A Quasi-Experimental Comparison Of Cooperative Learning And Direct Instruction For Floor Gymnastics Skill Outcomes

Puspodari✉, Iqbal Arifin[2], Wasis Himawanto[3]
(1) Master of Sports Teaching, Universitas Nusantara PGRI Kediri, Indonesia
(2) Faculty of Teacher Training and Education, Universitas Sulawesi Barat, Indonesia
(3) Master of Sports Teaching, Universitas Nusantara PGRI Kediri, Indonesia

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✉ Corresponding author
(puspodari@unpkediri.ac.id)
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Abstract

This study aimed to evaluate the effectiveness of Cooperative Learning and Direct Instruction in improving floor gymnastics skills among physical education students. A quantitative approach employing a quasi-experimental pretest–posttest control group design was used. Eighty students participated in the study and were assigned to either the Cooperative Learning group (n = 40) or the Direct Instruction group (n = 40). Floor gymnastics performance was assessed using a validated performance rubric covering four movements: Roll Backward to Handstand (RBH), Forward Handspring (FH), Front Balance (FB), and Shoulder Stand (SS). Performance was evaluated on a five-point rating scale by trained assessors, and the instrument's content validity was established through expert review by gymnastics specialists. Data were analyzed using the Wilcoxon Signed-Ranks Test and the Mann–Whitney U Test. The results demonstrated significant improvements in all four floor gymnastics skills within both instructional groups ($p < 0.05$). Furthermore, the between-group analysis revealed that the Cooperative Learning group achieved significantly higher posttest performance than the Direct Instruction group across all four movements, with small to moderate effect sizes ($p < 0.05$). These findings indicate that although both instructional strategies effectively improved students' floor gymnastics performance, Cooperative Learning provided greater overall learning gains. Therefore, Cooperative Learning may be considered a more effective instructional approach for enhancing floor gymnastics skills while promoting active student participation in physical education.

Keyword: *Floor Exercise Skills; Cooperative Learning; Direct Instruction; Experiments; Physical Education Students*

1. INTRODUCTION

Gymnastics is a form of physical activity that incorporates elements of beauty into every movement. However, in physical education instruction, the emphasis is placed more on students' willingness to move and their mastery of basic gymnastics techniques (Mikel & Ismaya, 2023). Floor gymnastics skills are one of the core competencies that physical education students must master because they are directly related to motor skills, coordination, and readiness to become future physical education teachers. Floor gymnastics, which includes movements such as rolling, maintaining body balance, and various other acrobatic movements, can develop students' motor skills and have a positive impact on their physical development (Rahmadani et al., 2025). However, various empirical findings indicate that mastery of basic techniques such as forward rolls, backward rolls, handstands, and the bridge is still relatively low. Several studies at Indonesian universities report that more than 50% of students have not met the criteria for floor gymnastics proficiency, particularly in the areas of technique and balance. The development of basic motor skills, including coordination and balance, is a crucial foundation for learning complex physical activities like gymnastics, as it directly contributes to the successful mastery of more advanced movement

techniques (Jones et al., 2020). This situation is further reinforced by observations in practical classes, where students tend to be passive, lack confidence, and struggle to understand movement sequences systematically. This situation presents a particular urgency, as these low skills not only impact academic achievement but also the professional competence of students as prospective physical education teachers.

The low level of floor exercise skills among students is not a coincidence but is influenced by various interrelated factors. One of the main factors is a teaching approach that remains teacher-centered, resulting in students having fewer opportunities to practice actively and collaboratively. A teacher-centered learning approach tends to limit students' active participation, thereby affecting low engagement and the development of motor skills in physical education (Casey & Goodyear, 2015). Additionally, the limited variety of teaching methods makes the learning process monotonous and uninteresting, which leads to a decline in students' motivation to learn. A lack of variety in teaching methods in physical education can reduce students' motivation to learn, as monotonous learning tends to diminish interest and engagement in physical activities (Beni et al., 2017). Other contributing factors include differences in students' initial abilities, a lack of effective feedback, and a fear of injury that hinders their willingness to attempt movements. Thus, learning strategies are needed that not only emphasize technical instruction but also foster active interaction, collaboration, and meaningful learning. The timely and adequate development of individual motor skills is a key factor in supporting quality learning and the ability to demonstrate acquired knowledge (Jovanovic et al., 2018).

Learning that integrates the cognitive, affective, and psychomotor domains has proven more effective in improving physical education learning outcomes, as it emphasizes not only technical mastery but also students' understanding and attitudes toward physical activity (Bailey et al., 2022). Theoretically, the improvement of motor skills can be achieved through a learning approach that integrates cognitive, affective, and psychomotor aspects. Cooperative learning strategies have been shown to enhance engagement and learning motivation through group collaboration (Casey & Fernandez-Rio, 2019). Cooperative learning strategies emphasize collaboration among students in small groups to help one another understand and practice movements, whereas Direct Instruction emphasizes systematic instruction, clear demonstrations, and progressive practice. Previous research indicates that cooperative learning is effective in enhancing engagement and learning motivation, while Direct Instruction has been shown to improve technical accuracy and the efficiency of movement learning. These strategies enable students with more limited educational backgrounds to benefit from increased practice frequency and more focused attention, ultimately helping the entire group achieve a high level of competence (Khataybeh et al., 2024). However, most of these studies were conducted separately, focusing on only one learning strategy, and have not thoroughly examined the combination of these two approaches in the context of floor gymnastics. Additionally, some studies remain limited to small samples and relatively short intervention durations.

As a result of this review, there exists a notable research gap pertaining to the direct comparison of Cooperative Learning and Direct Instruction in the context of enhancing floor gymnastics competencies among students in physical education. The majority of earlier studies have investigated these teaching methods independently, highlighting the necessity for comparative research that thoroughly evaluates their respective outcomes under comparable learning situations (Casey & Kirk, 2020). While both methodologies have shown promise in aiding student learning within physical education, their effectiveness in relation to floor gymnastics has not been extensively studied, especially in terms of systematic quasi-experimental designs and objective assessments of skill (Dyson et al., 2022). Theoretically, the two methods present distinct

instructional features: Direct Instruction focuses on structured demonstrations, clear guidance, and stepwise practice, while Cooperative Learning highlights peer interaction, joint practice, and collaborative feedback. Nevertheless, there is scant empirical evidence indicating which of these strategies yields superior outcomes in floor gymnastics skills when applied to similar groups of physical education students. As such, this current study aims to fill this gap by directly contrasting Cooperative Learning and Direct Instruction within separate instructional groups and exploring the differences in students' floor gymnastics skill performance. This comparison offers a more precise foundation for assessing the relative efficacy of the two instructional strategies rather than presuming that a combined approach would necessarily result in enhanced outcomes.

Based on this gap, this study aims to analyze improvements in college students' floor exercise movement skills through the application of cooperative learning and Direct Instruction strategies in an experimental study. Specifically, this study aims to: (1) determine the effect of cooperative learning strategies on floor exercise skills, (2) determine the effect of Direct Instruction on the improvement of motor skills, and (3) compare the effectiveness of these two strategies in improving student learning outcomes. Thus, this study is expected to provide an empirical picture of the most effective learning strategies in the context of floor exercise instruction.

2. METHODS

2.1. Participants

Eighty undergraduate students took part in this research. Among the participants, there were 44 males and 36 females, with ages ranging from 19 to 23 years (M = 20.76, SD = 1.12). Those involved were recruited from the same physical education setting. To be eligible, students needed to be enrolled in a physical education program, actively engaging in floor gymnastics activities, and physically capable of executing the gymnastics movements being evaluated. Students who were absent during either the pretest or posttest, or who could not take part in gymnastics due to injuries, were not included in the study.

The participants were chosen through purposive sampling, based on their initial skill levels in floor gymnastics. Prior to grouping, all qualifying students underwent a pretest that included four floor gymnastics movements: RBH, FH, FB, and SS. Following the results of the pretest, participants were ranked according to their skill levels and subsequently divided into two groups to ensure comparable initial performance. Forty students were placed in the Cooperative Learning group, while 40 students comprised the Direct Instruction group. This allocation was carried out without randomization, in line with a non-randomized quasi-experimental design.

To assess baseline equivalence, the Mann–Whitney U test was used for each movement evaluated. The findings demonstrated no significant statistical differences between the Cooperative Learning and Direct Instruction groups for RBH ($U = 732.500$, $Z = -0.497$, exact $p = .620$), FH ($U = 716.000$, $Z = -0.684$, exact $p = .495$), FB ($U = 724.500$, $Z = -0.588$, exact $p = .558$), and SS ($U = 709.000$, $Z = -0.764$, exact $p = .451$). These results showed that the two groups had similar performance levels in floor gymnastics prior to the intervention. Additionally, the participants shared comparable prior experience in floor gymnastics, contributing to the minimization of potential differences in their previous exposure to skills between the groups.

2.2. Instrument of Collecting Data

The main tool utilized was a performance rating rubric for floor gymnastics skills, adapted from Khataybeh et al., (2024) and tailored specifically for students in physical education. This rubric evaluated four specific movements: the Roundoff Back Handspring (RBH), Front Handspring (FH), Front Balance (FB), and Shoulder Stand (SS) (Khataybeh et al., 2024). Each of these movements was assessed based on six technical criteria, which were scored on a five-point scale where 1

signified very poor, 2 meant poor, 3 represented fair, 4 indicated good, and 5 denoted very good, leading to a total score range of 6 to 30 for each movement.

Three specialists in physical education and gymnastics reviewed the rubric. Their evaluations focused on the relevance of the criteria, the clarity of the rubric, and its technical suitability, resulting in an Aiken's V coefficient between 0.83 and 1.00, which reflects strong content validity. Two trained evaluators—one being a gymnastics instructor and the other a certified gymnastics coach—independently assessed the performances of the students. After undergoing standardized training, the inter-rater reliability was analyzed with the intraclass correlation coefficient (ICC), which produced values from 0.89 to 0.93 (95% CI) for the four movements. The final scores for each movement were determined by averaging the two assessors' ratings.

To ensure clarity and usability, the rubric was pilot-tested with 10 students who were not part of the primary sample group. Following this trial, minor adjustments to the wording were implemented prior to gathering the main set of data.

Table 1. Roundoff Back Handspring Movement

No.	Assessment Criteria	1	2	3	4	5
1	Warm-up (running & physical preparation)					
2	Roundoff technique (rotation & hand position)					
3	Transition to the back handspring					
4	Arm and leg push-off strength					
5	Body position during flight					
6	Landing (balance & control)					

Table 2. Front Handspring Movement

No.	Assessment Criteria	1	2	3	4	5
1	Start and approach					
2	Foot push-off					
3	Hand position during takeoff					
4	Body posture during flight					
5	Movement coordination					
6	Landing					

Table 3. Front Balance Movement

No.	Assessment Criteria	1	2	3	4	5
1	Starting position					
2	Body balance					
3	Core strength					
4	Precision of foot and hand positioning					
5	Movement stability					
6	Duration of maintaining the position					

Table 4. Shoulder Stand Movement

No.	Assessment Aspect	1	2	3	4	5
1	Starting position					
2	Body lift technique					
3	Foot position (straight and together)					
4	Balance					
5	Body control					
6	Holding the position					

2.3. Techniques for Collecting Data

Data gathering occurred in three phases: pretest, intervention, and posttest. Initially, every participant engaged in a pretest aimed at evaluating their foundational skills in floor gymnastics. The intervention spanned eight sessions lasting 90 minutes each, facilitated by the lead researcher. Both participant groups experienced identical instructional content in floor gymnastics and similar amounts of instructional time, which included training on RBH, FH, FB, and SS.

The Cooperative Learning group received organized, group-centered instruction, whereas the Direct Instruction group was guided through explanations, demonstrations, supervised practice, feedback, and individual exercises. Attendance and participation were tracked throughout the intervention, ensuring safety through warm-up exercises, the use of suitable gymnastics mats, oversight by the researcher, and a gradual approach to practice based on the students' abilities.

Following the intervention, every participant undertook a posttest, utilizing the same rubric for evaluating floor gymnastics skills. Each performance was assessed independently by two evaluators, comprising a lecturer and a gymnastics coach, according to specified technical standards for each movement. The final scores were averaged based on a predetermined scoring process for further statistical examination.

2.4. Data Analysis

The data from the pretest and posttest were analyzed using IBM SPSS Statistics version 26. Descriptive statistics for each group included calculations of the mean, standard deviation, and change scores (posttest results minus pretest results) for each floor gymnastics skill. Baseline disparities between the Cooperative Learning and Direct Instruction groups were assessed using the Mann–Whitney U test, with U, Z, and exact p values reported for each specific movement.

Due to the non-randomized allocation of groups, differences between them were evaluated utilizing change scores to reflect baseline performance. The Mann–Whitney U test was employed to compare change scores across the groups, while the Wilcoxon Signed-Rank test was utilized to investigate the differences within each group when comparing pretest and posttest scores. All statistical tests conducted were two-sided, with a significance threshold established at $\alpha = .05$.

Effect sizes were calculated to enhance the interpretation of statistical significance. For the Mann–Whitney U and Wilcoxon tests, the effect size was determined as $r = |Z|/\sqrt{N}$ and categorized as small (r = .10), moderate (r = .30), and large (r = .50). Gain-score descriptives and comprehensive baseline comparisons were also presented to give a clearer insight into the relative outcomes of Cooperative Learning and Direct Instruction.

3. RESULTS AND DISCUSSION

3.1. Result

This section presents the results of data analysis to determine the effect of cooperative learning and Direct Instruction strategies on improving the floor exercise skills of physical education students, including the Roundoff Back Handspring (RBH), Front Handspring (FH), Front Balance (FB), and Shoulder Stand (SS). In general, the results show an increase in scores from the pretest to the posttest in both groups. Based on the Shapiro-Wilk normality test, the data were not normally distributed ($p < 0.05$); therefore, the analysis proceeded using non-parametric tests: the Wilcoxon Signed Ranks Test to examine differences within groups and the Mann–Whitney U Test to test differences between groups. The results indicated a significant improvement and meaningful differences between the two learning strategies.

Table 5. Descriptive Statistics and Normality of the Cooperative Learning Group

Variable	N	Minimum	Maximum	Mean	SD	Median	IQR	Shapiro–Wilk p
Pre_RBH	40	11	15	12.5	1.132	12.5	2	<.001
Post_RBH	40	21	30	25.52	1.908	26	3	0.001
Pre_FH	40	6	12	10.55	2.264	11	3	<.001
Post_FH	40	21	27	24.95	1.176	25	2	<.001
Pre_FB	40	6	16	8.53	2.501	8	4	<.001

Post_FB	40	18	30	25.9	4.877	27	5	<.001
Pre_SS	40	6	15	10.23	3.068	10	5	<.001
Post_SS	40	24	30	26.73	2.32	27	3	<.001

Table 5 presents the results of descriptive statistical analysis and normality tests for the cooperative learning group comprising 40 students. Front Balance (FB), and Shoulder Stand (SS) showed a significant improvement from the pretest to the posttest. The mean RBH score increased from 12.50 (SD = 1.132) to 25.52 (SD = 1.908), FH from 10.55 (SD = 2.264) to 24.95 (SD = 1.176), FB from 8.53 (SD = 2.501) to 25.90 (SD = 4.877), and SS from 10.23 (SD = 3.068) to 26.73 (SD = 2.320). The results of the Shapiro-Wilk normality test showed that all data had a significance value < 0.05, indicating that the data were not normally distributed and required non-parametric analysis in the next stage.

Table 6. Descriptive and Normality Direct Instruction Group

Variable	N	Minimum	Maximum	Mean	SD	Median	IQR	Shapiro–Wilk p
Pre_RBH	40	10	15	12.05	1.284	12	2	0.002
Post_RBH	40	20	29	24.35	2.116	24.5	3	0.004
Pre_FH	40	6	13	9.9	1.845	10	3	0.001
Post_FH	40	20	28	24.05	1.693	24	2	0.003
Pre_FB	40	5	15	8.25	2.347	8	4	0.001
Post_FB	40	17	29	24.7	3.864	25	5	0.002
Pre_SS	40	6	14	9.75	2.781	10	4	0.001
Post_SS	40	22	30	25.4	2.547	26	4	0.005

Table 6 presents the descriptive statistics and normality test results for the Direct Instruction group, consisting of 40 students. All four floor gymnastics skills showed increases in mean scores following the intervention. The mean RBH score increased from 12.05 (SD = 1.284) to 24.35 (SD = 2.116), FH from 9.90 (SD = 1.845) to 24.05 (SD = 1.693), FB from 8.25 (SD = 2.347) to 24.70 (SD = 3.864), and SS from 9.75 (SD = 2.781) to 25.40 (SD = 2.547). The Shapiro–Wilk test showed $p < .05$ for all variables, indicating that the data were not normally distributed. Accordingly, non-parametric statistical procedures were used for subsequent analyses.

Table 7. Results of the Wilcoxon Test

Comparison	Z	p (2-tailed)	Effect size (r)
CL_RBH	−5.538	< .001	0.876
CL_FH	−5.533	< .001	0.875
CL_FB	−5.521	< .001	0.873
CL_SS	−5.517	< .001	0.872
DI_RBH	−5.484	< .001	0.867
DI_FH	−5.530	< .001	0.874
DI_FB	−5.347	< .001	0.845
DI_SS	−5.528	< .001	0.874

Description: CLRBH (cooperative learning RBH), CLFH (cooperative learning FH), CLFB (cooperative learning FB), CLSS (cooperative learning SS), DIRBH (Direct Instruction RBH), DIFH (Direct Instruction FH), DIFB (Direct Instruction FB), DISS (Direct Instruction SS). p values are two-sided. b = based on positive ranks/negative ranks as defined by the Wilcoxon Signed-Rank Test output; the direction reflects the coding of posttest and pretest scores. Effect size was calculated as $r=|Z|/N$, where N=40, and interpreted as small (0.10), moderate (0.30), and large (0.50).

Table 7 presents the results of the Wilcoxon Signed-Rank Test used to examine pretest–posttest differences within the Cooperative Learning and Direct Instruction groups. The results showed significant differences for all floor gymnastics skills in both groups, including RBH, FH, FB, and SS, with all two-sided p values < .001. The effect sizes were large across all comparisons (r = .845–.876). These findings indicate that students in both instructional groups demonstrated significant improvements in floor gymnastics skill scores from pretest to posttest. However, these within-group results do not by themselves establish that one instructional approach was more effective than the other; the relative outcomes of the two approaches were examined through the between-group comparison of change scores.

Table 8. Results of the Mann-Whitney U Test

Variable	Cooperative Learning Median (IQR)	Direct Instruction Median (IQR)	Mann–Whitney U	Z	p (2-tailed)	Effect size (r)
RBH	13.00 (2.00)	12.00 (3.00)	468.5	−2.314	0.021	0.26
FH	14.00 (2.00)	13.00 (3.00)	441	−2.682	0.007	0.3
FB	17.00 (5.00)	15.00 (4.00)	392.5	−3.218	0.001	0.36
SS	16.00 (4.00)	15.00 (5.00)	425	−2.857	0.004	0.32

Table 8 presents the results of the Mann–Whitney U test comparing change scores between the Cooperative Learning and Direct Instruction groups. The change scores were calculated as posttest minus pretest scores. The Cooperative Learning group showed higher median improvements than the Direct Instruction group for RBH (13.00 vs. 12.00), FH (14.00 vs. 13.00), FB (17.00 vs. 15.00), and SS (16.00 vs. 15.00). The between-group differences were statistically significant for RBH (U = 468.500, Z = −2.314, p = .021, r = .26), FH (U = 441.000, Z = −2.682, p = .007, r = .30), FB (U = 392.500, Z = −3.218, p = .001, r = .36), and SS (U = 425.000, Z = −2.857, p = .004, r = .32). The effect sizes ranged from small to moderate, indicating greater improvements in the Cooperative Learning group across the four floor gymnastics movements.

This study shows that both learning strategies cooperative learning and Direct Instruction significantly improve the floor exercise skills of physical education students. These results are supported by studies indicating that learning strategies in physical education, particularly the cooperative approach, positively contribute to improved learning outcomes in students' physical, cognitive, and social aspects, making them effective for developing movement skills comprehensively (Zach et al., 2023). This is evident from the increase in scores across all movement variables namely RBH, FH, FB, and SS from the pretest to the posttest. The results of the Wilcoxon test, showing a significance level of <0.05 for all variables, indicate that the observed changes are not due to chance but represent a genuine effect of the intervention. Additionally, the results of the Mann Whitney test also revealed significant differences between the two groups, suggesting that each strategy possesses distinct characteristics of effectiveness in enhancing students' motor skills. In line with these findings, the application of cooperative learning in physical education is capable of significantly improving motor skills and learning motivation, due to the interaction among students that allows for feedback and technical refinement (Yang et al., 2021).

Theoretically, these findings align with the concept of motor learning, which emphasizes the importance of repeated practice, feedback, and direct experience in improving motor skills. Effective motor learning is built through the principle of deliberate practice, which involves repeated, structured practice supported by continuous feedback to correct movement errors and gradually improve performance quality (Oppici et al., 2021). The Direct Instruction strategy offers advantages in terms of systematic material delivery, clear demonstrations, and step-by-step practice, enabling students to grasp foundational techniques in a more structured manner. On the other hand, cooperative learning provides students with opportunities to interact, discuss, and give each other feedback within groups, thereby reinforcing understanding and boosting confidence in performing movements. The combination of these two approaches indirectly supports the principle that effective learning occurs when cognitive, affective, and psychomotor aspects develop in a balanced manner.

The findings of this study are also supported by various previous studies showing that cooperative learning is effective in enhancing student engagement and motivation, particularly in physical activity-based learning. Other studies have also found that Direct Instruction is highly effective in improving basic technical skills because it provides clear and structured guidance. The Direct Instruction approach is considered effective because learners are able to understand concepts and master motor skills in accordance with the instructions provided by the educator (Ekatarani et al., 2025). However, previous studies have tended to examine these two strategies separately. In this context, this study makes an additional contribution by demonstrating that both strategies are equally effective but yield different dynamics of improvement, depending on the characteristics of the movements being learned.

The comparison indicates that the Cooperative Learning group demonstrated greater improvement in the overall floor gymnastics skill scores than the Direct Instruction group across the four assessed movements. However, the present study did not separately measure coordination, self-confidence, technical accuracy, or movement sequence; therefore, differences in these specific aspects cannot be interpreted as empirical findings. From a theoretical perspective, Cooperative Learning may support skill development through social interaction, peer feedback, and collaborative practice, whereas Direct Instruction emphasizes structured practice, modeling, and guided skill development. This distinction is consistent with research showing that cooperative learning enhances social interaction, communication, and conceptual understanding through group work, while Direct Instruction emphasizes structured practice, modeling, and gradual mastery of skills (Guzmán & Payá, 2020). Nevertheless, these theoretical differences should not be interpreted as evidence that Direct Instruction was superior for specific technical components in the present study. Rather, the findings suggest that the effectiveness of instructional strategies should be considered in relation to the overall learning outcomes, instructional objectives, and characteristics of the learning context.

The findings of this study, which demonstrate a significant effect of both learning strategies, underscore the importance of employing the appropriate approach in floor gymnastics instruction. The consistent significance levels across all variables indicate that the interventions administered were able to improve students' overall abilities, including technical skills, balance, and movement control. This also suggests that a systematically designed learning process that involves active student participation can yield optimal results in motor skill acquisition. In line with this, previous research has shown that cooperative learning in physical education significantly contributes to the improvement of motor skills and active student engagement, as the learning process is conducted through collaboration, individual responsibility, and structured social interaction (Zhou et al., 2023).

Nonetheless, this research has various limitations that must be recognized. Firstly, the intervention took place over a rather brief duration, which hinders the assessment of the long-term impacts of Cooperative Learning and Direct Instruction methods on students' gymnastics abilities. Secondly, the study utilized a quasi-experimental framework featuring purposive sampling and non-randomized group assignments based on ability, as opposed to random selection (Guzmán & Payá, 2020). As a result, initial differences between the groups might have affected the results, which should be factored in when analyzing the findings, posing a potential risk to internal validity. Thirdly, the participants were drawn from a single educational institution, potentially restricting the applicability of the findings to other learning environments and populations of students. It is therefore advisable for future research to utilize random group assignments whenever possible, to recruit participants from various institutions with a wider range of demographic characteristics, and to extend the duration of interventions to enhance both the internal and external validity of the results. These suggestions align with earlier research indicating that a broader and more diverse sample improves the representativeness and relevance of research findings.

The implications of this study are relevant both theoretically and practically. Theoretically, the findings support the view that different instructional approaches can contribute to the development of floor gymnastics skills, with the present study showing significant improvements in both the Cooperative Learning and Direct Instruction groups. Practically, the findings provide a reference for physical education instructors and teachers when selecting instructional strategies for floor gymnastics based on students' learning needs and instructional objectives. Although the

Cooperative Learning group demonstrated greater improvement in the assessed floor gymnastics skills, Direct Instruction also produced significant improvements and may therefore remain a useful instructional approach. The present study did not examine a combined or sequential application of the two approaches; therefore, integrating Cooperative Learning and Direct Instruction is proposed only as a direction for future research to determine whether such an instructional model can provide additional benefits for floor gymnastics learning outcomes.

CONCLUSION

This study concludes that both Cooperative Learning and Direct Instruction were associated with significant pretest–posttest improvements in physical education students' floor gymnastics skills, including RBH, FH, FB, and SS. The between-group analysis of change scores showed that the Cooperative Learning group demonstrated greater improvement than the Direct Instruction group across all four assessed movements, with small to moderate effect sizes. These findings indicate that Cooperative Learning was associated with greater observed improvement in the assessed floor gymnastics skills under the conditions of this quasi-experimental study. However, because participants were not randomly assigned and no untreated control group was included, the findings should not be interpreted as definitive evidence of causal treatment effectiveness. Future research should examine the longer-term effects of Cooperative Learning and Direct Instruction using randomized designs, different educational settings, and students with varying levels of gymnastics proficiency.

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