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Improving The Static Balance Ability Of Phase D Students Through Rope Bridge Games

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ABSTRACT

Static balance is one of the fundamental motor components that plays an important role in supporting students' movement efficiency, coordination, and participation in physical activities. However, preliminary observations at SMP Negeri 5 Banjarbaru indicated that many Phase D students experienced difficulties in maintaining body stability during physical education activities, reflecting low static balance ability. Therefore, innovative and engaging learning strategies are needed to enhance students' balance performance. This study aimed to determine the effectiveness of rope bridge games in improving the static balance ability of Phase D students. This research employed a quantitative approach using a Pre-Experimental method with a One Group Pretest–Posttest Design. The sample consisted of 27 students from class VII B of SMP Negeri 5 Banjarbaru selected through purposive sampling. Static balance ability was measured using the Stork Balance Stand Test. The intervention was implemented through rope bridge game activities integrated into physical education learning sessions. Data were analyzed using descriptive statistics and the Wilcoxon Signed Rank Test with a significance level of 0.05. The findings revealed a substantial improvement in students' static balance ability following the intervention. The mean pretest score increased from 8.22 seconds to 22.38 seconds in the posttest. Furthermore, the Wilcoxon test produced an Asymp. Sig. (2-tailed) value of 0.000, which was lower than 0.05, indicating a statistically significant difference between pretest and posttest results. These findings demonstrate that rope bridge games effectively stimulate postural control, body coordination, and balance maintenance. In conclusion, rope bridge games are an effective and enjoyable learning medium for improving the static balance ability of Phase D students and can be recommended as an innovative strategy in physical education learning.

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A. Conception and design of the study;
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INTRODUCTION

Education is fundamentally a deliberate effort to develop high-quality human resources through systematic learning experiences that foster cognitive, affective, and

psychomotor competencies. Within the educational system, Physical Education, Sports, and Health (PJOK) plays a strategic role in promoting students' holistic development by optimizing physical fitness, motor skills, social interaction, and healthy lifestyles (Bailey et al., 2023; Recky Ahmad Haffyandi et al., 2025). Through structured movement activities, physical education contributes significantly to the development of fundamental motor skills that become the foundation for lifelong physical activity participation.

One of the most essential components of motor development is balance. Balance refers to the ability to maintain the body's center of gravity within the base of support while performing static or dynamic movements (Maharani et al., 2025). It serves as a critical prerequisite for effective movement execution, postural control, coordination, and injury prevention. The neuromuscular system continuously regulates sensory information from the visual, vestibular, and proprioceptive systems to maintain balance and body stability (Granacher et al., 2023). Consequently, students with good balance abilities tend to demonstrate superior movement efficiency, better sports performance, and greater confidence in physical activities.

For adolescents in Phase D (equivalent to Grade VII Junior High School students), balance development is particularly important because this developmental stage is characterized by rapid growth and maturation of the musculoskeletal and nervous systems (Lopes et al., 2022). However, inadequate balance skills may negatively affect motor competence, physical activity participation, and overall movement quality. Furthermore, poor balance has been associated with increased risks of falls, sports injuries, and reduced engagement in physical education programs (Saragih et al., 2023).

Preliminary observations conducted by the researcher during PJOK learning activities at SMP Negeri 5 Banjarbaru revealed that many Phase D students exhibited low levels of static balance ability. This condition was evident when students were instructed to perform one-leg standing tasks, where numerous students demonstrated excessive body sway, instability, and inability to maintain postural control for prolonged periods. These findings indicate deficiencies in students' postural stability and neuromuscular coordination.

The problem is further exacerbated by the predominance of conventional teaching methods that rely heavily on repetitive drills and teacher-centered instruction. Such approaches often reduce students' motivation, engagement, and enthusiasm during learning activities (Singh et al., 2026). The lack of innovative learning media and game-based interventions specifically designed to improve balance abilities has also contributed to the suboptimal development of students' motor competencies. Therefore, alternative pedagogical strategies that are enjoyable, challenging, and capable of stimulating students' active participation are urgently needed.

Recent developments in physical education research have highlighted the effectiveness of game-based learning approaches in improving motor skills among school-aged children and adolescents. Contemporary pedagogical models emphasize student-centered learning environments that integrate physical challenges, problem-solving activities, and enjoyable movement experiences (Casey & MacPhail, 2018; Kirk, 2020).

Several studies have demonstrated that balance can be enhanced through various intervention programs, including balance board training, proprioceptive exercises, agility drills, obstacle courses, and functional movement activities (Granacher et al., 2023; Lesinski et al., 2020). For instance, Lesinski et al. (2020) reported that structured balance training significantly improved postural stability and motor control among children and adolescents. Similarly, Muehlbauer et al. (2021) found that balance-oriented exercises positively influenced neuromuscular adaptations and movement efficiency.

In the context of physical education, game-based activities have increasingly been recognized as effective tools for developing motor competence. Research by Munawarah and Batubara (2023) demonstrated that recreational games could increase students' motivation, participation, and physical performance. Likewise, Indah et al. (2020) emphasized that learning through play creates meaningful movement experiences while simultaneously promoting physical fitness and motor development.

Studies conducted in Indonesian educational settings have also shown positive outcomes of modified games in enhancing fundamental movement skills. Research by Pratama et al. (2022) found that traditional and modified games significantly improved balance and coordination among junior high school students. Similarly, Wibowo et al. (2023) reported that obstacle-based learning activities increased students' postural control and movement confidence.

The rope bridge game represents a modified physical activity that combines elements of balance, coordination, concentration, and body control. During this activity, students are required to walk carefully across a rope pathway while maintaining postural stability. Such movement challenges stimulate proprioceptive receptors, activate postural muscles, and enhance neuromuscular coordination (Behm et al., 2021). In addition, the game provides an enjoyable and engaging learning experience that aligns with contemporary physical education principles emphasizing active participation and meaningful learning. Despite growing evidence supporting game-based learning approaches, empirical investigations specifically examining rope bridge games as an intervention to improve static balance remain limited, particularly among Phase D students in Indonesian schools.

Although numerous studies have explored the relationship between physical activity and balance development, several important gaps remain evident in the literature. First, most previous studies have focused on structured balance exercises, proprioceptive training programs, or laboratory-based interventions (Lesinski et al., 2020; Granacher et al., 2023). Comparatively fewer studies have examined balance improvement through recreational and game-based learning activities implemented directly within school physical education contexts. Second, existing research predominantly investigates dynamic balance rather than static balance among junior high school students. Since static balance forms the fundamental basis for more complex motor skills, further investigation into effective strategies for enhancing this ability is warranted (Muehlbauer et al., 2021). Third, studies examining rope bridge games as a pedagogical intervention remain scarce, especially within Indonesian educational

environments. Most available research has investigated obstacle courses, balance beams, or traditional games, leaving the effectiveness of rope bridge activities insufficiently documented. Fourth, previous studies rarely integrate objective measurements of static balance improvements resulting from innovative PJOK learning interventions. Consequently, evidence regarding the magnitude of improvement generated by rope bridge games remains limited. Therefore, this study seeks to address these gaps by investigating the effectiveness of rope bridge games in improving static balance ability among Phase D students at SMP Negeri 5 Banjarbaru through a structured and measurable intervention.

The primary objective of this study is to determine whether the implementation of rope bridge games can significantly improve the static balance ability of Phase D students at SMP Negeri 5 Banjarbaru. This research offers several novelties. First, it introduces the rope bridge game as an innovative learning medium specifically designed to improve static balance within physical education settings. Second, it integrates a game-based learning approach with balance training principles, creating a more enjoyable and student-centered learning experience. Third, the study focuses specifically on Phase D students, a population that has received limited attention in previous balance-related research. Finally, this study provides empirical evidence regarding the effectiveness of rope bridge games in improving static balance performance through systematic measurement procedures. By addressing these aspects, the research contributes both theoretically and practically to the development of innovative PJOK learning strategies aimed at enhancing students' motor competence and physical literacy.

In summary, balance is a fundamental motor component that plays a crucial role in students' movement efficiency, physical activity participation, and injury prevention. Observations at SMP Negeri 5 Banjarbaru indicate that many Phase D students experience difficulties in maintaining static balance, partly due to conventional learning approaches that fail to stimulate active engagement. Although previous studies have demonstrated the benefits of balance training and game-based learning, empirical evidence regarding the effectiveness of rope bridge games remains limited. This study addresses this gap by examining whether rope bridge games can significantly improve static balance ability among Phase D students. The findings are expected to contribute to the advancement of innovative physical education practices and provide practical recommendations for enhancing motor skill development through enjoyable and meaningful learning experiences.

METHODS

This study employed a quantitative research approach using a pre-experimental method with a One-Group Pretest–Posttest Design. This design was selected to evaluate the effectiveness of rope bridge game interventions in improving the static balance ability of Phase D students through comparisons between measurements obtained before and after treatment. According to Sugiyono (2013), the One-Group Pretest–Posttest Design allows researchers to determine the magnitude of change resulting from

a specific intervention by comparing pre-intervention and post-intervention outcomes within the same group. Although this design does not involve a control group, it remains widely utilized in educational and sports science research to assess the effectiveness of innovative learning models and physical training programs (Saputra et al., 2017; Creswell & Creswell, 2023).

The research design can be illustrated as follows:

$$O_1 \rightarrow X \rightarrow O_2$$

The study was conducted at SMP Negeri 5 Banjarbaru, Indonesia. The population consisted of all students enrolled in Grade VII B during the 2025/2026 academic year. A total of 27 students participated in the study and were selected through purposive sampling based on predetermined criteria, including active participation in Physical Education classes, regular attendance, and willingness to engage in all intervention sessions. Purposive sampling is considered appropriate when researchers aim to select participants who possess characteristics relevant to the research objectives (Etikan & Bala, 2017).

The intervention program was implemented over a two-week period with a frequency of four instructional sessions conducted on the school sports field. Previous studies in physical education settings have demonstrated that four-session intervention programs can produce measurable improvements in students' motor skills and movement performance (Ardiansyah & Hartati, 2014; Hidayat & Darmawan, 2019; Anggraini & Darmawan, 2019). During each session, students participated in structured rope bridge game activities designed to challenge postural control, proprioceptive awareness, concentration, and neuromuscular coordination. The rope bridge game required participants to walk along a rope pathway while maintaining body stability and controlling their center of gravity. Such activities stimulate the vestibular, visual, and proprioceptive systems, which collectively contribute to balance regulation and motor control (Granacher et al., 2023; Behm et al., 2021).

Data collection was conducted using the Stork Balance Stand Test, one of the most widely recognized and reliable assessments for measuring static balance performance among children and adolescents (Muehlbauer et al., 2021; Lesinski et al., 2020). In this test, participants stood on their dominant foot while placing the opposite foot against the inside of the supporting knee and positioning their hands on their hips. The duration for which participants could maintain the position without losing balance was measured using a digital stopwatch and recorded in seconds. The Stork Balance Stand Test has demonstrated acceptable validity and reliability for evaluating postural stability in educational and sports settings (Granacher et al., 2023).

Data analysis was performed using IBM SPSS Statistics software. Descriptive statistics were initially calculated to determine mean scores, standard deviations, minimum values, and maximum values. Before hypothesis testing, assumption tests were conducted, including normality testing using the Shapiro-Wilk test and homogeneity testing using Levene's test. If the data met the assumptions of normality and homogeneity, a paired-samples t-test was employed to determine significant differences between pretest and posttest scores. Statistical significance was

established at α = 0.05 (Field, 2022). This analytical procedure has been widely recommended for pretest-posttest studies investigating the effectiveness of educational and motor skill interventions (Cohen et al., 2018; Creswell & Creswell, 2023).

RESULTS AND DISCUSSION

Result

The results of observations before being given treatment of observation data obtained in the field based on the aspects observed, the results can be seen in the following table

Table 1.
Overall pretest and posttest data

NO	*PRETEST*	CATEGORIES	*POSTTEST*	CATEGORIES
1	10,47	Less	25,23	Medium
2	05,33	Less	17,32	Medium
3	05,23	Less	14,88	Medium
4	02,46	Less Than Once	10,45	Medium
5	03,21	Less Than Once	11,24	Medium
6	07,32	Less	15,89	Medium
7	06,11	Less	27,32	Medium
8	05,23	Less	14,84	Medium
9	06,80	Less	17,11	Medium
10	10,19	Less	25,11	Good
11	12,34	Less	22,03	Medium
12	17,57	Medium	40,45	Very good
13	04,89	Less Than Once	16,53	Medium
14	06,59	Less	18,11	Medium
15	20,15	Medium	30,33	Very good
16	16,03	Medium	37,55	Very good
17	03,80	Less Than Once	16,23	Medium
18	08,31	Medium	38,34	Good
19	07,34	Less	39,67	Good
20	07,11	Less	20,48	Medium
21	10,80	Less	28,28	Medium
22	06,42	Less	23,52	Medium
23	07,22	Less	38,23	Good
24	09,11	Less	18,71	Medium
25	06,37	Less	16,77	Medium
26	03,75	Less Than Once	09,33	Medium
27	02,51	Less Than Once	10,42	Medium

N		Median	Mode	Red	SD	Range
27	Pretest	6,8	5,23	8,22	4,712	17,69
27	Posttest	18,71	22,38	22,38	9,482	31,12

Based on Table 1 above the recapitulation of the observation of static balance ability of SMP Negeri 5 Banjarbaru students before and after being treated from 27 students who were the subjects of the study, it can be seen that before being given treatment on the aspect of balance in the static balance ability test of 27 students, there were 6 students in the category Less than once, there were 17 students in the less category, 4 students in the medium category. In addition, after the intervention, the

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balance abilities of the 27 learners improved: 20 increased to a moderate level, 4 to a good level, and 3 to an excellent level.

Descriptive statistics for pre-test showed a minimum score of 2.46, a maximum of 20.15, an average of 6.8, a median of 8.222, a mode of 5.23, a standard deviation of 4.712, and a range of 17.69. For the post-test, the score ranged from a low of 9.33 to a high of 40.45, with an average of 22.38, a median of 18.71, a mode of 22.38, a standard deviation of 9.482, and a range of 31.12. Thus, judging from the results of recapitulation before and after treatment, there was a difference and improvement in phase D balance ability in SMP Negeri 5 Banjarbaru students.

Table 2.
Shapiro Wilk Test Results

	Statistic.	df	Sig.
Posttest	0,904	27	0,017
Pretest	0,872	27	0,003

Based on Table 2 above, the results of the data normality test obtained with a Sig value can be seen that the pretest and posttest values are below 0.05 so that the data is distributed abnormally. Therefore, it was immediately continued to the non-parametric test using the wilcoxon test. To find out whether or not there is a significant effect of the rope bridge game on improving the balance ability of Phase D of SMP Negeri 5 Banjarbaru students.

Table 3.
Results of the Levene Statistical Test

Living Statistic			df1	df2	sig.
Score	Basen on Mean	13.656	1	52	.001
	Basen on Mean	8.388	1	52	.006

Based on Table 3 above, it can be seen that the results of the homogeneity test with a significance value (Sig.), namely Based on the Average of 0.001 and Based on the Median of 0.006. The results showed significance levels of 0.001 and 0.006, both below the 0.05 limit. Therefore, we conclude that the variation in students' static balance scores between pre-test and post-test is not uniform. This lack of homogeneity, along with normality tests showing non-normal distributions, supported the researchers' decision to use a non-parametric method in particular, the Wilcoxon Marked Rank Test for hypothesis testing.

Table 4.
Wilcoxon Test Rank Results

Remarks	N	Mean Rank	Sum Of Ranks
Negative Ranks (Posttest-Pretest)	0	0,00	0,00
Positive Ranks (Posttest-Pretest)	27	14,00	378,00
Ties (Posttest=Pretest)	0	0,00	0,00
Total	**27**		

Based on table 4 of the results of the Wilcoxon test, it is known that as many as 27 students are on Positive Ranks, there are no Negative Ranks or Ties. This shows that all students experienced an increase in static balance scores after being treated in the form of rope bridge games.

Table 5. Wilcoxon Test Results

Variable	N	Z Count	Asymp.Sig. (2-tailed)	Remarks
Static Balance Pretest	27	-4,526	0,00	Significant

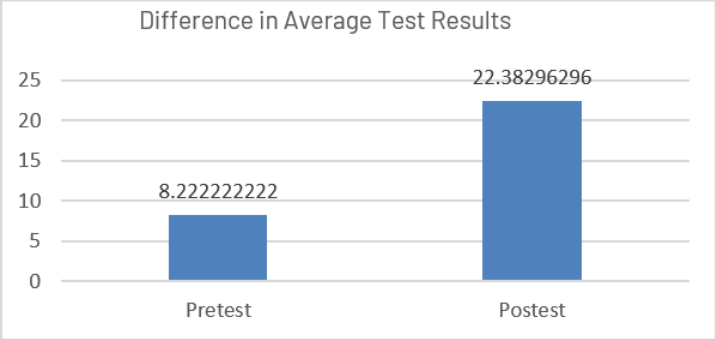

Figure 1.
Graph of the average difference in test results

According to Table 5, the Wilcoxon Marked Rating Test yields an Asymptomatic (2-tailed) Significance <0.001. Since this number is lower than the α level of 0.05 (p<0.05), we can conclude that there is a significant difference between Pretest and Posttest scores. This conclusion was reinforced by 27 positive ratings, which showed a significant improvement in scores after the intervention. Since the p-value is 0.000, which is well below 0.05, an alternative hypothesis (H_a) is supported. As a result, the hypothesis is accepted.

Discussion

The results showed that rope bridge exercises significantly improved students' static balance, which was reflected in the increase in average scores from 8.22 before the intervention to 22.38 afterwards, with differences that reached statistical significance. This shows that activities that involve balance are directly able to provide stimulus to the neuromuscular system thereby increasing the body's ability to maintain stability. Theoretically, this improvement in balance can be explained through neuromuscular adaptation mechanisms. The activity of walking on a rope demands the integration of the sensory system (visual, vestibular and proprioceptive) with muscle coordination, thus strengthening the control of the body's center of gravity. This is in line with the theory of balance which states that the ability to maintain body stability is the result of complex coordination between the nervous system and muscles (O'Sullivan in Irfan et al. 2012). Thus, the results of this study reinforce that balance challenge-based exercises can directly increase the efficiency of students' motion control systems.

In addition to the physical aspect, the approach to the game has a positive psychological impact. The use of rope bridge games shows that a game-based approach is more effective than conventional methods in increasing student engagement. The data on the improvement that occurred not only reflected the results of physical exercise, but also showed an increase in student motivation and participation during learning. This is in line with the game-based learning theory, which states that fun activities increase engagement and improve the learning process (Mahfud et al. 2020).

Thus, the significance of these findings is that the success of motor learning is not only determined by the type of exercise, but also by how the activity is attractively packaged.

From the psychological aspect, the game approach has been proven to be able to increase students' motivation to learn, because the activities carried out are fun and not monotonous. Students become more active, confident, and dare to try, which ultimately has a positive impact on learning outcomes (Susanto et al. 2017). According to Gallahue & Ozmun, it is said that challenging activities like this will help students develop body control and body awareness. So that while performing this game, students learn how to manage balance while in an unstable position, which is an important skill in various sports activities (Setiawan et al. 2025).

The rope bridge game is a learning medium where the use of this game is oriented to hone students' stability through a creative approach. This activity provides challenges in the form of walking on narrow planes, so students must control their body position optimally. This condition forces the nervous and muscular systems to work more effectively in maintaining balance. In addition, this activity also increases body awareness and movement coordination (Putri et al. 2024). The results of this study are consistent with previous studies that showed that traditional games such as engklek and estil can improve static balance(Agus, I. N., Adi, N., Pramita, I., Putu, L., & Vitalistyawati et al. 2022). Thus, this study fills a gap in the literature related to the variety of balance learning media, especially in the use of simple tools that are easy to implement in schools.

Rope bridge games can be used as an alternative learning medium that not only improves balance skills, but also encourages students' confidence, cooperation, and social engagement. In addition, the use of simple media such as ropes makes this method easy to apply in various school conditions, including those with limited facilities. Thus, the contribution of this research is not only academic, but also applicable in the context of learning in the field. These findings are consistent with previous research that states that the use of assistive devices and traditional games is effective in improving gross motor skills (Mahfud & Yuliandra et al. 2020).

CONCLUSION

Based on the results of the study, the application of the rope bridge game has been proven to significantly increase the static balance ability of SMP Negeri 5 Banjarbaru students. Thus, the purpose of the study to determine the effect of rope bridge games on static balance has been achieved, and the formulation of the problem is answered that rope bridge games are able to improve students' static balance abilities. Practically, these findings show that the rope bridge game can be used as an alternative to an effective, interesting, and fun PJOK learning method in developing motor skills, especially balance.

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