The Effect of the Sport Education Model on Sports Ability: A Critical Systematic Review

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Abstract

The impact of the Sport Education Model (SEM) and Traditional Teaching (TT) methods on students' sports ability in PE teaching, including game performance, technical performance, and physical fitness is substantial. However, a systematic evaluation of the comparative impact of these two teaching methods on students' sports abilities is lacking. This study aims to assess the difference between Sports Education and traditional teaching methods in enhancing students' sports abilities. Web of Science, PubMed, Scopus, and EBSCOhost (CENTRAL and SPORTDicus) were utilized as databases for a comprehensive search. Eligibility criteria for study selection were developed using the PICOS framework, with the following components: (i) Population - healthy students; (ii) Intervention - any SEM intervention program aimed at improving students' sports ability; (iii) Contrast - any form of traditional teaching methods; (iv) Results - (measured by sports ability, including game performance, technical performance, and physical fitness); and (v) Study design - randomized controlled trial and non-randomized controlled trial. This study analyzed 12 studies, five of which were published in the last five years. Methodological quality was assessed using the Downs and Black checklist, with all studies found to be of moderate quality. The literature's risk of bias was evaluated using the ROBINS-I tool, and only three articles were at moderate risk of bias, while the rest were at high risk. The results of the majority of studies, which utilized quasi-experimental design with college and junior high school students as participants, indicate that both the Sport Education Model (SEM) and Traditional Teaching (TT) were effective in enhancing students' sports ability. However, SEM demonstrated a superior outcome compared to TT. More than half of the studies failed to meet Siedentop's requirement of a minimum of 18 units. Moreover, the model fidelity in most studies cannot be ensured. Current studies have shown that SEM is more effective than TT in improving students' sports ability. However, these studies lack the universality of objects, and further research is needed to evaluate the effectiveness of SEM on primary and high school students. To ensure reliable results, future studies should prioritize proper planning and design of intervention frequency and quantity. Additionally, model fidelity must be implemented as a necessary procedure.

Keywords: Sport Education Model, Sports Ability, Game Performance, Technical Performance, Physical Fitness.

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Introduction

The Importance of the Traditional Teaching and Sport Education Model

Physical education (PE) in schools, plays a crucial role in fostering students' sports ability. Traditional Teaching (TT) methods, commonly adopted by teachers throughout the 20th century and still prevalent today (Gubacs-Collins, 2015), typically revolve around the teacher as the primary authority in the classroom. In such approaches, teachers assume full responsibility for curriculum planning, teaching, and evaluation, while students have limited involvement (Mosston & Ashworth, 2008). Teachers often emphasize classroom discipline and behavioral norms to optimize teaching effectiveness and maximize instructional time. This approach allows students to acquire a certain level of

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sports skills and knowledge, providing a foundation for future application (Bessa et al., 2021). The emphasis on repetitive exercises, feed-through, and progressive difficulty in traditional instruction has been particularly successful in developing beginner skills. However, some scholars have pointed out that this teaching method greatly limits students' sports experience and is not conducive to the development of students' sports ability, because most of the knowledge is instilled by teachers themselves (McMorris, 1998). In recent decades, education researchers have been exploring different teaching models, to improve the quality of PE and provide a better learning environment for students.

The SEM seeks to provide students with authentic and educational sports experiences in the context of school sports, aiming to achieve the goal of developing competent, literate, and enthusiastic individuals and is an effective way for teachers to enhance students' sports experience in the school educational environment. The SEM provides students with a more comprehensive understanding of sports and practical experience in PE. In this model of teaching, the entire learning unit is treated as a competitive season. The season typically consists of at least 20 lessons with their respective adaptations (Kastrena & Setiawan, 2017; Layne & Hastie, 2015; Pereira et al., 2015; Pritchard et al., 2008). Students are divided into teams and assigned different roles, including coach, team leader, athlete, referee, recorder, reporter, and support staff. Along with the competitive season and affiliation, the SEM also includes four other defining characteristics. Throughout the season, students will have the opportunity to participate in official games, capture and preserve memorable moments, foster a celebratory atmosphere, and culminate in exciting events. Moreover, the SEM offers great flexibility in teaching content and strategies (García López & Kirk, 2022) allowing for adaptation to different stages of the season, including direct teaching, cooperative teaching, and peer learning. Consequently, the SEM represents a paradigm shift from the traditional teacher-centered approach to a more student-centered teaching method (Manninen & Campbell, 2022).

Objective and Research Gap

This systematic review aims to examine the main findings of a comparative investigation into the effects of SEM and TT on students' sports ability in the context of physical education. The traditional methodology in physical education instruction underscores a teacher-centric paradigm, raising concerns about its limitations in furnishing students with a holistic athletic experience and proficiency. SEM is acknowledged for its pursuit of fostering adept, literate, and enthusiastic individuals among students. Furthermore, numerous scholars have undertaken empirical inquiries and systematic assessments elucidating the merits of SEM across diverse dimensions of student development (Bessa et al., 2021; Manninen & Campbell, 2022; Tendinha et al., 2021; Zhang & Ronghai, 2020). Nevertheless, a gap persists in reviews that specifically scrutinize the correlation between SEM and TT methodologies and the motor abilities of students. Hence, the inquiry into whether SEM may assume a pivotal role in nurturing the sports proficiency of students prompted the genesis of this review.

The study addresses four research questions:

(Q1) In which contexts do studies on the development of students' sports abilities predominantly focus when comparing the two teaching methods, SEM and TT?

(Q2) What are the most frequently analyzed variables in these comparative experiments, and what are the results?

(Q3) Which methodologies are employed to investigate the development of sports abilities within the SEM curriculum?

(Q4) How many studies have determined the fidelity of the model implementation?

By answering these questions, the research aims to provide a comprehensive understanding of the impact of SEM and TT on students' sports abilities, contributing to the ongoing efforts to enhance the quality of physical education and improve students' learning experiences in sports.

Literature Review

Sports Ability

Sports ability is a nonstandard measure that was subject to the respondent's interpretation (Houston et al., 2002). Based on the previous studies on sports ability (Houston et al., 2002; Huang, Shi, & He, 2021; Li et al., 2022; Sun, 2015; Yadav & Bhainaik, 2022). This review interprets sports ability as the concepts of talent (basic physical fitness), skill (ability to complete a specific task or set of tasks), and game performance (Ackerman, 1990; Famose & Duranl, 1988). It incorporates factors such as coordination, strength, agility, speed, and overall athleticism. Sports ability can vary widely among individuals and can be cultivated and enhanced through training, practice, and experience (Wilmore, Costill, & Gleim, 1995).

Previous Studies of the SEM on Students' Sports Ability

Quiñonero-Martínez et al. (2023) examined children's and

teens' physical fitness using Eurofit and Alpha Fitness tests. Results showed improved scores in standing long jump and speed-agility for the control group, while the experimental group did not show significant progress. Parker and Curtner-Smith (2005) highlighted the significance of the SEM and traditional multi-activity (MA) units in impacting students' health-related fitness. Despite the lack of statistical significance, data trends suggested directions for future research and insights for refining current physical education practices. Researchers also used FITNESSGRAM® tests to evaluate fitness levels, showing that integrating key SEM principles into fitness units effectively improved students' skills. Prior literature explored innovation in physical education, applying SEM to assess middle school students' physical fitness. The study suggested SEM features could effectively teach and develop key competencies. Wahl-Alexander and Chomentowski (2018) studied the impact of university foundational physical education courses on college students' aerobic fitness. Comparing the SEM with direct instruction, they found significant improvements in students participating in the SE physical conditioning course, emphasizing the positive impact of adopting SEM in university physical education.

A prior study, investigated the impact of the SEM on students' motor skill development during a volleyball season. The study, conducted by in-service teachers with continuous professional development support, assessed motor skills through the "Keep It Alive" volleyball game. Significant improvements were observed in volleyball form, communication, movement to the ball, and total score from pretest to postseason, emphasizing the positive influence of SEM on motor skill development. Researchers in a prior study, compared two forms of SEM in track and field events, assessing their impact on students' skills, technical performance, and content knowledge. Both groups showed significant improvements, with the SEM classes outperforming in technique and skill execution. Only the SE group demonstrated significant content knowledge improvements, emphasizing the structured nature of SEM as a contributing factor. Hastie et al. (2009) explored students' skill development and tactical knowledge during a badminton season using the SEM. Notable progress was noted in students' ability to control and play badminton aggressively. Additionally, advancements were observed in selecting tactical solutions and justifying decisions.

Scholars also compared SEM with a combined SEM and Teaching Games for Understanding (TGfU) approach, finding the combined model more effective in decision-making, support, overall game performance, and involvement. This supports the idea of endorsing the combined use of these models in physical education to enhance students' game performance and engagement. Researchers studied game performance improvements in three hybrid Sport Education-Step-Game-Approach volleyball seasons with 18 Portuguese high school students, emphasizing the value of multiple seasons within SEM to reduce skill level gaps. Prior study investigated the impact of SEM on college students' basketball game performance and content knowledge. Comparing SEM with traditional methods for 25 participants, the study showed significant improvements in offensive game performance and content knowledge in the SEM group, suggesting the model's effectiveness in enhancing game skills and knowledge.

The reviewed studies present nuanced outcomes in sports ability, revealing variations in responses to fitness tests and motor skill development. While Quiñonero-Martínez et al. (2023) showcased divergent physical fitness results, Parker and Curtner-Smith (2005) hinted at potential trends in refining physical education practices. SEM consistently demonstrated positive effects on fitness levels and motor skill development, as seen in Hastie et al. (2009). Notably, a prior study, highlighted the superiority of a combined SEM and TGfU approach, emphasizing the impact of instructional models on game performance. These variations underscore the need for tailored strategies, indicating that SEM's effectiveness is context-dependent, with instructional nuances playing a pivotal role in shaping outcomes across diverse educational settings.

Previous Systematic Review Research

Previous SEM-centered reviews are irrefutably helpful in summarizing the available evidence on the main goals of physical activity, the focus of which is primarily on students' personal and social skills (Bessa et al., 2021), motor and cognitive development (Bessa et al., 2021), motivation (Manninen & Campbell, 2022; Tendinha et al., 2021), basic needs (Manninen & Campbell, 2022), prosocial attitudes (Manninen & Campbell, 2022), and learning outcomes, and it is concluded that the implementation of SEM has a positive effect on improving student's performance in these aspects. While these reviews contribute valuable insights, they exhibit certain limitations. Although many systematic reviews have summarized major findings on the impact of different teaching methods, no quantitative or qualitative reviews have been found so far that specifically compare, contrast, and discuss the impact of SEM and TT on students' sports ability, which reinforces the innovation of this review. In line with the above rationality, this study attempts to

evaluate the main findings of relevant surveys dedicated to comparing the effects of SEM and TT on students' sports ability.

Methods

Protocol and Registration

The PRISMA statement (Page et al., 2021) was followed in reporting this systematic review and meta-analysis, and the review protocol has been registered on Inplasy.com (INPLASY022100040).

Search Strategy

The following four electronic databases were searched for articles related to the topic: SCOPUS, PubMed, EBSCOhost (SPORT Discus and CINAHL Plus), and Web of Science. The search covered the period from 2008 to 2023, with a final search deadline of mid-June 2023. The search terms used included citations and keywords reviewed by Labata-Lezaun et al. (2020) in their systematic literature review, as well as the names of indicators related to sports ability such as (sports ability, physical skills, techniques, performance, coordination, strength, agility, speed, and athleticism). To combine these terms, this research utilized English Boolean operators "AND" and "OR" The terms used for combining were: "sports education," "direct instruction," "traditional teaching," "traditional instruction ", "traditional style", "teacher-centered teaching model", and "skill-drill-game". The authors also sought guidance from librarians in the field to ensure the attainment of optimal search results. Furthermore, we meticulously examined and explored the reference lists of the included studies within this review to validate the impact of the initial search and identify any potentially overlooked relevant studies. This manual process involved thorough scrutiny of titles, author names, and publication years to gather supplementary literature.

Eligibility Criteria

Prior literature suggested defining eligibility criteria prior to electronic retrieval. In addition, inclusion and exclusion criteria were established for this review based on the PICOS principles (Population, Intervention, Comparison, Outcomes, and Study Design) prior to commencing the search of electronic literature (refer to Table 1).

Inclusion Criteria: The selected literature had to meet the following requirements (i) the selected literature must be full-text articles in English from peer-reviewed journals, excluding books, incomplete articles, conference abstracts, and dissertations; (ii) The study participants should be students with a health status permitting regular exercise; (iii) The research should feature interventions conducted within the context of physical education, with comprehensive descriptions of the intervention process and content; (iv) The study should compare the effects of SEM (Simulated Environment) and TT methods on at least one indicator of student sports ability; (v) The study design should be quantitative, and the evaluation results should be based on objective experiments or measurements.

Exclusion Criteria: (i) Studies that do not meet the inclusion criteria mentioned above; (ii) Literature outside the educational context; (iii) Studies involving a combination of SEM and other teaching models, such as Teaching Games for Understanding (TGfU), as mentioned in Bessa et al. (2021); (iv) Studies that do not use a quantitative study design and do not provide evaluation results based on objective experiments or measurements; (v) There was no control group or the control group was not taught traditionally.

Table 1

Inclusion criteria according to the PICOS conditions

Items	Detailed Inclusion Criteria
Population	Students (male/female)
Intervention	Sports Education Model
Comparison	Traditional teaching (direct instruction, traditional instruction, traditional style, teacher-centered teaching model)
Outcome	Sport ability
Study designs	RCT

Study Selection

The search strategy was initially guided by the librarian to ensure the removal of duplicate literature, The retrieved articles were imported into Mendeley reference management software. Subsequently, we independently assessed the titles and abstracts to determine which articles should be excluded or retained. Those articles deemed highly relevant were then thoroughly read in their entirety. The Notes function in Mendeley software facilitated the

marking and editing of SEM and TT intervention results based on their impact on students' sports abilities. Finally, two review authors reviewed the full text of the included articles and extracted significant information. In cases of disagreement, a third author participated in the evaluation process until a consensus was reached among the three reviewers regarding the screening results.

Data Extraction and Quality Assessment

From the selected literature, we extracted crucial information such as the author, publication period, study objective, participant's characteristics, nationality of participants, exercise program details, intervention method employed in the experimental group, teaching method used in the comparison group, fidelity measures for the intervention model, variables pertaining to sports ability, and the primary comparison results.

Risk Assessment of Bias in Non-Randomized Controlled Trial Studies

In the book Risk of Bias in Non-randomized Studies-of Interventions (ROBINS-I), a more general bias risk assessment tool for non-randomized studies of the effects of interventions (NRSI), in the British Medical Journal (BMJ). It is a domain assessment tool applicable to a variety of non-randomized studies for the evaluation of intervention effects, including cohort studies, case-control studies, and quasi-experiments. The release of this tool is a milestone for quality evaluation in the NRSI field. Building upon the parallel design of RCT in the RoB2.0 tool, ROBINS-I further categorizes the evaluation areas into three parts: pre-intervention (confounding bias, object selection bias), intervention (bias in intervention classification), and post-intervention (bias from established intervention, bias from missing data, bias from outcome measures, and bias from selective reporting of outcomes). Each evaluation area consists of multiple Signaling questions, with a total of 34 signaling questions.

Methodical Quality

Methodological quality was assessed using the Downs and Black's checklist. This checklist provides a comprehensive evaluation of the strengths and weaknesses of each study, covering literature reporting (1-10), validity (11-26), and statistical validity (27) through 27 items. Each item is scored on a scale of 1, and the checklist offers detailed criteria for scoring. The quality of the studies was categorized. Scores ranging from 20 to 27 were classified as "good quality", scores from 11 to 19 as "medium quality", and scoring below 11 as "poor quality". Two independent researchers conducted the assessment of the selected studies. The final score was reviewed and discussed by the study team, comprised of the first author and coauthors, any discrepancies were addressed by consulting with the third author until a consensus was reached. The articles were rated ranging from 12 and 13 points, indicating a moderate level of quality (see Table 2).

Table 2

Study Quality Checklist with Quality Scores Assigned

Author(s)/Date	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	QS
Kastrena and Setiawan (2017)	1	1	1	1	0	1	1	0	0	1	UTD	UTD	UTD	0	0	0	1	1	1	1	1	1	1	0	0	UTD	0	13
Layne and Yli-Piipari (2015)	1	0	1	1	0	1	1	0	1	1	UTD	UTD	UTD	0	0	0	1	1	1	1	1	1	0	0	0	UTD	0	13
Layne (2015)	1	0	1	1	0	1	1	0	1	1	UTD	UTD	UTD	0	0	0	1	1	1	1	1	1	0	0	0	UTD	0	13
Li et al. (2022)	1	0	1	1	0	1	1	0	0	1	UTD	UTD	UTD	0	0	0	1	1	1	1	1	1	1	0	0	UTD	0	13
Nikravan, Safania and Zarei (2019)	1	0	1	1	0	1	1	0	0	1	UTD	UTD	UTD	0	0	0	1	1	1	1	1	1	0	0	0	UTD	0	12
Pereira et al. (2015)	1	0	1	1	0	1	1	0	0	1	UTD	UTD	UTD	0	0	0	1	1	1	1	1	1	1	0	0	UTD	0	13
Hastie et al. (2009)	1	0	1	1	0	1	1	0	0	1	UTD	UTD	UTD	0	0	0	1	1	1	1	1	1	1	0	0	UTD	0	13
Pritchard et al. (2008)	1	0	1	1	0	1	1	0	0	1	UTD	UTD	UTD	0	0	0	1	1	1	1	1	1	1	0	0	UTD	0	13
Rocamora et al. (2019)	1	0	1	1	0	1	1	0	0	1	UTD	UTD	UTD	0	0	0	1	1	1	1	1	1	1	0	0	UTD	0	13
Wahl-Alexander and Chomentowski (2018)	1	0	1	1	0	1	1	0	0	1	UTD	UTD	UTD	0	0	0	1	1	1	1	1	1	1	0	0	UTD	0	13
Layne (2015)	1	1	1	1	0	1	1	0	0	1	UTD	UTD	UTD	0	0	0	1	1	1	1	1	1	0	0	0	UTD	0	13
Zhang and Ronghai (2020)	1	0	1	1	0	1	1	0	0	1	UTD	UTD	UTD	0	0	0	1	1	1	1	1	1	0	0	0	UTD	0	12

QS: quality score

Results

Figure 1 presents the study selection processes and Table 3 provides an overview of each of the 12 studies included in this review. Table 4 shows the results of the assessment of literature bias risk, including author(s)/date, research area, study type, risk assessment tool, and overall evaluation rating. The comprehensive evaluation reports for each project can be found in the supplementary information. The primary factor contributing to the overall bias risk is confounders, with evaluation results indicating moderate bias in 25% of experimental studies and severe bias in 75% of them, all included literature demonstrated low risk concerning participant selection, recommended intervention classifications, and deviations from established interventions. Furthermore, a quarter of the literature (Layne & Yli-Piipari, 2015; Pritchard et al., 2008) presented low-risk missing data, while other literature did not provide relevant information in this regard. As for outcome measures, the majority of projects exhibited a moderate risk of bias, with only one study (Pritchard et al., 2008) demonstrating a low risk of bias in outcome measurement. Finally, there was a moderate risk of bias observed in assessing selective reporting bias across all project outcomes.

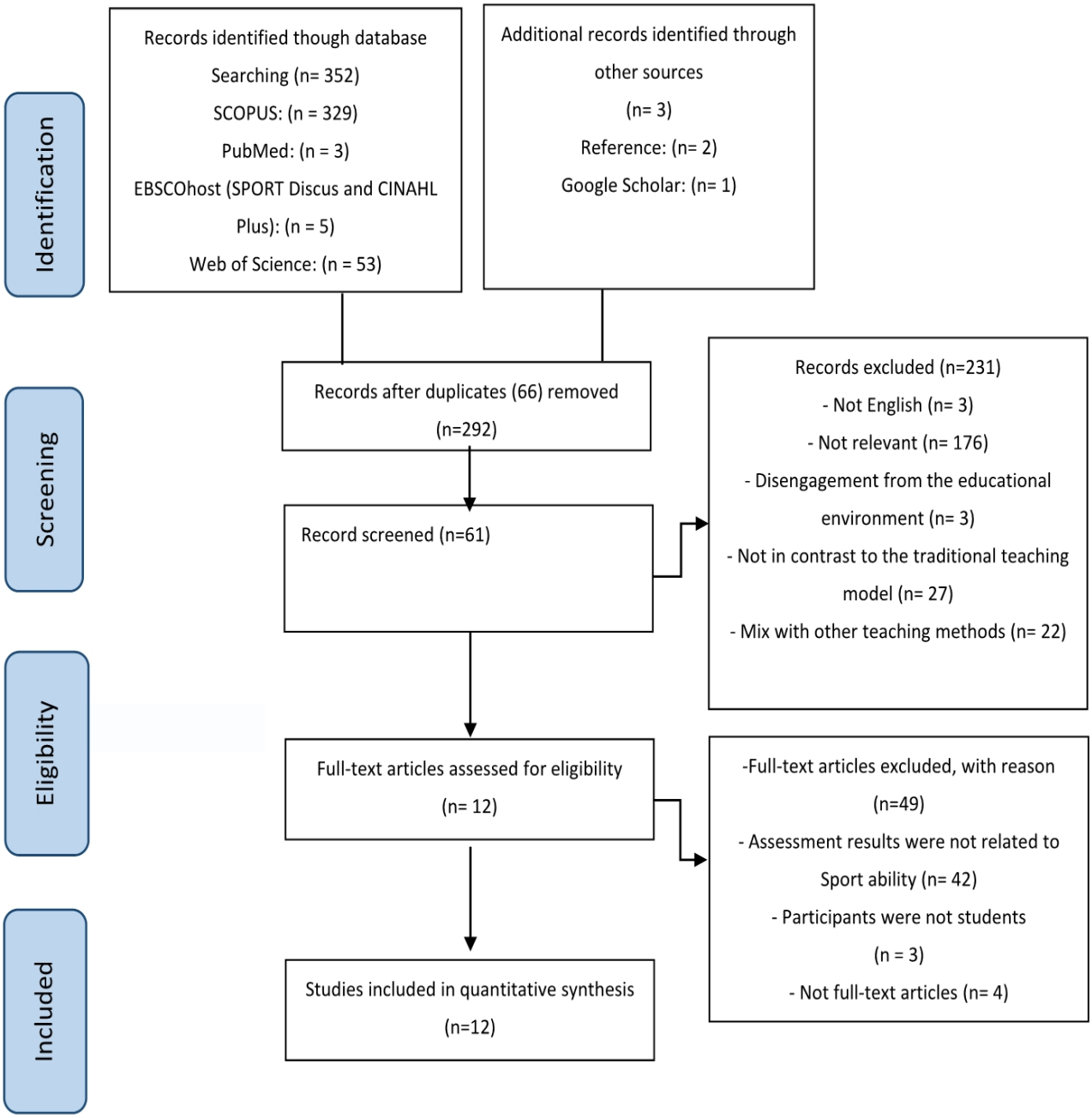

Figure 1: PRISMA Summary of the Study Selection Process.

Table 3

Characteristics of Included Studies

Author(s)/Date	Purpose	N (sex) / Age	Country	Sport	Intervention	Comparison	Fidelity	Variables	Main Findings
Kastrena and Setiawan (2017)	To explore the influence of SEM and TT on improving students' volleyball playing skills	Middle school N=30 Male 22, Female 3	Indonesia	Volleyball	SEM 19 lessons Three times a week	TT	Unit plan and curriculum elements	volleyball playing skills	-SEM is significantly better than TT in improving students' volleyball skills
Layne and Yli-Piipari (2015)	To investigate the effect of the SEM model on basketball performance and knowledge of physical activity curriculum content among students	College N = 25, Male 22, Female 3 EG=12 male and 1 female CG=10 male and 2 female	US	basketball	SEM 28 lessons Two to three times a week One hour and 25 minutes	TT	No	Offensive game performance Game efficiency	- Students in the sports education group showed significant improvements in offensive game performance compared to the TT model. - There was a slight increase in game efficiency in the SEM group, whereas students in the traditional group experienced a decrease.
Layne (2015)	To compare the effects of SEM and DI on students' running performance	College 26 students (15 males, 11 females) SEM=15 CG=11	US	Running	SEM 42 lessons Three times a week 50min	DI	Experienced & Checklist	Running performance	- Both two teaching methods can significantly improve the jogging performance of college students. - There was no significant difference between the two teaching methods.
Li et al. (2022)	To compare the effects of SEM and TT teaching modes on the ability and knowledge of volleyball in Chinese sports professionals.	College EG=55 (41 boys, 14 girls) CG=55 (39 boys, 16 girls)	China	Volleyball	SEM 16 lessons Once a week 90min	TT	Unit plan and curriculum elements and experienced	Game-like Skills (forearm pass, overhead setting) Game Performance (Adjustment, decision making, skill technique, and skill outcome)	- In the SEM group, the Performance of forearm pass, overhead setting skill, and Game Performance were significantly improved. - In the TI group, only the Performance of overhead setting skill and Game Performance produced a significant improvement effect. - SEM was significantly better than TI.

Nikravan et al. (2019)	To compare the effects of traditional methods and sports education on Physical Fitness and Competency.	Junior EG=18 CG=18 grade two of junior school	Iran	volleyball	SEM 12 sessions 90 min	TT	No	Physical Fitness (Agility, Jump Sport, Sit-up, Speed, Endurance, Flexibility, Horizontal bar) Competency	- Comparison between groups: Exercise education was given priority over traditional methods in improving physical fitness (except jumping). - Intra-group comparison: the competency was significantly improved.
Pereira et al. (2015)	To compare the influence of SEM and DI on students' track and field performance	Junior N=47 10-13 years old EG=19 (9 boys and 10 girls) CG=28 (16 boys and 12 girls)	Portugal	Track and Field	SEM 20 lessons Twice a week 45 min	DI	Unit plan and curriculum elements & Experienced & Checklist	Shot-put Triple-jump Hurdles	- The SEM group showed significant improvements in all items, but evidence of significant improvements in DI was limited to boys and taller students
Hastie et al. (2009)	To explore the effects of obstacle course education season on the aerobic fitness level of college students	Primary school N = 48 (Mage=10.6), M/F=23/ 25 EG = 23 (M\F=12/11) CG = 25 (M\F=12/11)	US	Disc Lacrosse	SEM 20 classes Five times a week 40min	DI	Experienced	Aerobic fitness (PACER)	The Aerobic fitness of students in the SEM group was significantly better than that in the DI group.
Pritchard et al. (2008)	To investigate how SEM and TS would affect skill development, knowledge, and game performance for volleyball at the secondary level.	Junior EG=26 CG=21 Age=14–15	US	Volleyball	SEM 20 lessons Five times a week 50 min	TS	Unit plan and curriculum elements & Checklist	Skill (Set and Pass) Game Performance (Decision made Skill execution Adjust)	- There was no statistically significant difference between the skills, but there was a statistically significant difference between the game performance, SEM better than TS
Rocamora et al. (2019)	To assess SEM and DI in Primary Education students' physical activity intensity levels, game performance, and friendship goals.	Primary school N=88 EG=47 CG=41 Mage=11.16±0.63	Spain	Handball	SEM 15 lessons Three times a week 45min	DI	Trained& Experienced & Checklist	Game performance (Progress to goal Get open Defend opponent Prevent score)	The SEM could be considered more effective than DI to improve Primary Education students' game performance.

Wahl-Alexander and Chomentowski (2018)	To compare the effects of SEM and TI on aerobic fitness levels of college students.	College M=23, F=24 EG= 12 boys and 11 girls Mage=22 CG=11 boys and 13 girls Mage=21.25	US	physical conditioning Sports Education course	SEM 26 lessons Bi-weekly for 75 min	TI	Unit plan and curriculum elements and experienced	Cardiovascular fitness levels	The Progressive Aerobic Cardiovascular Endurance Run (PACER) and the one-mile run were significantly improved in the SEM group, and the PACER laps were significantly improved compared with the TT group.
Layne (2015)	To compare the effects of SEM and TSM on table tennis skills and attitudes of high school students in China.	High school N=64 Age: 16–17 years old	China	Table tennis	SEM 16 lessons Once a week 40min	TSM	Unit plan and curriculum elements and experienced	Table tennis skills (Backhand drive Forehand drive Topspin serve)	- The technical level of the students in both classes has improved significantly, and the progress of SEM students in forehand drive and serve is obviously higher than that of TSM students.
Zhang and Ronghai (2020)	The enlightenment of the physical education model to college physical educatio.	College N=60 (20 boys, 40 girls) Mage= 20.52±0.8	China	Physical actions and running	SEM 16 lessons Once a week 90 min	TT	No	Physical quality	The SEM model was significantly better than the control group in improving the physical quality of college students.

DI: Direct instruction, TI: Traditional instruction, TS: Traditional Style, TSM: Traditional Sports Model

Table 4

Study Risk of Bias

Author(s)/Date	Study Design	Risk assessment tool	Overall Evaluation Rating
Kastrena and Setiawan (2017)	CT	ROBINS-I	Serious
Layne and Yli-Piipari (2015)	CT	ROBINS-I	Serious
Layne (2015)	CT	ROBINS-I	Serious
Li et al. (2022)	CT	ROBINS-I	Serious
Nikravan et al. (2019)	CT	ROBINS-I	Serious
Pereira et al. (2015)	CT	ROBINS-I	Serious
Hastie et al. (2009)	CT	ROBINS-I	Serious
Pritchard et al. (2008)	CT	ROBINS-I	Serious
Rocamora et al. (2019)	CT	ROBINS-I	Serious
Wahl-Alexander and Chomentowski (2018)	CT	ROBINS-I	Moderate
Layne (2015)	CT	ROBINS-I	Serious
Zhang and Ronghai (2020)	CT	ROBINS-I	Serious

CT = non-randomized controlled trial/quasi-experimental studies

The Findings of This Review Can Be Summarized as Follows

(Q1) In which contexts do studies on the development of students' sports abilities predominantly focus when comparing the two teaching methods, SEM and TT?

The majority of the 12 items included in this review originated from developed countries, accounting for 7 studies, 58%) Specially, the United States contributed 5 items, (42%), while Spain and Portugal each provided 1 item, (8%), respectively. Developing countries accounted for 5 items, 42%), including China with 3 items, 25%), Iran with 1 item, 8%), and Indonesia with 1 item, 8%). Based on student classification, participants were categorized as university students (5 items, 42%), senior high school students (1 item, 8%), junior high school students (4 items, 33%), and primary school students (2 items, 17%). Team sports were predominantly presented, with volleyball featuring (4 items, 33%), basketball (1 item, 8%), handball (1 item, 8%), and disc lacrosse (1 item, 8%). Individual sports encompassed running (1 item, 8%), track and field (1 item, 8%), table tennis (1 item, 8%), physical fitness (1 item, 8%), and multi-activity physical fitness (1 item, 8%).

(Q2) What are the variables most commonly analyzed in these comparative experiments?

The 12 studies examined three variables associated with athletic ability, namely game performance, technical performance, and physical fitness. Four of these studies focused on game performance (Layne & Yli-Piipari, 2015; Li et al., 2022; Pritchard et al., 2008; Rocamora et al., 2019), six studies investigated technical performance (Kastrena & Setiawan, 2017; Li et al., 2022; Pereira et al., 2015; Pritchard et al., 2008), and four studies explored physical health (Hastie et al., 2009; Nikravan et al., 2019; Wahl-Alexander & Chomentowski, 2018; Zhang & Ronghai, 2020).

(Q3) What methodologies are employed to investigate the development of sports abilities within the SEM curriculum?

Most of the studies included in this review were quasi-experimental studies with quantitative analysis. Among the experimental designs, 11 studies utilized before and after tests, accounting for 92%, while only one study employed a 2 × 3 (group × time) research design (Pritchard et al., 2008). None of the studies mentioned the distribution of major confounders and only two studies provided characterization of patients who were lost to follow-up (Layne & Yli-Piipari, 2015). Additionally, none of the studies attempted to blind subjects to the intervention they received or those who assessed the primary outcome of the intervention. There are five studies randomized pairs (Hastie et al., 2009; Li et al., 2022; Pereira et al., 2015; Rocamora et al., 2019), making up 33% of the total. While nine studies described the source of the test or assessment criteria when measuring variables, only three studies demonstrated the reliability of the test instrument, test method, and rater (Li et al., 2022; Pereira et al., 2015; Pritchard et al., 2015). Regarding the duration and frequency of the intervention: out of the 12 studies, only 6 studies (50%) had SEM seasons longer than 20 class hours, while the remaining 6 studies (50%) had durations below 20 class hours. The frequency of Course interventions ranged from once every two weeks to five times per week, with Each session lasting between 40 and 90 minutes. Only one study (8%) did not provide information on the timing of each implementation (Kastrena & Setiawan, 2017).

(Q4) How many studies have assessed the fidelity of model implementation?

Fidelity to SEM implementation was confirmed in 9 out of 12 studies (75%), although different ways were employed. The assessment of SEM and TT courses primarily involved a detailed description of the SEM unit plan and curriculum elements, the involvement of experienced teachers, or the use of the instructional checklist. In 5 of the 9 studies (56%), the authors solely provided thorough descriptions of the curriculum elements or sought the expertise of experienced instructors, which may not guarantee adherence to accepted SEM standards. However, in four studies, instructional checklists were utilized alongside detailed descriptions of curriculum elements or the involvement of experienced instructors.

Discussion

Findings About Studies Background

The majority of studies on the SEM model have been conducted in developed countries, particularly in the United States. However, there has been a growing interest in applying the SEM model in developing countries, most notably in China (Sun, 2018). This shift is likely due to the alignment between the SEM model's objectives and the direction of educational reform in China. The participants in these studies are predominantly co-educational students, aligning with the SEM's primary implementation environment within schools (Bessa et al., 2021). Most participants come from junior high school and college settings, which is consistent with previous research (Bessa et al., 2021; Manninen & Campbell, 2022; Tendinha et al., 2021). The SEM's unique role lies in its comprehensive approach to promoting students' healthy development, both physically and psychologically. It not only focuses on skill acquisition but also fosters a sense of community, teamwork, and sportsmanship among students. This is particularly important in the context of educational reform

in China, where there is an increasing emphasis on holistic education (Sun, 2018).

In terms of sports, the study found that team sports are predominant in SEM research (Bessa et al., 2021). This suggests a need for future studies to focus on individual sports to provide a more comprehensive understanding and to mitigate the risk of inaccurate outcomes. The literature emphasizes the importance of reporting participants who are lost to follow-up, as it influences various aspects of research quality, including bias assessment and data integrity (Kabir, 2016). However, this review found that only two studies provided such information, highlighting a gap in the current research landscape.

Given the SEM's unique role in promoting healthy development and its growing relevance in various educational settings, future research should focus on diversifying the sports and geographical locations studied. Additionally, there is a need for greater transparency and rigor in reporting to improve the quality of research in this field.

Findings About the Game Performance

The impact of teaching models on students' athletic abilities has been a subject of considerable interest, with 'game performance development' serving as a key dimension for analysis (Layne & Yli-Piipari, 2015; Li et al., 2022; Pritchard et al., 2008; Rocamora et al., 2019). Various metrics have been identified by scholars to evaluate game performance, encompassing offensive and defensive skills, as well as decision-making and adaptability (Li et al., 2022; Pritchard et al., 2008). In comparing the SEM and TT methods, the SEM group demonstrated significant improvements in offensive skills (Rocamora et al., 2019). Notably, in the metrics of 'Defend Opponent' and 'Prevent Score,' the effect size for SEM was 4.8 times that of TT (Rocamora et al., 2019). This aligns with the findings of Pritchard et al. (2008), who also reported that SEM significantly outperforms TT in skill execution. Interestingly, while SEM showed significant improvements in decision-making and adaptability (Li et al., 2022; Pritchard et al., 2008), Pritchard et al. (2008) concluded that TT had no significant impact on students' decision-making abilities. This is consistent with the measurements of game efficiency indicators by Layne and Yli-Piipari (2015). Although SEM appears superior in multiple aspects, further research is needed to validate these findings, especially across different sports and age groups. Coaches and educators might consider adopting the SEM, particularly in scenarios requiring the enhancement of students' offensive and defensive skills.

Findings About Technical Performance

A focal point of this review is the advancement of students' technical performance, a subject that has garnered considerable scholarly attention (Kastrena & Setiawan, 2017; Li et al., 2022; Pereira et al., 2015; Pritchard et al., 2008). Researchers have employed a range of metrics to assess technical performance, including but not limited to volleyball techniques, running performance, and various athletic skills (Li et al., 2022; Pereira et al., 2015; Pritchard et al., 2008). Studies have yielded mixed results regarding the efficacy of SEM and TT methods. Kastrena and Setiawan (2017) reported that SEM significantly outperformed TT in improving volleyball skills. Conversely, Layne (2015) found no significant difference between the two methods in enhancing jogging performance among college students. However, Li et al. (2022) and others have found SEM to be notably superior in specific skills like forearm passing and overhead setting. Pereira et al. (2015) and Pritchard et al. (2008) extended these findings to specific demographic groups, such as boys and taller students, noting that only certain skills like forearm passing showed significant improvement under TT. Layne (2015) also reported that both SEM and TT were effective, but SEM showed greater enhancement in skills like forehand spike and serve. Taking into account the findings from five different studies, it can be concluded that SEM is generally more effective than TT in enhancing students' technical performance (Kastrena & Setiawan, 2017; Li et al., 2022; Pereira et al., 2015; Pritchard et al., 2008).

Findings About Physical Fitness

This review scrutinizes four studies that focus on the dimension of physical fitness (Hastie et al., 2009; Nikravan et al., 2019; Wahl-Alexander & Chomentowski, 2018; Zhang & Ronghai, 2020). Scholars have employed a diverse array of indicators such as agility, jump, sit-up, speed, endurance, flexibility, balance (Nikravan et al., 2019), aerobic fitness (Hastie et al., 2009), cardiovascular fitness (Wahl-Alexander & Chomentowski, 2018), and physical quality (Zhang & Ronghai, 2020) to gauge physical fitness. Nikravan et al. (2019) concluded that SEM displayed significant advantages over the TT method in most aspects, with the exception of the high jump. Hastie et al. (2009) found that students in the SEM group exhibited significantly better aerobic fitness compared to those in the Direct Instruction (DI) group, a finding that aligns with Wahl-Alexander and Chomentowski (2018). Additionally, Zhang and Ronghai (2020) reported that the SEM group showed significant improvements in the physical quality of college students when compared to a control group. Based

on these consistent findings across multiple studies, it can be concluded that SEM is significantly more effective than TT in enhancing students' physical fitness.

Findings About the Methodology of The Studies

A quasi-experimental design with pre-post testing is often employed to achieve greater experimental control (Stratton, 2019). Consequently, research exploring the impact of teaching methods on students' physical and mental development commonly utilizes quasi-experimental designs, such as non-randomized controlled design with pre-test and post-test measurements (Burgueño & Medina-Casaubón, 2020; Puente-Maxera et al., 2018). This review also affirms this finding. Due to the inherent connection between teaching methods and educational settings, much of the research takes place within schools. The information on classes in schools presents a significant challenge to achieve full participant randomization. As a result, true experimental designs, widely regarded as the highest quality, are lacking in many studies. Moreover, among the 12 studies included in this review, 11 adopted a pre-test and post-test design, while only 1 study employed a pre-test, mid-test, and post-test approach to capture the dynamic development of students' sports ability in the classroom. Understanding these pedagogical dynamics is crucial for gaining a comprehensive comprehension of the teaching process and guiding future pedagogical models (Bessa et al., 2021). This perspective aligns with the emphasis on the teaching process. Although current research has started to address the recommendation of conducting experimental studies related to the SEM, there is still a need for more extensive participation of participants, particularly among younger students. Furthermore, in terms of SEM season length, Siedentop et al have clearly explained in their book that the duration should comprise at least 20 lessons, allowing students to acquire a comprehensive and systematic understanding of specific sports knowledge and skills. However, based on the literature reviewed, we found that over half of the studies failed to meet this standard principle. Consequently, some scholars have suggested that enhancing the length of the season or the frequency of intervention could lead to a notable improvement in the performance of students in the SEM group (Layne & Yli-Piipari, 2015; Tendinha et al., 2021). To achieve success and ensure more reliable results, future research should prioritize the planning and design of an appropriate number and frequency of interventions.

Findings About the Model Fidelity

The fidelity of the SEM curriculum in research plays a pivotal role in ensuring the validity and comprehensiveness of the study outcomes. This is particularly important for two main reasons: (i) it allows readers to establish a clear link between the intervention and its results, and (ii) it mitigates the risk of drawing false conclusions by evaluating fidelity (Bessa et al., 2021). Research in this area should encompass a detailed account of the unit plan, curriculum elements, and the teacher's experience with the SEM during its implementation. Model fidelity has emerged as a focal point of scholarly concern, often assessed through tools based on the Instructional Checklist developed by Pritchard et al. (2008). Despite the acknowledged importance of fidelity, this review found that only one out of 12 studies examined both the curriculum unit plan and elements, as well as the instructors' experience with the SEM. A majority of the studies (67%) did not examine the SEM curriculum at all, while half merely provided descriptions without addressing the critical aspect of model fidelity. Such omissions can lead to inconsistent research findings. Given these gaps, this systematic review strongly advocates for a renewed emphasis on evaluating model fidelity as a key research focus in future studies.

Furthermore, during the quality assessment of the included literature, we also found that the average score was 12.67. The full score of the Downs and Black checklist was 27 points. While the overall rating falls within the medium quality range, it approaches the lower threshold for this category. Few of the studies scored on blinding, randomization, power, representation of the sample group, and adjustment for confounders in the data analysis. Additionally, upon close examination of the literature, it becomes apparent that many studies provide a comprehensive description of the SEM, but offer limited detail regarding the TT model, often presenting it in a somewhat unfavorable light. This review emphasizes the need for future studies to provide an objective and comprehensive description of all teaching models or methods compared. This approach will enable So that most front-line teachers to accurately leverage the advantages of each model in addressing various challenges encountered during the teaching process.

Conclusion

This study provides a summary and comparison of the effect of TT and SEM on students' sports abilities. Despite the continued use of TT teaching by PE teachers, there is limited literature supporting its effectiveness in improving students' sports ability. On the other hand, SEM consistently demonstrates better outcomes across various dimensions, including game performance, technical

performance, and physical fitness. This finding aligns with the current emphasis on enhancing students' sports abilities. However, it is important to note that research on elementary and high school levels is relatively scarce, although SEM plays a vital role in meeting students' sports abilities at different age levels. Furthermore, TT, as a commonly employed teaching method, also possesses certain advantages. Hence, it is necessary to approach teaching without bias, considering the current teaching situation, and selecting suitable methods to address unforeseen and complex teaching challenges. It is crucial to acknowledge the correct utilization of the TT method while dispelling any notion that it cannot be implemented. This review suggests that future research should prioritize the incorporation of unit plans, curriculum elements, experienced lecturers, and instructional checklists to standardize the teaching and learning process. Additionally, experimental designs in future studies should encompass blinding, randomization, efficacy, sample group representation, and confounder adjustment.

Limitations

This review provides substantial evidence to support the superiority of the SEM over TT models in improving students' sports abilities. However, there are some limitations to this review. First, the studies included did not consider the effect of varying class sizes on the outcome of teaching experiments, each study employed a predetermined grouping method without exploring the optimal number of students per group or the ideal number of groups for achieving better teaching results. How does class size affect teaching effect deserve scholars to consider in the future comparative study of SEM and TT teaching. Some scholars have proposed that inappropriate, insufficient, or excessive sample size can compromise the quality and accuracy of experiments (Rodríguez del Águila & González-Ramírez, 2014). Second, the majority of studies did not document the experimental environment nor account for participants' engagement in exercise outside of the controlled setting, which could have influenced student's attitudes toward physics learning. Furthermore, most studies failed to examine the effects of climate, time, and other factors on students' attitudes toward physical education during experimental teaching. Last, the literature reviewed lacks short - or long-term follow-up assessment of students after the end of the trial, making it challenging to determine the long-term impact of the SEM curriculum on students' sports ability.

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