al. [2]	2019	Pre-post	Dance	University students; EG1 + EG2 + CG = 38; Age 19–20	Frequency: 1 time/week; Time: 100 min; Length: 9 weeks	EG1 = FL + PA EG2 = FL CG = CT	EG1: Technical skills ↑; Performance skills ↑; EG2: Self-efficacy ↑; Satisfaction ↑

Table 3. *Cont.*

No.	Author(s)	Year	Design	Course	Population Characteristics	Intervention	Main Content	Outcomes
10	Papastergiou and Gerodimos [53]	2013	Pre-post	Basketball	Freshmen; EG = 45; CG = 43, Age 1 = 18.38 ± 0.68; 33 M + 12 F; Age 2 = 18.53 ± 0.93; 23 M + 20 F	Frequency: 2 times/week; Time: 120 min; Length: 9 weeks	EG = BL CG = CT	Basketball knowledge ↑; Learning attitude ↑; Satisfaction ↑
11	Bayyat [59]	2020	Pre-post	Ballet	University students (F); EG = 22, CG = 18; Age = 19.7 ± 0.09	Frequency: 3 times/week; Time: 60 min; Length: 14 weeks	EG = BL CG = CT	Ballet skills ↔, Motivation ↔
12	Chao et al. [63]	2021	Pre-post	Dance	University students EG1 = 124; Age: 19.78 ± 1.35; EG2: 89; Age: 19.78 ± 1.38; CG = 77, Age: 18.69 ± 1.38	Frequency: 1 time/week; Time: 120 min; Length: 10 weeks	EG1 = BL EG2 = FL CG = CT	EG1 and EG2: Dance skills ↑; Relaxation ↑; Teaching satisfaction ↑; Cognitive development ↑; Normative success ↔; Communication ↔; Mastery experience ↔
13	Chiang et al. [1]	2019	Pre-post	Basketball	University students, Age: 20; EG1 + 122 (95 M + 27 F), EG2 = 119 (80 M + 39 F), CG = 85 (63 M + 22 F)	Frequency = 1 time/week; Time: 100 min; Length 9 weeks	EG1 = FL EG2 = PT CG = CT	EG1: Connectedness of moves ↑; Manoeuvrability ↑; Teamwork ↑; Sense of balance ↑; Adaptability ↑
14	Zhang and Liao [60]	2021	Pre-post	Taiji	Freshmen; EG = 121 (60 M + 61 F); CG = 125 (62 M + 63 F)	Frequency: NR; Time: NR; Length: 16 weeks	EG = BL CG = CT	Motor skills ↑; Learning interest ↑
15	Yuan et al. [61]	2021	Pre-post	Basketball	Freshmen; EG = CG = 64	Frequency: 1 time/week; Time: 90 min; Length: 18 weeks	EG = BL CG = CT	Basketball skills ↑; 1000-m run ↑; Satisfaction ↑; Learning interest ↑; Learning attitude ↑; Learning outcomes ↑; Standing long jimp ↔
16	Li et al. [58]	2019	Pre-post	Public basketball course	Sophomores; EG = CG = 15	Frequency: 1 time/week; Time: NR; Length: 18 weeks	EG = BL CG = CT	Set shot ↑; Half-court lay-up ↑; Standing dribble ↑
17	Peng and Yang [54]	2017	Pre-post	Swimming	University students; EG = CG = 40	Frequency: NR; Time: NR; Length: 16 weeks	EG = BL CG = CT	Swimming skills ↑
18	Xiang et al. [57]	2021	Pre-post	Tennis	Freshmen and Sophomores; EG = 91 (41 M + 50 F); CG = 97 (56 M + 41 F)	Frequency: 1 time/week; Time: 90 min; Length: 16 weeks	EG = BL CG = CT	Learning environment ↑; Forehand stroke ↔; Technical score ↑

↑, significant improvement before and after intervention; ↓, significant decrease before and after intervention; ↔, no change before and after intervention; CG, control group; EG, experiment group; CT, classroom teaching; OT, online teaching; ES, electronic sites; F, female; M, male.

3.4. Effect of Blended Learning on Physical Fitness

There were three studies related to physical fitness [56,61,62]. All sports covered in the literature were basketball [61,62] and yoga [56]. The evaluation approaches used in the three studies included body weight [56], lung capacity [56], sit up [56,62], sit and reach [56], pull-ups [62], 1000 m [54,61,62], 800 m [62] and standing long jump [61]. Studies have observed significant effects on lung capacity [56], sit and reach [56], pull-ups [62], 1000 m [54,61,62], and 800 m [62]. However, there was no significant difference in body weight [56] or standing long jump [61]. Interestingly, two articles studied the effect of BL on sit ups, but the findings were different, one demonstrating significant improvement [62], while the other showed no significant difference [56].

3.5. Effect of Blended Learning on Attitude

The six studies included in this review assessed attitudes. Most of them involved basketball [49,53,56,61], the other three were related to yoga [56], aerobics [64], and badminton [51]. Two studies reported on exercise attitude, with evaluation indicators including target attitude [51], behavioral cognition [51], behavioral habits [51,56], and emotional experience [51]. The other four articles stated learning attitudes [49,53,61,64]. The intervention period of the six studies was 9 weeks [53], 12 weeks [51,56], 18 weeks [61,64], and 26 weeks [49], respectively. The results of these six articles demonstrate that BL can significantly improve students' attitudes, except for behavioral habits [51].

3.6. Effect of Blended Learning on Other Outcomes

Based on the results collected, BL seemed to have a significant influence on student satisfaction in basketball [53,61], aerobics [64], and dance [2,63]. In addition, five studies have proved the remarkable effect of BL on the learning interest of university students in badminton [51], aerobics [64], Taiji [60], and basketball [61,62]. In addition, five articles assessed theoretical knowledge and learning efficiency and demonstrated significant improvements in basketball [49,53], dance [2], and badminton [50,55]. Other results have been shown to have significant effects on the aspects of attendance [56,62], relaxation [63], cognitive development [63], and diversified experience [63]. However, there was no significant difference between BL and traditional teaching in motivation [59], communication [63], normative success [63], or mastery experiences [63].

4. Discussion

This systematic review presents a comprehensive overview of the effect of BL models on physical education for university students. Eighteen studies were identified in the systematic review, seventeen of which were controlled studies. One of these was a single-arm study using pre-test test scores as a control. The majority of the studies showed that BL could increase motor skills, attitude, and physical fitness among university students. Some articles, however, reported different findings. These results differed significantly in terms of participants, sports, and intervention. Nevertheless, based on the research findings of the studies, BL may be an effective intervention for physical education among university students. This section presented a detailed analysis of the findings.

4.1. Effect of Blended Learning on Motor Skills

Physical education is an essential context for the development of motor skills [66–68]. Most studies empirically showed that BL could significantly improve students' basketball [1,49,58,61,62], volleyball [52], yoga [56], aerobics [64], Taiji [60], and swimming [54] skills. This can be explained by the fact that the BL approach enhances students' motor skill learning, thus facilitating their development of sports. In the learning process of motor skills, learners need to focus on timely stimulation and reinforcement, and the control of stimulation depends on two conditions, one is active practice and the other is following reinforcement [69]. Meanwhile, pre-practice instruction and demonstration, arrangement of exercises, and feedback methods are important and lasting influences on

movement skill learning [56]. On the one hand, the teaching demonstration before the class and the teacher's instruction during the class reasonably arranged the time, intensity, and frequency of practice, in line with the law of motor skill learning. On the other hand, BL provides an effective learning environment for students and provides them with more flexible interaction and learning support [70].

Badminton tests, including serve [50,51], lob shot [51], net shot [50,55], and smash shot [55], also showed significant increases after the BL intervention. Noteworthy, Jia [50] compared the effectiveness of teaching badminton in BL, MOOC learning, and traditional learning, respectively, and the results showed that the effects of the BL model are better than single traditional and MOOC learning. The results are in accordance with the findings of other studies that students' academic performance was significantly improved in the BL model compared to single traditional and online learning [71,72]. However, there were no significant differences between BL and traditional teaching in terms of badminton combination techniques [51]. A reasonable explanation for this may be that learning motor skills are more about practice than learning concepts and more than 90% of the students in the experimental and control groups had no previous experience in badminton, making it difficult for the students to improve their stability of the combination techniques in a short period.

In addition, two of three articles confirmed that BL could improve students' dance skills [2,63], while one study took a different view [59]. According to Bayyat [59], 40 female undergraduate students (beginners) were assigned to the control group (18 students) and experimental group (22 students). They attended a one-hour class three times a week for fourteen weeks. The results of this study revealed no obvious differences between BL and traditional teaching with students' dance performance. Such results are consistent with the work of Xiang et al. [57], who performed BL on tennis and reported no significant differences in the forehand stroke results. Nevertheless, the results showed that there was a significant difference in the technical evaluation, which means that BL is more conducive to the improvement of students' technical movements. Overall, the results showed that BL had a positive effect on motor skills. Although some studies have presented different findings, the limited number of studies supporting this view means that the evidence is insufficient. In addition, this study only involved nine types of sports. Therefore, future studies should address this gap.

4.2. Effect of Blended Learning on Physical Fitness

Physical education is one of the main ways to promote students' physical fitness [73,74]. The results of this research indicated significant effects on lung capacity [56], sit and reach [56], pull-ups [62], 1000 m [54,61,62], and 800 m [62]. The results of this study are similar to those of AI Qudah et al. [75], who conducted a 14-week experiment on physical fitness among sixth-grade students, and the results reported that BL showed a positive impact on student's performance in the fitness element. However, two studies revealed no significant difference in body weight [56] or standing long jump [61]. The reasons for this analysis are, first, because there are many factors that affect the changes in students' physical indicators, and it is difficult to make them change only through two months of teaching practice and exercise; second, the problem of controlling irrelevant variables, which cannot exclude the interference of factors such as students' independent exercise after class. Furthermore, two articles studied the effect of BL on sit ups, but the findings were different, one demonstrating a significant improvement [62], while the other showed no significant difference [56]. Due to the different populations and interventions, we cannot draw definitive conclusions in this regard. In addition, all sports covered in the literature were basketball [61,62] and yoga [56]. Therefore, there should be more articles that cover different sports and explore other aspects of physical fitness, such as speed, reaction time, agility, balance, and coordination.

4.3. Effect of Blended Learning on Attitudes

Exploring students' attitudes towards physical education can enrich the body of knowledge in sports pedagogy [76]. Six studies explored the effect of BL on students' learning attitudes and exercise attitudes [49,51,53,56,61,64]. The results demonstrated that BL can significantly improve students' learning attitude, target attitude, behavioral cognition, and emotional experience. The students' positive attitudes detected in this study support the outcomes of previous and recent studies [77–80] conducted in academic disciplines other than physical education (e.g., English, mathematics, physics), where the BL method was found to generate a positive attitude among students. As (blinded for peer-review) [64] points out, compared with the traditional teaching strategy, students in the BL model had a more positive attitude towards aerobics, and they were more actively involved in aerobics training. In addition, the BL approach focuses more on developing students' ability to learn cooperatively and independently using online teaching materials, which can enhance students' motivation. At the same time, using classroom group cooperation and online independent learning improves the interaction between teachers and students, which is conducive to facilitating students' emotional exchange and communication. However, the two articles produced different results in behavioral habits [51,56]. Although the same intervention characteristics were used in both articles, the sports and population characteristics were different. Furthermore, student exercise habits need to be developed and formed over time, and the 12-week experiment was relatively short. Therefore, BL still needs to continuously prove the effects on the behavioral habits of university students.

4.4. Effect of Blended Learning on Other Outcomes

Satisfaction and interest in learning were also popular topics regarding BL and were found to have improved significantly [2,51,53,60,61,63,64]. In addition, other results have been shown to have positive effects on the aspects of attendance [56], relaxation [63], cognitive development [63], diversified experience [63], theoretical knowledge and learning efficiency [2,50,53,55]. A possible explanation is that the BL approach is a student-centered pedagogy strategy and a variety of high-level online learning resources (e.g., videos, pictures) present many opportunities for supplemental learning, which can increase their self-confidence, and thus their willingness to participate in sports. However, there was no significant difference between BL and traditional teaching in motivation [59], communication [63], normative success [63], or mastery experiences [63]. These findings are inconsistent with the findings of Waheed et al. [81], who found that a BL strategy significantly enhances students' satisfaction and motivation to participate in sports. They indicated that the modified modules of the MOODLE platform greatly helped students to improve their learning experience and can be a motivator for learners.

The significant range of different levels of intrinsic and extrinsic motivation depends on the BL environment [82]. Overall, BL combines both traditional and online teaching methods, which not only increases learning flexibility but also optimistic learning outcomes [83]. This finding is in line with Balakrishnan et al.'s [84] view that the application of BL has a more positive impact compared to a single model of instruction. For the non-positive effects mentioned in the literature, it is assumed that the short duration of the experiment and the highly technical nature of the sports made it impossible for the students to adapt to the change in the educational environment over a short period.

5. Conclusions

The main purpose and contributions of the present study were to review and analyze the effects of blended learning in physical education among university students, to propose possible future research directions, and to provide suggestions for this field. We discussed the current problems with traditional physical education, the advantages of the BL model over traditional instructional methods, and the effects of BL applied to other academic learning activities. According to the analytical results, the researchers have focused more on the effects of blended learning on motor skills, satisfaction, learning interests, and learning

attitudes than on physical fitness. The majority of the studies showed that BL effectively improves students' physical performance. The results are consistent with the findings of other studies that students' academic performance was significantly improved in the BL model [71,72]. In addition, ball sports are the most studied of all the sports, such as basketball, badminton, volleyball, and tennis. Therefore, future research should explore the effects of blended learning on physical fitness among university students and the potential of blended learning for more sports.

6. Limitation and Direction for Future Research

This study has the following limitations. Firstly, all studies reported only partial demographic characteristics, such as gender [1,53,56,57,59,60], grade level [1,2,49,51,52,54,56,59,63], age [1,2,52,53,59,63], and BMI [52,56]. This information is important because there are studies that point to a significant effect of demographic characteristics on student academic performance [85]. Secondly, intervention characteristics are the key factors in the effectiveness of the intervention. In this study, eight studies did not report the intervention duration [49,51,54–56,58,60,64], while two studies did not show the intervention frequency [54,60]. Thirdly, only three studies were related to physical fitness [56,61,62], while six studies included in this review assessed attitudes [49,51,53,56,61,64]. Finally, none of the studies reported on sample size calculations, and five articles had sample sizes of less than 30 participants in each group [50,52,56,58,59].

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