



Implementing Big Ball Games to Enhance Coordination in 11–12-Year-Old Students: A Gender-Based Analysis

Aziza Puspawati Safitri^{1ABCD}, Erwin Setyo Kriswanto^{1ABD},
Aris Fajar Pambudi^{1BDE} and Trisnar Adi Prabowo^{2ABCDE}

¹Universitas Negeri Yogyakarta

²Universitas Muhammadiyah Brebes

Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

Corresponding Author: Aziza Puspawati Safitri, e-mail: azizapuspadewi.2024@student.uny.ac.id

Accepted for Publication: November 14, 2025

Published: November 30, 2025

DOI: 10.17309/tmfv.2025.6.11

Abstract

Background. The development of coordination during childhood, particularly between the ages of 11 and 12, plays a critical role in overall well-being and long-term physical development. Big ball games have been recognized as an effective medium to improve coordination. However, these games often emphasize basic technical skills, with limited scientific evidence exploring whether gender moderates the effect of big ball games on coordination outcomes.

Objectives. This study's primary objective was to evaluate the impact of big ball games on coordination development in 11–12-year-old students, with consideration of gender differences.

Materials and Methods. A quasi-experimental research design with a pretest–posttest approach was employed. Participants included 40 students: 20 male students (age: 11.5 ± 0.3 years; height: 148.9 ± 3.0 cm; weight: 44.6 ± 2.5 kg), and 20 female students (age: 11.4 ± 0.2 years; height: 145.7 ± 1.3 cm; weight: 40.0 ± 1.1 kg). Samples with known initial pretest scores were divided using ordinal pairing with the A-B-B-A formula and then grouped into the experimental group (EG) and the control group (CG). The intervention consisted of five big ball game models delivered over six weeks (18 sessions), with three sessions per week held from 7:00 to 9:00 AM. Intensity monitoring for this game was 65% - 75% or rating of perceived exertion (RPE) at level 12 - 14 (moderate). Coordination was assessed using the Alternate Hand Wall Toss Test (AHWT), a validated tool for evaluating hand-eye coordination. Data were analyzed using MANOVA via SPSS version 26.

Results. MANOVA analysis showed a significant effect between gender ($p < 0.05$) and EG ($p < 0.05$) on coordination. Meanwhile, interaction between the two did not determine a substantial effect multivariately ($p > 0.05$). The results of the Univariate Test revealed that gender had a significant influence on the improvement of coordination ($F = 85.652$, $p < 0.001$, $\eta^2_p = 0.704$), which shows that 70.4% of the variation in coordination enhancement is explained by gender differences. Subsequently, based on the treatment (EG and CG) on student coordination ($F = 147.366$, $p < 0.001$, $\eta^2_p = 0.804$), it was demonstrated that 80.4% of the variation in coordination is explained by differences in treatment. Between-Subjects Effect Test indicated that in pretest stage there was no difference in coordination between EG and CG ($p = 0.600$), while in posttest stage there was a significant difference ($p = 0.000$). In addition, a marked interaction was found between gender and group in posttest stage ($p = 0.048$).

Conclusions. The structured, engaging, and consistent application of big ball games significantly enhances coordination in children aged 11–12 years, with pronounced effects in the experimental groups. These findings underscore the influence of physiological and psychological factors on coordination development, highlighting gender-based differences in responsiveness to physical activity interventions. Therefore, physical education programs should adopt inclusive game-based approaches that consider gender-specific needs to maximize coordination development in all students.

Keywords: children's games, children's motor coordination, big ball games, 11–12-year-old children.

Introduction

Coordination is a physical component that needs to be developed for children aged 11–12 years. In this age range, children's motor coordination undergoes essential developments that will affect their physical and cognitive abilities in the future (Çakit et al., 2022). Good coordination is vital for a variety of daily activities and is critical in academic, social, and sports activities (Tanineh & Halaweh, 2023). Understanding the factors that can improve coordination at this age is key to helping them reach their full potential in various aspects of life.

Factors that affect coordination in children aged 11–12 years, based on the results of previous research studies, include physical growth, specifically anthropometry, which is often unbalanced, the development of gross and fine motor skills, and genetic factors, all of which affect children's motor skills (Sabău et al., 2023; Putro et al., 2025). Prior physical experience and environmental support, including regular opportunities to participate in physical activities such as sports clubs or extracurricular sports at school, also play an essential role (Sobko et al., 2021; Yin et al., 2023). Good coordination at this age provides broad benefits, ranging from increasing efficiency and safety in physical activities to developing academic skills such as writing, enhancing social interaction, and improving children's self-confidence (Aguayo et al., 2022). Therefore, understanding and supporting the development of coordination at an early age can significantly impact a child's overall well-being and future growth.

Some methods to improve coordination in one child include playing games that involve a ball (Ramli et al., 2023; Hikmawati et al., 2023). To date, no study has examined the coordination in children during big ball games, particularly at the age of 11–12 years. Big ball games can utilize various sports, such as football, basketball, and volleyball (Dewi, 2023). Based on the results of previous studies, basketball games can affect physical ability and fitness, particularly in terms of coordination among elementary school children (Mitova et al., 2022; Glišović, 2022). Then, basic technique training methods in soccer and basic techniques in volleyball can affect coordination movements at the ages of 10–15 years (Marchenko & Dykhanova, 2019; Mikail & Suharjana, 2019). However, the study's results indicate that the method employed utilizes only one type of game, featuring a big ball, and is tailored specifically to the basic techniques of the sport.

However, a problem that has not been extensively studied is the extent to which gender influences the impact of big ball games on motor coordination in children aged 11–12 years. Previous studies have often overlooked this gender dimension, even though physical and psychological differences between male and female at this age can significantly impact the results obtained from certain types of physical training. Thus, this study will build upon the results of previous studies to analyze and discuss details related to gender. According to the results of previous studies, traditional games and circuit games are effective in reducing manipulative movements in children aged 9–12 years, regardless of gender (Santoso et al., 2024; Kuspratiwi et al., 2025). Therefore, it is important to examine more deeply how gender can moderate the effectiveness of big ball games in developing coordination.

The purpose of this study is to investigate the impact of big ball games on the coordination of students aged 11–12 years, taking into account gender variables. This study aims to provide scientific evidence that physical educators can use in designing more efficient and effective exercise programs tailored to specific gender needs. Thus, the results of this study are expected to contribute to the physical education literature and enhance the quality of teaching coordination and physical activity in children, thereby benefiting them not only in physical activity but also in other aspects of learning and social interaction.

Materials and Methods

Study Participants

The population of this study consisted of elementary schools in the city of Yogyakarta, Indonesia. The elementary schools involved were Sorobayan Elementary School and Bantul Timur Elementary School, all of which had 5th and 6th-grade students aged 11–12 years. Selection of samples was offered voluntarily to students, provided that they were physically and mentally healthy, not experiencing any illness or injury and were willing to attend at least 80% of the intervention sessions. The ethical aspects of the study were fully adhered to. This research was approved by the institutional ethics committee (B/1468/UN34.16/PT.01.02/2025), and written informed consent was obtained from the school principals, physical education teachers, and the parents/guardians of all participants. Before giving consent, all participants and their parents/guardians were provided with complete information regarding the study's objectives, procedures, potential risks, and participant rights, including the right to withdraw at any time.

So that the number of students willing to be a sample is 40 students (20 male and 20 female students), with 20 students per school. The characteristics of the students in the male group (mean±SD) are as follows: age, 11.5±0.3 years; height, 148.9±3.0 cm; and body weight, 44.6±2.5 kg, and in 20 female students, aged 11.4±0.2 years, with a height of 145.7±1.3 centimeters and a body weight of 40±1.1 kilograms. Then, the 40 students were divided into four groups: 1) 10 male students in the experimental group, 2) 10 female students in the experimental group, 3) 10 male students in the control group, and 4) 10 female students in the control group.

Study Organization

This study employed a quasi-experimental design with a pretest–posttest approach. The research flow, designed for clarity and ease of understanding, is illustrated in detail in Figure 1.

The study was conducted in seven stages. The first stage involved a document analysis based on previous research findings, using keywords such as big ball games, coordination, and children aged 11–12 years, to identify the research problem and establish novelty in this field. The second stage consisted of observing elementary school students during physical education classes, with the approval of the school principal. This observation was followed by tracking the learning process, particularly among 5th-

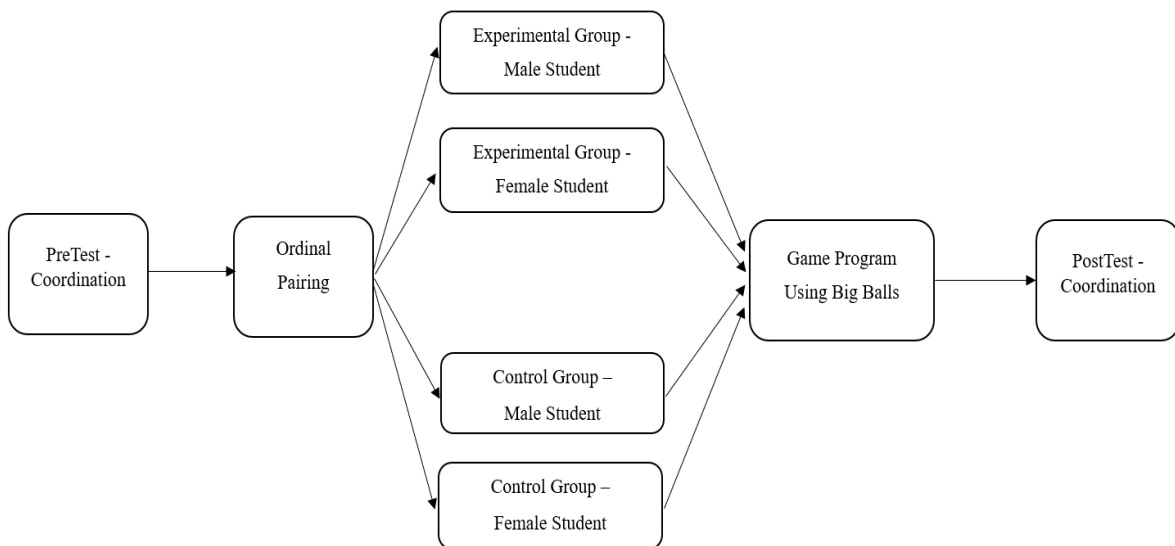


Fig. 1. Research framework referring to stage four - stage six

and 6th-grade students aged 11–12 years. The third stage included the preparation of a big ball game program and its validation to ensure the program's feasibility for training students.

The fourth stage involved the collection of baseline data through a pretest using the Alternative Hand Wall Toss Test (AHWT) with the 40 student participants. Once the pretest results were obtained, the experimental group (EG) and control group (CG) were determined using the ordinal pairing technique A-B-B-A, as shown in Figure 1 (Rusli et al., 2024). This counterbalancing method aimed to ensure balanced distribution of students' initial characteristics across experimental and control groups, as well as across genders. The process was carried out by ranking students' pretest scores from highest to lowest, then sequentially assigning them to groups as follows: the first-ranked student entered Group A (experimental), the second-ranked student entered Group B (control), the third-ranked student entered Group B (control), and the fourth-ranked student entered Group A (experimental), and so on until all students were distributed. This method ensured that both groups (experimental and control) included students with both high and low levels of coordination, for both male and female students.

The fifth stage consisted of the intervention, delivered over six weeks with three sessions per week, totaling 18 sessions. During this period, the experimental group received interventions using five validated big ball game models designed to enhance coordination, while the control group engaged in free play activities that did not specifically target coordination. The sixth stage involved the collection of post-intervention data through a posttest using the AHWT, administered after the students had completed the intervention. The seventh stage encompassed data analysis, reporting of findings, and revision of the article until it was ready for publication.

The research instrument adapted a coordination test, namely the Alternative Hand Wall Toss Test (AHWT), which has been proven reliable and valid for evaluating the coordination skills of students aged 11–12 years (Cho et al.,

2020; Çakit et al., 2022). AHWT is performed by throwing the ball towards a wall that is 2-meter away, with a minimum height of 2-meter using 1 hand and catching it using 2 hands for 30 seconds. The equipment consists of tennis balls, duct tape, wall with a flat surface, whistle, stopwatch, forms and stationery. The implementation procedure is as follows: 1) students with the ball in their hands stand on the throwing boundary line at a distance of 2-meter from the wall, 2) students throw (over head pass) the ball to the wall using 1 hand when the whistle sounds, the target of the throw is as high as the boundary that has been made, 3) students then catch it using 2 hands, 4) students do the test for 30 seconds, and the end is marked by the sound of the whistle. AHWT examiners during pretest and posttest were assessed directly by research team, not by the physical education teacher from the student's school, this aim was to maintain the transparency of test results.

Big Ball Games Program

This game program was developed based on the results of previous research studies (Hikmawati et al., 2023; Mikalonytė et al., 2022). Then the researchers developed it again with the aim of producing an original game model. For this game program to run effectively, specific equipment was required. The equipment consisted of: 1) a ball, 2) a cone, 3) a jump square, 4) a mini-goal, 5) a basket or basketball hoop, 6) a marking line, 7) a whistle, 8) a mini-goal. In addition to some supporting equipment, such as health box components for first aid in case of accidents, stationery, chalk, and a stopwatch. After the equipment was prepared, the following game models were available, each representing one of the five models.

The first game started by dividing students into three groups. Each group marched against the other. The first student from Group 1 performed an overhead pass to the first student from Group 2. After throwing the ball, the student ran and moved to Group 2. Next, the first student from Group 2 performed a bounce pass with one hand to the

first student from Group 3, then ran and moved to the Group 3 area. Next, the first student from Group 3 performed a two-handed bounce pass to the leading student in Group 1, then moved to join Group 1. This exercise pattern was carried out alternately and continuously until the teacher felt that training was enough.

The second game involved students running while carrying the ball, then jumping over the jump plots that the teacher had prepared. After successfully passing the jump plot, students continued to run and jump over the safe goal, then stopped at the designated place. Next, the student attempted to put the ball into the provided basket. If it failed, the experiment was repeated until the ball successfully entered the basket. After that, the students ran back to the line and continued with the next student in line. To make the game more interesting and challenging, it could be played in the form of competitions between groups.

The third game began by dividing the students into two large groups that faced each other at a distance of approximately two meters. Each member of one of the groups held a ball. The teacher then gave two codes: the correct code and the wrong code. If the teacher provided the wrong code, the student must follow the opposite instruction. Students were asked to follow the teacher's instructions, such as jumping forward or throwing a ball, as indicated by the provided code. This game trains concentration, reaction speed, and coordination between body movements, as well as understanding instructions.

The fourth game began by dividing students into three large groups. Each student in the group ran a zig-zag through the obstacles that the teacher had compiled while carrying the ball. After completing the zig-zag trajectory, students quickly ran to the provided cone, circled it, and then ran back to the predetermined line, which was approximately two meters from the colleague lined up behind them. After arriving at the line, the student threw the ball to his partner in the line, who then performed the same sequence of activities. This game was played until all students had a turn, and it could be made into a competition to increase students' enthusiasm.

The Fifth Game was conducted by dividing the students into three large groups. The first person from each group ran towards the cone, then circled the cone, and continued running until the limit set by the teacher. After that, the student must put the ball into the goal by kicking it; if it fails, the experiment is repeated until it succeeds. After succeeding, the student retrieved the ball that had been kicked and returned it to its original place, then ran to clap the next friend's hand as a turn signal. This game was played in turns, allowing all group members to participate.

This game program was held over six weeks, consisting of 18 meetings, with three sessions every week on Mondays, Wednesdays, and Fridays. Student attendance is monitored directly at the beginning and end of each meeting. The implementation time was from 7:00 am to 9:00 am, with 1 hour allocated for play and 1 hour used for warm-up, cooling, and evaluation at the end of the meeting. The implementation of the game in one meeting involved two models that will alternate in each subsequent meeting. The time allocated for each game model is 25 minutes, with a 10-minute rest between games.

The intensity of each session was set between 65% - 75% to ensure students enjoyed their time and fitness, while

avoiding stress and fatigue. Heart rate intensity monitoring, based on the rating of perceived exertion (RPE) with a moderate target (12–14) (Chowdhury et al., 2019). This monitoring was recorded every 10–15 minutes during the main training session during a major ball game and summarized per session. Progression rules for each model of the big ball game included adding targets, widening the distance, or increasing the number of participants. However, these progression rules adhered to maximum and minimum intensity limits. Close supervision by the research team and each physical education teacher was also implemented to avoid accidents and minimize conflicts during play.

Validity of the Big Ball Games Program and Coordination Test

The Big Ball Games program and the coordination test using the Alternative Hand Wall Toss Test (AHWT) required validation to ensure their feasibility, credibility, and ability to produce reliable and significant research findings. The validation of both the program and the test instrument was calculated using Aiken's V formula (Aiken, 1985):

$$V \text{ Aiken's: } \frac{\sum S}{n(c-1)}$$

- S : r - lo
- Lo : lowest rating score
- C : highest rating score
- r : the score given by the assessor

The validation process involved six physical education teachers from the participating elementary schools. A 4-point rating scale was applied, and five assessment statements were evaluated based on a literature review and the research context. The validation results are presented in Table 1.

Table 1. Validation results of training programs and coordination instrument

	Assessment aspects	ΣS	n(c-1)	Aiken V
Big Ball Games Program				
1	Game models using big balls	15	18	0.833
2	Fun and varied game models	17		0.944
3	Safe game models	15		0.833
4	Easy-to-understand game procedures	16		0.889
5	Systematic and measurable game programs (training dosages)	15		0.833
Alternative Hand Wall Toss Tes (AHWT)				
1	Capable of measuring coordination skills	17	18	0.944
2	Suitability of coordination tests for children aged 11-12 years	15		0.833
3	Produces objective test scores	16		0.889
4	Adequate test security	15		0.833
5	Easy-to-understand test procedures	15		0.833

Based on Table 1, the validation results of the Big Ball Games program across all aspects, use of big balls, fun and

varied models, safety, ease of understanding, and systematic structure with measurable dosage, showed Aiken's V values greater than 0.8. Similarly, the AHWT validation also showed Aiken's $V > 0.8$ for all assessed aspects, including measurement of coordination skills, suitability for children aged 11–12 years, objectivity of test scores, safety, and procedural clarity. Therefore, with all Aiken's V values exceeding 0.8, the program and test instrument can be considered to have a high level of validity and are deemed appropriate for use in children aged 11–12 years (Wedi et al., 2024; Putro et al., 2025).

Statistical Analysis

Analysis of this research, the first stage carried out was to display descriptive statistics to analyze the pretest-posttest values in each group. The second stage involved a normality test to analyze whether the data had a normal distribution, with a significance value of $p > 0.05$. Then, the third stage involved hypothesis testing using MANOVA (Multivariate Analysis of Variance). MANOVA results can analyze gender differences, group differences, and gender-group interactions based on pre-test and post-test scores. MANOVA can examine model variation in coordination tests. Then, further testing through effect size using partial eta squared and the results of pairwise comparisons to analyze how gender and group differences affect the results of the coordination test. Analysis of the research data was conducted using SPSS version 26 software (George & Mallery, 2019).

Results

The first research report is a descriptive analysis based on the scores from the coordination pretest and posttest by student gender. These scores represent the number of repetitions of the coordination test, indicating the minimum and maximum scores. The following is a descriptive table of the results of this study.

Based on the descriptive results in table 2, mean EG-pretest for male was 13.30 and mean EG-posttest for male was 20.80 with a difference of 7 repetitions. Then, mean CG-pretest for male was 13.20 and mean EG-posttest for male was 14.90 with a difference of 1 repetition. Meanwhile, mean EG-pretest for female was 10.70 and mean EG-posttest for female was 16.10 with a difference of 6 repetitions. Then,

mean CG-pretest for female was 11.20 and mean CG-posttest for female was 11.90.

After the research results were reported based on pretest and posttest values, followed by the second analysis, which included a normality test and homogeneity test. However, to keep the tables in this study concise and easy to understand, the researchers combined the normality test results with the descriptive results in Table 2. In this study, the normality test used was the Shapiro-Wilk test because the sample size was 10 students in each group. Based on the results in Table 2, the significance value from the Shapiro-Wilk test is sig. > 0.05 , so the research data is usually distributed (Bernadett & Csaba, 2024).

After the normality test, a homogeneity test was performed to assess whether two or more data groups had equal variance. The results of the homogeneity test are shown in Table 3 below.

Table 3. The results of the homogeneity test in this study

		Levene Statistic	df1	df2	Sig.
Pretest on	Based on Mean	1.168	3	36	0.335
Coordination	Based on Median	1.064	3	36	0.376
Posttest on	Based on Mean	0.189	3	36	0.903
Coordination	Based on Median	0.134	3	36	0.939

Based on the results of Table 3, the homogeneity value refers to the average value of each pretest and posttest. The pretest on coordination shows a sig. $0.335 > 0.05$, and the posttest on coordination shows a sig. $0.903 > 0.05$, indicating that all samples involved in this study come from the same population.

After the data were assumed to be normally distributed and homogeneous, MANOVA was used to analyze the results from the students in the big ball game group and the control group. The following are the results of the MANOVA test.

Based on the results of table 4 referring to Wilks' Lambda, the effect shown on gender is sig. $0.000 < 0.05$ ($F = 56.646$) so there is a difference in coordination ability based on gender. The effect shown on the group is $0.000 < 0.05$ ($F = 72.383$) so the big ball game significantly improves student coordination compared to the control group. The effect shown on Gender*Group is sig. $0.120 < 0.05$ ($F = 2.252$) so there is no significant interaction between gender and group.

Table 2. Descriptive results and normality of coordination test

	Descriptive Statistics					Shapiro-Wilk		
	N	Minimum	Maximum	Mean	Std. Deviation	Statistics	df	Sig.
EG-pretest pria	10	12	15	13,30	0,949	0.911	10	0.287
EG-posttest pria	10	19	23	20,80	1,317	0.942	10	0.575
CG-pretest pria	10	11	16	13,20	1,476	0.918	10	0.337
CG-posstest pria	10	13	17	14,90	1,197	0.952	10	0.691
EG-pretest wanita	10	9	12	10,70	0,949	0.911	10	0.287
EG-posttest wanita	10	14	19	16,10	1,524	0.929	10	0.441
CG-pretest wanita	10	9	13	11,20	1,317	0.942	10	0.575
CG-posstest wanita	10	10	14	11,90	1,197	0.952	10	0.691

Table 4. Multivariate Test Results on the Big Ball Game Program

	Effect	Value	F	Sig.
Intercept	Pillai's Trace	0.996	4580.984 ^b	0.000
	Wilks' Lambda	0.004	4580.984 ^b	
	Hotelling's Trace	261.771	4580.984 ^b	
	Roy's Largest Root	261.771	4580.984 ^b	
Gender	Pillai's Trace	0.764	56.646 ^b	0.000
	Wilks' Lambda	0.236	56.646 ^b	
	Hotelling's Trace	3.237	56.646 ^b	
	Roy's Largest Root	3.237	56.646 ^b	
Group	Pillai's Trace	0.805	72.383 ^b	0.000
	Wilks' Lambda	0.195	72.383 ^b	
	Hotelling's Trace	4.136	72.383 ^b	
	Roy's Largest Root	4.136	72.383 ^b	
Gender*Group	Pillai's Trace	0.114	2.252 ^b	0.120
	Wilks' Lambda	0.886	2.252 ^b	
	Hotelling's Trace	0.129	2.252 ^b	
	Roy's Largest Root	0.129	2.252 ^b	

The third analysis was an tests of between-subjects effects to examine the differences between experimental groups and those by gender in students aged 11-12 years. The following are the results of the tests of between-subjects effects.

Based on the results of table 4, Tests of Between-Subjects Effects shows that at the pretest stage there was no difference in coordination between EG and CG sig. 0.600 <

0.05, indicating equivalent initial conditions. However, after being given the big ball game treatment, there was a significant increase in coordination in EG compared to CG (F = 147.366; 0.000 < 0.05). In addition, a significant interaction between gender and group was also found in the posttest coordination (F = 4.175; 0.048 < 0.05), indicating that the effect of the big ball game on coordination differs between male and female students. Overall, the analysis model explains 86.8% of the variation in changes in student coordination, confirming that the big ball game is effective in improving coordination abilities in students aged 11–12 years.

The final analysis involved testing the effect size using partial eta squared and the results of pairwise comparisons based on gender and group. The results of the effect size and pairwise comparisons are presented in Table 6 below.

Based on the results of table 6, it shows that gender has a significant influence on student coordination (F = 85.652, p < 0.001, $\eta^2_p = 0.704$). The partial η^2 value of 0.704 indicates a very large effect, so approximately 70.4% of the variation in coordination improvement can be explained by gender differences. Then, there is a very significant influence between treatments (EG vs CG) on improving student coordination (F = 147.366, p < 0.001, $\eta^2_p = 0.804$). The partial η^2 value of 0.804 indicates a very large effect, which means approximately 80.4% of the variation in coordination improvement is explained by differences in treatment types.

Discussion

Based on the results of this study, it was found that big ball games have a positive effect on coordination skills, especially in male and female students who are members of the experimental group. Meanwhile, the control group of

Table 5. Result of Tests of Between-Subjects Effects

	Source	Type III Sum of Squares	Mean Square	F	Sig.
Corrected Model	Pretest Coordination	54.200a	18.067	12.654	0.000
	Posttest Coordination	410.475b	136.825	79.064	0.000
Intercept	Pretest Coordination	5856.400	5856.400	4101.759	0.000
	Posttest Coordination	10144.225	10144.225	5861.831	0.000
Gender	Pretest Coordination	52.900	52.900	37.051	0.000
	Posttest Coordination	148.225	148.225	85.652	0.000
Group	Pretest Coordination	0.400	0.400	0.280	0.600
	Posttest Coordination	255.025	255.025	147.366	0.000
Gender*Group	Pretest Coordination	0.900	0.900	0.630	0.432
	Posttest Coordination	7.225	7.225	4.175	0.048

a.R Squared = .513 (Adjusted R Squared = .473)

b.R Squared = .868 (Adjusted R Squared = .857)

Table 6. Results of Estimated Marginal Means, Pairwise Comparisons, and Univariate Tests

Factor	Category	Estimates				Pairwise Comparisons		Univariate Tests		
		Mean	Std. Error	95% CI Lower	95% CI Upper	Mean Difference	Sig.	F	Sig	Partial Eta Squared
Gender	Male	17.85	0.29	17.25	18.45	3.85*	0.000	85.652	0.000	0.704
	Female	14.00	0.29	13.40	14.60					
Group	Experiment	18.45	0.29	17.85	19.05	5.05*	0.000	147.366	0.000	0.804
	Control	13.40	0.29	12.80	14.00					

female students did not show any significant effect, indicating that their coordination did not increase significantly in the absence of the big ball game treatment.

These findings suggest that big ball games are effective as a practice method for improving coordination, particularly when administered in a structured and consistent manner. This finding has also been supported by the results of previous studies, which have shown that training programs using structured big balls, such as those with clear procedures and fun game models, can improve physical skills in students aged 11–12 years (Mikail & Suharyana, 2019; Nikšić et al., 2020). In big ball games, such as soccer, basketball, or volleyball, cooperation between the various systems of the body is required (Dewi, 2023). These body systems include fine and gross motor, as well as sensory systems such as vision and balance (Cenizo-Benjumea et al., 2022; Wedi et al., 2024). In this training method, students are also required to be physically active, such as running by moving, jumping and leaping, and playing reactions. Therefore, training methods with various games are able to stimulate an increase in overall coordination (Giuriato et al., 2022), in the new findings of this study through big ball games.

In male students, both the experimental group and the control group showed significant differences in coordination, with the experimental group that received the big ball game treatment showing a higher increase. This can be explained based on previous scientific studies, that male students aged 11–12 years tend to be more physically active (Sari et al., 2024; Syahriadi et al., 2024). So it has higher courage in playing competitively, and is more familiar with big ball games. Then, the basis of the big ball game in this study is fun, but the factor of the difficulty level of the game model also has an impact on self-confidence and motivation to complete challenges (Arifin et al., 2021; Kurniawan et al., 2024). These factors can increase the effectiveness of the exercises they undergo.

Meanwhile, in female students, increased coordination also occurred in the experimental group. This suggests that big ball games are also effective for female students, although they may exhibit different physiological and psychological responses compared to male students. Physiologically, based on the results of the study, it was found that male students tend to have more developed muscle strength, reaction speed, and motor capacity than female students at that age (Sánchez-Díaz et al., 2021; Sugimoto et al., 2023). This ability supports their involvement in dynamic physical activities, such as big ball games, which require movement coordination, balance, and quick responses to visual and tactical stimuli (Dewi, 2023). Psychologically, male students generally show a higher interest in competitive and physical games, so their involvement in big ball game activities becomes more intense (Aguayo et al., 2022). In contrast, female students tend to be more cautious, tend to participate in collaborative activities, and may feel less confident in competitive games (Amenya et al., 2021), which may limit the optimization of coordination development through such exercises.

Then, other findings showed that there was no significant effect in the control group of female students, indicating that without stimulation of exercises such as big ball games, coordination skills tended to stagnate. It can be influenced by a lack of spontaneous physical activity or

involvement in games that require complex coordination, outside of treatment (Sugimoto et al., 2023). Therefore, the coordination development program should consider a game-based approach tailored to gender characteristics so that the benefits are even and optimal. As the results of previous studies indicate, female students can improve their physical skills through traditional games for female students aged 9–12, such as scholarship games (Santoso et al., 2024) and circuit games, including the Fabric Volleyball Game, Football Circuit Game, and Suki Basketball Circuit Game, as well as Quickie (Who's Fast?)—a game for female students (Kuspratiwi et al., 2025). Then, a more specific training program was developed specifically for female students, without groups for male students, such as using the small-sided game method (Mikalonytė et al., 2022). To enable female students to be more confident from a young age, without a comparison group, such as male students.

This study has several limitations worth noting, including the involvement of students in the experimental and control groups, which cannot be fully controlled in terms of motivation, interest, and active participation, especially among female students, which affects the results obtained. In addition, the duration and intensity of treatment for big ball games are still limited, so it does not fully describe the long-term impact, and the approach has not been fully adapted to psychological characteristics based on gender. External factors, such as physical activity outside of school, also cannot be controlled thoroughly. Nevertheless, the results of this study have important implications for the development of physical education learning in elementary schools, where big ball games are effective in improving students' motor coordination, for both boys and girls aged 11–12 years. Therefore, educators and coaches are advised to integrate varied and adaptive game approaches to enhance students' character development and maximize participation and overall motor development.

Conclusion

The results of this study indicate that playing with a large ball significantly improves the coordination skills of 11–12-year-old students, particularly in the experimental group compared to the control group ($F = 147.366$, $p < 0.001$, $\eta^2_p = 0.804$). This effect is very large, indicating that approximately 80.4% of the variation in coordination improvement is explained by treatment differences. In addition, gender also significantly influences coordination ($F = 85.652$, $p < 0.001$, $\eta^2_p = 0.704$), with male students tending to show better coordination than female students. Big ball games, presented in a structured, fun, and consistent manner, have been proven to stimulate the motor and sensory systems while also encouraging students' overall active physical involvement. Differences in responses between male and female students showed that physiological and psychological factors also influenced the coordination results obtained. Meanwhile, although female students in the experimental group also showed increased coordination, the control group of female students did not exhibit significant changes, which highlighted the importance of physical stimulation through game activities in their coordination development process. Thus, physical education learning programs should incorporate game approaches that consider

differences in gender characteristics, allowing all students to benefit optimally from them.

Acknowledgment

The researcher gratefully acknowledges the support provided by Universitas Negeri Yogyakarta, both in terms of materials and funding, which significantly contributed to the successful completion of this research. This study is part of the requirements for the first author's Doctoral Education Program at Yogyakarta State University. All scientific article writing, intervention program development, and language translation in this study did not use Artificial Intelligence (AI).

Conflict of Interest

The author declares no conflict of interest with any other authors or related research findings.

References

- ÇAKIT, İ., ÇAMLIGÜNEY, F., & ERDİL, G. (2022). The Impact of Differential Learning Model on Motor Skills and Handball-Specific Coordination Performance in 11–13-Year-Old Beginners in Handball. *International Journal of Sport, Exercise & Training Sciences*. <https://doi.org/10.18826/useeabd.1152610>
- Tanineh, W., & Halaweh, H. (2023). Cardiorespiratory Fitness, Motor Coordination, and Academic Achievement in School Students (11-13 years). *Global Pediatric Health*, 10. <https://doi.org/10.1177/2333794X231207311>
- Sabău, A. M., Săvescu, B., Bulz, C., Damian, M., & Săvescu, D. (2023). Development study determining motor qualities in rhythmic gymnastics. Mobility and coordination in gymnasts 10-12 years old. *GeoSport for Society*, 19(2), 65-75. <https://doi.org/10.30892/gss.1903-097>
- Putro, K. H., Suharjana, S., Marhaendro, A. S. D., Hariono, A., Siswantoyo, S., Fauzi, F., & Prabowo, T. A. (2025). Evaluating Validity and Test-retest Reliability on Indonesian Basketball Talent Scouting Model for Athletes Aged 10 to 14. *Physical Education Theory and Methodology*, 25(3), 540-547. <https://doi.org/10.17309/tmfv.2025.3.09>
- Sobko, S. H., Sobko, N. H., Maleniuk, T. V., Babalich, V. A., & Panchenko, H. I. (2021). Improving coordination of young footballers aged 9-10 years. *International Journal of Human Movement and Sports Sciences*, 9(5), 940-947. <https://doi.org/10.13189/saj.2021.090515>
- Yin, X., Zhu, R., Shi, X., Cai, G., Jing, C., Pan, Q., & Yang, T. (2023). The effect of rhythm training on the motor coordination abilities of 8–12-year-old freestyle swimmers. *PeerJ*, 11. <https://doi.org/10.7717/peerj.15667>
- Aguayo, B. B., Román, P. Á. L., Sánchez, J. S., & Vallejo, A. P. (2022). Effect of physical activity and fitness on executive functions and academic performance in children of elementary school. A systematic review. *Cultura, Ciencia y Deporte*, 17(51), 85-103. <https://doi.org/10.12800/ccd.v17i51.1699>
- Ramli, R., Aji, T., Suwardi, S., Yanti, N., & Hanafi, M. (2023). Eye-foot coordination and balance with serving ability: A correlation study in sepak takraw game. *Jurnal SPORTIF : Jurnal Penelitian Pembelajaran*, 9(3), 483-495. https://doi.org/10.29407/js_unpgri.v9i3.21217
- Hikmawati, H., Hartati, H., & Usra, M. (2023). The Impact of Hanging Ball Training Method on Volleyball Under Passing and Hands Eye Coordination. *AL-ISHLAH: Jurnal Pendidikan*, 15(4), 4527-4536. <https://doi.org/10.35445/alishlah.v15i4.3862>
- Dewi, R. (2023). The Effect Of Big Ball Game Modification On Gross Motor Development Of Elementary School Students. *COMPETITOR: Jurnal Pendidikan Keperawatan Olahraga*, 15(1), 48. <https://doi.org/10.26858/cjpk.v15i1.43810>
- Mitova, O., Griban, G., Oleniev, D., Yakovenko, A., Onyshchenko, V., Mozolev, O., & Hres, M. (2022). The Impact of Mini-Basketball Training Sessions on the 6-7-Year-Old Boys' Physical Fitness and Physical Development. *International Journal of Human Movement and Sports Sciences*, 10(4), 754-767. <https://doi.org/10.13189/saj.2022.100416>
- Glišović, G. (2022). Influence of basketball training on morphological characteristics and motor abilities of younger grades of primary school. *Metodicka Praksa*, 25(1), 69-82. <https://doi.org/10.5937/metpra2201069g>
- Marchenko, S. I., & Dykhanova, A. I. (2019). Motor abilities: Peculiarities of effects of volleyball training on coordination preparedness of girls aged 15. *Physical Education Theory and Methodology*, 19(1), 23-28. <https://doi.org/10.17309/tmfv.2019.1.03>
- Mikail, K., & Suharjana, S. (2019). Pengembangan model latihan teknik dasar sepakbola bagi anak usia 10-12 tahun di sekolah sepakbola. *Jorpres (Jurnal Olahraga Prestasi)*, 15(1), 14–27. <https://doi.org/10.21831/jorpres.v15i1.26023>
- Santoso, N. P., Subagyo, S., Santoso, N., Prabowo, T. A., & Yulianto, W. D. (2024). Assessing the Effect of Traditional Games on Manipulative Movements in Elementary School Students Based on Gender. *Physical Education Theory and Methodology*, 24(3), 441-448. <https://doi.org/10.17309/tmfv.2024.3.13>
- Kuspratiwi, F. W., Suherman, W. S., & Komari, A. (2025). The effect of circuit games on manipulative movement for elementary school students aged 9-10 years. *Retos*, 65, 13-21. <https://doi.org/10.47197/retos.v65.111144>
- Rusli, M., Marsuna, M., & Jud, J. (2024). Increase the speed of running 100 meters using the bench and skipping training methods. *Pedagogy of Physical Culture and Sports*, 28(5), 336-343. <https://doi.org/10.15561/26649837.2024.0501>
- Cho, E. H., Yun, H. J., & So, W. Y. (2020). THE validity of alternative hand wall toss tests in Korean children. *Journal of Men's Health*, 16(1), e10-e18. <https://doi.org/10.15586/jomh.v16i1.166>
- Mikalonytė, R., Paulauskas, R., Abade, E., & Figueira, B. (2022). Effects of small-sided games vs. simulated match training on physical performance of youth female handball players. *PLoS ONE*, 17(9 September). <https://doi.org/10.1371/journal.pone.0273574>
- Chowdhury, A. K., Tjondronegoro, D., Chandran, V., Zhang, J., & Trost, S. G. (2019). Prediction of relative physical activity intensity using multimodal sensing of physiological data. *Sensors (Switzerland)*, 19(20). <https://doi.org/10.3390/s19204509>

- Aiken, L. R. (1985). Three Coefficients For Analyzing The Reliability And Validity Of Ratings. *Educational and Psychological Measurement*, 45, 131-141. <https://doi.org/10.1177/0013164485451012>
- Wedi, S., Tomolijus, T., Fauzi, F., Gemaini, A., & Prabowo, T. A. (2024). Innovation, Validity, and Reliability of Modified Dynamic Balance Test for Karate Kata Category. *Sport Mont*, 22(3), 3-8. <https://doi.org/10.26773/smj.241004>
- George, D., & Mallery, P. (2019). *IBM SPSS Statistics 26 Step by Step*. Routledge. <https://doi.org/10.4324/9780429056765>
- Bernadett, S. P., & Csaba, B. M. (2024). Examining normal distribution: which test to use? *Statisztikai Szemle*, 102(1), 5-37. <https://doi.org/10.20311/stat2024.01.hu0005>
- Nikšić, E., Beganović, E., & Joksimović, M. (2020). The impact of the program of basketball, volleyball and handball on the situation-motorized capability of the first classes of the elementary school. *Pedagogy of Physical Culture and Sports*, 24(2), 85-92. <https://doi.org/10.15561/26649837.2020.0206>
- Cenizo-Benjumea, J. M., Vázquez-Ramos, F. J., Ferreras-Mencía, S., & Gálvez-González, J. (2022). Effect of a gamified program on physical fitness and motor coordination. *Cultura, Ciencia y Deporte*, 17(52), 155-177. <https://doi.org/10.12800/ccd.v17i52.1786>
- Giuriato, M., Lovecchio, N., Pellino, V. C., Mieszkowski, J., Kawczynski, A., Nevill, A., & Biino, V. (2022). Gross motor coordination and their relationship with body mass and physical activity level during growth in Children aged 8-11 years old: a longitudinal and allometric approach. *PeerJ*, 10. <https://doi.org/10.7717/peerj.13483>
- Sari, I. P. T. P., Doewes, M., Hidayatullah, M. F., & Hariono, A. (2024). Physical activity questionnaire for older children (PAQ-C) versi Indonesia: confirmatory factor analysis. *Retos*, 61, 100-107. <https://doi.org/10.47197/retos.v61.109522>
- Syahriadi, S., Sugiyanto, F. X., Lumintuarso, R., Juita, A., & Prabowo, T. A. (2024). The effect of groundstroke forehand exercise on enhancing cardiorespiratory endurance (VO2 MAX) in 12- to 14-year-old tennis athletes. *SPORT TK-Revista EuroAmericana de Ciencias Del Deporte*, 13(13), 1-17. <https://doi.org/10.6018/sportk.564831>
- Arifin, R., Erliana, M., & Faisal, A. (2021). Improving Learning Outcomes Of Big Ball Games Using Coopertive Methods In Primary Schools. *Kinestetik: Jurnal Ilmiah Pendidikan Jasmani*, 5(1), 179-185. <https://doi.org/10.33369/jk.v5i1.14616>
- Kurniawan, F., Hidayatullah, M. F., Kristiyanto, A., Riyadi, S., Ekawati, F. F., Ningrum, N. R., & Prabowo, T. A. (2024). Physical literacy needs in esports: literature review. *Retos*, 58, 495-505. <https://doi.org/10.47197/retos.v58.107885>
- Sánchez-Díaz, S., Yanci, J., Raya-González, J., Scanlan, A. T., & Castillo, D. (2021). A Comparison in Physical Fitness Attributes, Physical Activity Behaviors, Nutritional Habits, and Nutritional Knowledge Between Elite Male and Female Youth Basketball Players. *Frontiers in Psychology*, 12. <https://doi.org/10.3389/fpsyg.2021.685203>
- Sugimoto, D., Stracciolini, A., Berbert, L., Nohelty, E., Kobelski, G. P., Parmeter, B., & Myer, G. D. (2023). Assessment of Physical Tests in 6–11 Years Old Children: Findings from the Play Lifestyle and Activity in Youth (PLAY) Study. *International Journal of Environmental Research and Public Health*, 20(3). <https://doi.org/10.3390/ijerph20032552>
- Akpenyena, P. C., Annan, R. A., Apprey, C., & Agbley, E. N. (2021). The relationship between nutrition and physical activity knowledge and body mass index-for-age of school-aged children in selected schools in Ghana. *Heliyon*, 7(11). <https://doi.org/10.1016/j.heliyon.2021.e08298>

Впровадження ігор з великим м'ячем для покращення координації учнів 11–12 років: Аналіз з урахуванням гендерних аспектів

Азіза Пуспадеві Сафітрі^{1ABCD}, Ервін Сетьо Крісванто^{1ABD}, Аріс Фаджар Памбуді^{1BDE}, Тріснар Аді Прабово^{2ABCDE}

¹Університет Негері Джок'якарта

²Університет Мухаммадія Бребес

Авторський вклад: А – дизайн дослідження; В – збір даних; С – статаналіз; D – підготовка рукопису; Е – збір коштів

Реферат. Стаття: 10 с., 6 табл., 1 рис., 34 джерела.

Історія питання. Розвиток координації в дитинстві, зокрема у віці від 11 до 12 років, відіграє важливу роль у загальному самопочутті та довгостроковому фізичному розвитку. Ігри з великим м'ячем визнані ефективним засобом покращення координації. Однак у зазначених іграх часто акцентується увага на базових технічних навичках, причому наукові дані щодо впливу статі на показники координації у іграх з великим м'ячем представлені в обмеженій кількості.

Мета дослідження. Основною метою цього дослідження було оцінити вплив ігор з великим м'ячем на розвиток координації учнів 11–12 років з урахуванням гендерних відмінностей.

Матеріали та методи. Застосовано квазіекспериментальний дизайн дослідження з використанням претестового та посттестового методів. У дослідженні взяли участь 40 учнів: 20 хлопців (вік: 11.5 ± 0.3 роки; зріст: 148.9 ± 3.0 см; вага: 44.6 ± 2.5 кг) та 20 дівчат (вік: 11.4 ± 0.2 роки; зріст: 145.7 ± 1.3 см; вага: 40.0 ± 1.1 кг). Вибірki з визначеними початковими показниками претесту було розподілено за методом порядкового сполучення за формулою A-B-B-A, а потім об'єднано в експериментальну групу (ЕГ) та контрольну групу (КГ). Інтервенція складалася з п'яти моделей ігор з великим м'ячем, що проводилися протягом шести тижнів (18 сесій), з трьома сесіями на тиждень у період з 7:00 до 9:00 ранку. Моніторинг інтенсивності для цієї гри становив 65% – 75% або рейтинг сприйнятого навантаження (Rating of Perceived Exertion, RPE) на рівні 12 – 14 (помірний). Координація оцінювалася з використанням тесту почергового підкидання м'яча до стіни (Alternative Hand Wall Toss Test, АНWT), валідованого інструменту для оцінки зорово-моторної координації. Аналіз даних проводився з використанням багатовимірного дисперсійного аналізу (MANOVA) за допомогою програмного забезпечення SPSS версії 26.

Результати. Багатовимірний аналіз показав значний вплив на координацію між статтю ($p < 0.05$) та ЕГ ($p < 0.05$). Водночас взаємодія між зазначеними факторами не визначила істотного впливу на багатовимірному рівні ($p > 0.05$). Результати одновимірного тесту виявили, що стать мала суттєвий вплив на поліпшення координації ($F = 85.652$, $p < 0.001$, $\eta^2_p = 0.704$), вказуючи на наявність 70.4% варіації в покращенні показників координації, що пояснюється гендерними відмінностями. Згодом на основі інтервенційного підходу (ЕГ та КГ) щодо координації учнів ($F = 147.366$, $p < 0.001$, $\eta^2_p = 0.804$) було продемонстровано, що 80.4% варіації координації пояснюється відмінностями методики. Тест міжсуб'єктного ефекту показав, що на претестовому етапі не спостерігалось відмінностей у координації між ЕГ і КГ ($p = 0.600$), тоді як на посттестовому етапі дослідження було виявлено значущу відмінність ($p = 0.000$). Крім того, на посттестовому етапі встановлено помітну взаємодію між статтю та групою ($p = 0.048$).

Висновки. Структуроване, цікаве та послідовне застосування ігор з великим м'ячем сприяє значному покращенню координації у дітей віком 11–12 років та має виражений ефект в експериментальних групах. Отримані результати підкреслюють вплив фізіологічних та психологічних чинників на розвиток координації, висвітлюючи гендерні відмінності у реагуванні на інтервенції з фізичної активності. Отже, програми фізичного виховання повинні застосовувати інклюзивні ігрові підходи, що враховують гендерно-специфічні потреби з метою забезпечення максимізації розвитку координації у всіх учнів.

Ключові слова: ігри для дітей, моторна координація дітей, ігри з великим м'ячем, діти віком 11–12 років.

Information about the authors:

Safitri, Aziza Puspawati: azizapuspadewi.2024@student.uny.ac.id; <https://orcid.org/0009-0000-2122-831X>; Faculty of Sport and Health Sciences, Universitas Negeri Yogyakarta, Jl. Colombo Yogyakarta No.1, Karang Malang, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta 55281, Indonesia.

Kriswanto, Erwin Setyo: erwin_sk@uny.ac.id; <https://orcid.org/0000-0002-6421-808X>; Faculty of Sport and Health Sciences, Universitas Negeri Yogyakarta, Jl. Colombo Yogyakarta No.1, Karang Malang, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta 55281, Indonesia.

Pambudi, Aris Fajar: arisfajarpambudi@uny.ac.id; <https://orcid.org/0000-0002-0819-7894>; Faculty of Sport and Health Sciences, Universitas Negeri Yogyakarta, Jl. Colombo Yogyakarta No.1, Karang Malang, Caturtunggal, Kec. Depok, Kabupaten Sleman, Daerah Istimewa Yogyakarta 55281, Indonesia.

Prabowo, Trisnar Adi: trisnar.prabowo@umbs.ac.id; <https://orcid.org/0000-0001-6977-0503>; Study Program of Physical Education, Universitas Muhammadiyah Brebes, Jl. Pangeran Diponegoro Grengseng No.184, Grengseng, Taraban, Kec. Paguyangan, Kabupaten Brebes, Jawa Tengah 52276, Indonesia.

Cite this article as: Safitri, A. P., Kriswanto, E. S., Pambudi, A. F., & Prabowo, T. A. (2025). Implementing Big Ball Games to Enhance Coordination in 11–12-Year-Old Students: A Gender-Based Analysis. *Physical Education Theory and Methodology*, 25(6), 1406–1415. <https://doi.org/10.17309/tmfv.2025.6.11>

Received: 14.10.2025. Accepted: 14.11.2025. Published: 30.11.2025

This work is licensed under a Creative Commons Attribution 4.0 International License (<http://creativecommons.org/licenses/by/4.0>)