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THE EFFECT OF EXERCISE VARIATIONS USING THE DRILL METHOD ON THE IMPROVEMENT OF VOLLEYBALL UNDERHAND PASS SKILLS

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Abstract

Lower passing skills determine the smooth preparation of attacks in volleyball, but single-form exercises often do not maximize the progress of junior-age students due to motor saturation and lack of stimulation of physical conditions. This study aims to analyze the effect of drill training variations that integrate the physical condition components of coordination (pipe jump), strength (push-up), agility (cone run), and core stability (sit-up) on the improvement of the lower passing skills of students of the UPT SMPN 2 Ulaweng Volleyball Club. The study used a quantitative approach with ~~the~~ One Group Pretest-Posttest experimental design. The population was 110 students; ~~a sample of 14 students~~ was ~~selected~~ through ~~purposive sampling~~ based on ~~the~~ criteria of active practice and mastery of basic skills. Treatment was administered over 12 meetings, and measurements were made using the Brumbach Forearms Pass Wall Volley Test (reliability 0.896; validity 0.80). Data were analyzed with descriptive statistics and paired *t*-tests through SPSS 25. The results showed an increase in the average score from 27.57 to 37.86 (an increase of 10.29 points or 37.32%), with a *t*-count of 10.81 > *t*-table of 2.160 ($p < 0.001$) and a very large effect size (Cohen's $d = 2.91$). The distribution of ability categories shifted from the dominant category of low (78.5%) to the category of sufficient and good. The variety of drill exercises was shown to ~~have a significant effect on improving lower passing skills~~. School club coaches can adopt this 12-meeting program as a reference for developing effective, varied, and at the same time developing techniques and physical conditions of junior age students.

Keywords: Bottom Passing; Drill Drill Variations; Volleyball; Junior High School Students; Physical Condition

INTRODUCTION

Volleyball occupies a position as one of the most popular team sports in the world and is played by hundreds of millions of people in both competitive and recreational fields (Fédération Internationale de Volleyball [FIVB], 2022). At the elite level, the quality of fundamental technique plays a role in determining the outcome of the match; analysis of technical performance indicators in elite teams shows that the quality of ball reception is a predictor of attack effectiveness and successful defense of rallies (Giatsis et al., 2023). The character of the game that requires coordination, physical strength, and mastery of adequate technique

confirms that the development of basic skills from an early age is the foundation of athletes' success at the international level (Bandung Bumburo et al., 2023).

In Indonesia, volleyball has experienced continuous growth since the Indonesian Volleyball Association (PBVSI) was formed on January 22, 1955 (Bandung Bumburo et al., 2023). The achievements of the Indonesian men's volleyball team that won gold medals at the 2019 and 2023 SEA Games, as well as the presence of the Proliga competition as a forum for the development of young athletes, mark the progress of this sport at the national level (Hendry et al., n.d.). Nevertheless, the regeneration of national achievements relies on coaching at the school level through learning Physical Education, Sports, and Health (PJOK) as well as extracurricular and club activities (Amila et al., 2023; Bayo et al., 2025). The quality of training programs at this level, thus, determines the quality of talents that are ready to be developed at a higher level.

Bone Regency, South Sulawesi, is one of the regions that actively fosters student volleyball through district, provincial, and inter-club championships. The UPT SMPN 2 Ulaweng Volleyball Club routinely participates in competitions between students every year. The results of the initial observation carried out on September 13, 2025 showed that only about 30% of players were able to pass down well, while the other 70% still needed special coaching. Identification through preliminary measurements (pre-test) strengthened these findings: the average score of the Brumbach Forearms Pass Wall Volley Test reached only 27.57 (SD = 5.14), with 78.6% of students in the poor category, 21.4% in the adequate category, and none of them reaching the good category.

The low level of lower passing skills is rooted in three interrelated problems. First, technical errors include inappropriate body position and execution, uncontrolled ball bounce, and inaccuracy of passing direction (Elisanti & Syaputra, 2022; Purba et al., 2025). Second, club training patterns are not programmed; players generally train independently without load planning, progression, and evaluation (Harahap et al., 2025). Third, monotonous repetitive training decreases student engagement. ² The characteristics of Generation Z who are educated at the junior high school level demand interactive, fast, and challenging activities because

their attention spans are relatively short (Hayati, 2024; Jannah, 2024), while less interactive learning models have been proven to limit the mastery of technical skills (Fadhillah et al., 2023). These three problems require an effective and varied training program.

A number of studies have tested the effect of drill exercises on bottom passing skills and reported positive results, including in elementary school students (Rahmatillah & Hendrawan, 2025), through paired drills (Riksandi et al., 2024), passing variation exercises in high school students (Pamungkas et al., 2021), village club players (Afdol & Putra, 2025), physical education students (Faradila, 2025), variations in bottom passing exercises in volleyball players (Sehabudin & Mustaqim, 2023), variations in bouncing balls against the wall at the same club as the location of this study (Herlinda et al., 2025), drill training models (Komalasari, 2024), and drill methods in general (Ramadhan & Parlindungan, 2025). Although consistent, these studies opened up at least three research gaps. First, the majority test a single form of drill or simply compare two forms of exercise; there has not been a program that explicitly combines technique repetition with physical condition stimulation that supports passing movements in a single training design. Second, statistical reporting generally stops at significance without effect measurements, so the amount of training contribution is difficult compared between studies. Third, the context of junior high school age players in regional clubs, especially in the western region of South Sulawesi, is still rarely studied, so the generalization of findings in this population is limited.

The novelty of this study lies in three things. First, the drill training variation program is theoretically designed by juxtaposing the repetition of lower passing techniques and stimulation of specific physical conditions: pipe jumps for coordination and leg strength, push-ups for arm-shoulder strength, cone runs for agility and reaction, and sit-ups for core stability, referring to the principles of overload, progressivity, specificity, and variation (Bompa & Buzzichelli, 2019; Fitriani et al., 2022). Second, the program is structured in 12 meetings with structured load progression and according to the characteristics of the junior age, answering the varied exercise needs of generation Z learners (Diyah & Daya, 2025).

Third, the analysis is equipped with effect measures so that the amount of influence of treatment can be positioned in the literature map of junior high school volleyball technique skills.

On the basis of these gaps and novelties, ⁶ this study aims to analyze the effect of drill practice variations on improving lower passing skills in students of the UPT SMPN 2 Ulaweng Volleyball Club. The tested hypothesis states that the variation of drill practice has a positive and significant effect on improving students' lower passing skills.

Acquisition of Motor Skills as a Foundation for Repetitive Training

Movement skills are formed through a gradual process of motor learning, starting from the cognitive stage when the learner is still building an understanding of movement, the associative stage when the movement begins to smooth out but is still accompanied by errors, to the autonomous stage when the movement is carried out automatically without full attention (Magill & Anderson, 2021). The position of these stages provides a theoretical basis for the use of repetitive exercises: programmed repetitions allow the learner to go through each stage with quick feedback and immediate correction. Schmidt's schema theory strengthens this argument by asserting that the movement schema is constructed through the provision of a variety of training experiences that demand adjustment of movement parameters, so that variations in the form of exercises actually enrich the structure of the schema and increase the transfer of skills to the game situation (Magill & Anderson, 2021). From this point of view, drills are not just mechanical routines, but instruments for the formation of motor schemas, and variation in drills is a requirement for learning, not just a deterrent.

Exercises and Principles of Loading

Exercise is a series of physical activities that are designed systematically, structured, and continuous with a gradual increase in load to optimize physical capacity and skill mastery (Durrumnafisa et al., 2022; Anggriawan, 2022; Harjono, 2023). The effectiveness of exercise is determined by the appropriateness of applying the training principles. Bompa and Buzzichelli (2019) formulated the principles of overload, progressivity, specificity, and variation as pillars of program

preparation: stimulation must exceed the current ability threshold, increase in a planned manner, mimic the characteristics of the intended movement, and be reshaped so that adaptation continues (Fitriani et al., 2022). Load norms also require the regulation of volume, intensity, rest intervals, and density so that adaptation occurs without the risk of excessive fatigue (Harahap et al., 2025; Diyah & Daya, 2025; Sari et al., 2023). Comparisons between ideas show a consistent pattern: the game-based model relies on a competitive context, while the practice-based model relies on a load structure; the first weakness lies in the difficulty of controlling the repetition of the technique, while the second weakness lies in the risk of saturation if the form is monotonous. The integration of the two is the most promising direction of program development.

Drill Methods and Their Position Among Alternative Methods

The drill method emphasizes the systematic repetition of movements in the same or varied form with the aim of stabilizing movement patterns (Ramadhan & Parlindungan, 2025). Empirical evidence of its effectiveness includes increasing the lower passing of elementary school students through general drills (Rahmatillah & Hendrawan, 2025), paired drill exercises (Riksandi et al., 2024), wall passing exercises for students (Faradila, 2025) and at the same club as the location of this study (Herlinda et al., 2025), passing diamonds (Fatuhrohman et al., 2021), SPBT structured drill models (Khotimah, 2022), as well as passing variation programs in high school students (Pamungkas et al., 2021), club players (Afdol & Putra, 2025), and general volleyball players (Sehabudin & Mustaqim, 2023). The strength of this method lies in its high focus of motion, the opportunity for instant correction, and measurable results over time. The weakness arises in learners who demand interactive experiences: generation Z students have short attention spans and quickly get bored of repetitive activities (Hayati, 2024; Jannah, 2024), so drills presented in a single form risk of decreased engagement.

Alternative methods offer different solutions and each carries its own limits. The 2 on 2 modified game approach enriches the situational experience but sacrifices the concentration of repetition of certain techniques (Kurniawan et al., 2021). Audiovisual media accelerate the understanding of movement concepts but

do not guarantee the quantity of the movement practice itself (Amila et al., 2023). The direct interaction learning model increases social engagement but consumes a portion of time for classroom management (Fadhillah et al., 2023). Compared to the three, the drills vary to maintain the intensity of the repetition while refreshing the form of the exercise; the weakness of monotony can be mitigated without sacrificing the principle of repetition. This position is the basis of this study.

Bottom Passing Skills and Their Supporting Physical Components

Underpassing is a technique of receiving and directing the ball using a tightly guarded plane between the wrist and elbow, whose function is to support service reception, attack deterrence, and attack preparation (Elisanti & Syaputra, 2022; Purba et al., 2025). This ability is evaluated through three indicators: an initial stance that guarantees balance, an execution stance that ensures ball contact and bounce control, and directional accuracy towards the goal (Jamil et al., 2022; Pratiwi, 2021; Putro & Ismoko, 2021). Recent studies show that these skills do not stand alone: eye-hand coordination and balance correlate with passing quality (Darmawati et al., 2025), while limb, arm-shoulder, abdominal strength, and core stability provide the power and movement control needed during ball contact (Paramida et al., 2025; Reinaldi et al., 2025). These findings confirm that passing training programs that only contain technique reps tend to be less optimal because the supporting physical components are not stimulated.

METHODS

Research Approach and Design

This study uses a quantitative approach with a quasi-experimental design. This approach was chosen because the effect of treatment on bound variables is tested through measurements that produce numerical data and statistical analysis, while full control of all external variables is not possible because the subjects are a naturally formed club training group (Sugiyono, 2022). The design applied is One Group Pretest–Posttest Design, where one group of subjects is measured before treatment (O_1), receives treatment (X), then is measured again after treatment (O_2) without a comparison group (Sugiyono, 2022; Kurniawati, 2022).

Table 1. Research Design Scheme

Groups	Pre-test	Treatment (X)	Post-test
Eksperimen	O ₁	Drill drill variations	O ₂

Remarks: O₁ = lower passing skill score before treatment; X = 12-session drill variation program; O₂ = lower passing skill score after treatment.

The design of a single group limits purely causal inference, but remains appropriate for this context because the number of club players is limited so the formation of a control group would empty one of the groups, and the research questions focus on changes in the abilities of the exercise group itself. To compensate, the design limitations are mitigated through standardization of test procedures, control of training schedules, as well as testing of statistical assumptions prior to inference.

Research Location and Time

The research was carried out in the field of UPT SMPN 2 Ulaweng, Ulaweng District, Bone Regency, South Sulawesi. The location was chosen because the school has an active volleyball club that regularly participates in competitions between students. The research lasted one month, consisting of four stages: preparation and testing of instruments (April, first week), pre-test (April 30, 2026), treatment of 12 meetings (May 1–24, 2026), and post-test (May 25, 2026) and data analysis.

Population and Sample

The research population includes all active students of UPT SMPN 2 Ulaweng as many as 110 people. The sample was determined to be 14 students who are members of the Volleyball Club who meet three criteria: (1) actively participate in club training, (2) have basic volleyball skills, and (3) are willing to participate in the entire series of research without interruption attendance. The sampling technique is purposive sampling, which is the selection of subjects based on criteria set by the researcher according to the research objectives (Sugiyono, 2022). This technique was chosen because the nature of the research requires homogeneity of the training experience so that the change in score can be attributed to treatment, not to differences in experience background.

Research Instruments

Underpass skills were measured using the Brumbach Forearms Pass Wall Volley Test developed by Borevik (1969). This instrument measures the ability to make underpasses repeatedly for 60 seconds: the tester throws the ball to a participant standing at a distance of 4.5 meters behind the line, and the participant makes a low pass through the net 2.43 meters high; one pass is declared valid if the ball exceeds the height of the net and is within the area limit. The number of valid passes in one minute becomes the final score. The classification of scores follows the criteria of Table 2.

Table 2. Lower Passing Skill Assessment Criteria

Score	Category
≥ 50	Excellent
41 – 50	Good
31 – 40	Enough
21 – 30	Less
< 20	Very Less

Source: Faradila (2025)

Measurements are carried out by two officers: the first officer supervises the height of the ball bounce, the area limit, and the time; the second officer calculates the number of valid passes from the measurement bench position. All participants get one chance at each measurement with identical procedures in the pre-test and post-test, so that measurement bias can be minimized.

Instrument Validity and Reliability

The instrument has a validity coefficient of 0.80 and a reliability coefficient of 0.896 based on testing on male and female subjects in the age range of 9–22 years (Borevik, 1969; Faradila, 2025). Both coefficients classify the instruments in the category of valid and high reliability, making them suitable for use without re-testing. The consistency of the procedure between measurements is maintained by using the same officers, tools, distance, net height, and duration, as well as the implementation of tests in similar time spans and environmental conditions.

Treatment (Drill Drill Variation Program)

The treatment took the form of a program of variation drill exercises for 12 meetings ¹ with a frequency of three times per week. Each session lasted 70–85 minutes and consisted of four parts: introduction and explanation of the material

(10 minutes), general and special warm-ups (10–15 minutes), core exercises (45–60 minutes), and brief cool-downs and reflections (5–10 minutes). The program combines two training tracks: repetitions of lower-passing techniques in varying forms and stimulation of specific physical conditions, namely pipe jumps (coordination and leg strength), push-ups (arm-shoulder strength), cone runs (agility and reaction), and sit-ups (abdominal strength and core stability). The training load progresses between meetings through increased reps, number of sets, and reduction of rest intervals according to the principles of overload and progressivity.

Table 3. Summary of the 12 Meeting Training Program

Meetings	Exercise Variations	Dosage	Focus
1	Pipe jump + push-ups	4 reps/set $\times$ 3 sets; 10 reps/set $\times$ 3 sets	Leg and arm strength
2	Lompat pipa + cone run	4 reps/set $\times$ 3 sets; 2 minutes/set $\times$ 3 sets	<i>Footwork</i> and coordination
3	Push-up + cone run	10 reps/set $\times$ 3 sets; 2 minutes/set $\times$ 3 sets	Upper body strength
4	Sit-ups + pipe jumps	10 rep/set $\times$ 3 set; 4 rep/set $\times$ 3 set	Abdominal strength and stability
5	Lompat pipa + cone run	4 reps/set $\times$ 3 sets; 2 minutes/set $\times$ 3 sets	Leg reaction
6	Sit-up + push-up	10 rep/set $\times$ 3 set; 10 rep/set $\times$ 3 set	Core and arm coordination
7	Pipe jump + push-ups	5 rep/set $\times$ 3 set; 10 rep/set $\times$ 4 set	Stable ball bounce
8	Sit-up + cone run	10 reps/set $\times$ 4 sets; 2 minutes/set $\times$ 5 sets	Balance and change of direction
9	Push-up + cone run	10 reps/set $\times$ 4 sets; 2 minutes/set $\times$ 5 sets	Ball control and durability
10	Sit-ups + pipe jumps	10 rep/set $\times$ 4 set; 5 rep/set $\times$ 3 set	Continuous core strengthening
11	Lompat pipa + cone run	4 reps/set $\times$ 3 sets; 2 minutes/set $\times$ 5 sets	Accuracy of passing to the target
12	Sit-ups + push-ups + bottom passes	10 rep/set $\times$ 4 set; 10 rep/set $\times$ 4 set	Final evaluation before post-test

Data Collection Procedure

Data was collected through three complementary techniques. First, the lower passing skill test was carried out twice: pre-test before treatment to map initial ability and post-test after treatment to assess changes. Second, observation of the

training process was carried out at each meeting to ensure the suitability of the program implementation with the design, including dose, rest, and movement quality. Third, documentation in the form of photos and recordings of activities served as evidence of implementation and verification materials for the procedure. The completeness of the subjects' attendance was verified before the analysis; all 14 subjects were fully present so that no data was released.

Data Analysis

The analysis was carried out in three stages using SPSS version 25. The first stage was a descriptive analysis to present the average, standard deviation, minimum, maximum value, and category frequency distribution in the pre-test and post-test. The second stage was prerequisite testing. Normality was tested with Shapiro–Wilk because the number of samples was less than 50; the assumption of normality in paired design was applied to the distribution of difference values ($D = \text{post-test} - \text{pre-test}$), not to the score distribution of each measurement (Siregar, 2013). The homogeneity of variance was tested by the F test at a significance level of 0.05. The third stage was hypothesis testing with a paired sample t-test at a significance level of $\alpha = 0.05$. The hypothesis was accepted if $\text{Sig. (2-tailed)} < 0.05$; if the assumption of the normality of the difference is not met, the analysis switches to the nonparametric Wilcoxon Signed Rank Test. The magnitude of the influence is reported through Cohen's d which is calculated from the average difference divided by the standard deviation of the difference, with the categories 0.2 (small), 0.5 (medium), 0.8 (large), and above 1.2 (very large). The increase in scores is also expressed in percentages to facilitate comparison with previous studies.

RESULTS

Lower Passing Skills Pre-Test Results

The initial measurement was carried out on April 30, 2026 involving all 14 sample students. Table 4 presents each student's lower passing skill scores and categories before receiving treatment.

Table 4. Lower Passing Skills Pre-Test Results Data

Yes	Shoes	Category
1	25	Less
2	28	Less

3	34	Enough
4	36	Enough
5	37	Enough
6	20	Less
7	29	Less
8	22	Less
9	23	Less
10	24	Less
11	25	Less
12	26	Less
13	28	Less
14	29	Less

N = 14; Minimum = 20; Maximum = 37; Average = 27.57; SD = 5.14. Source: SPSS data processing 25, 2026

Table 5. presents the frequency distribution of the ability category in the pre-test.

Table 5. Frequency Distribution of Lower Passing Skills Pre-Test Category

No	Interval	Category	Frequency	Percentage
1	≥ 50	Excellent	0	0%
2	41 – 50	Good	0	0%
3	31 – 40	Enough	3	21,4%
4	21 – 30	Less	11	78,6%
5	< 20	Very Less	0	0%
Quantity			14	100%

The pre-test data showed an average score of 27.57 with a standard deviation of 5.14. Eleven students (78.6%) were in the poor category and three students (21.4%) were in the adequate category; none of the students achieved the good or excellent category. The lowest score (20) was achieved by Riski and the highest score (37) by Adam.

Lower Passing Skills Post-Test Results

The final measurement was carried out on May 25, 2026 with procedures, instruments, and officers identical to the pre-test. Table 6 presents the scores and categories of each student after 12 treatments.

Table 6. Bottom Passing Skills Post-Test Results Data

No	Shoes	Category
1	39	Enough
2	35	Enough
3	47	Good

4	48	Good
5	49	Good
6	35	Enough
7	37	Enough
8	38	Enough
9	34	Enough
10	32	Enough
11	32	Enough
12	36	Enough
13	35	Enough
14	33	Enough

N = 14; Minimum = 32; Maximum = 49; Average = 37.86; SD = 5.87. Source: SPSS data processing 25, 2026

Table 7. Frequency Distribution of Lower Passing Skills Post-Test Category

No	Interval	Category	Frequency	Percentage
1	≥ 50	Excellent	0	0%
2	40 – 49	Good	3	21,4%
3	30 – 39	Enough	11	78,6%
4	20 – 29	Less	0	0%
5	< 20	Very Less	0	0%
Quantity			14	100%

Post-test data showed an average score of 37.86 with a standard deviation of 5.87. All students were in the category of adequate (78.6%) and good (21.4%); there were no more students in the poor category. The lowest score (32) was achieved by Muh. Ikbal and Esa, while the highest score (49) was achieved by Adam.

Difference in Pre-Test and Post-Test Scores

The difference of each student is calculated using the formula $D = \text{post-test} - \text{pre-test}$. Table 8 presents the results of the difference calculation along with its squares.

Table 8. Difference Calculation Data (D) Pre-Test and Post-Test Results

No	D (Post – Pre)	D ²
1	14	196
2	7	49
3	13	169
4	12	144
5	12	144
6	15	225
7	8	64
8	16	256
9	11	121
10	8	64

11	7	49
12	10	100
13	7	49
14	4	16

N = 14; Minimum D = 4; Maksimum D = 16; Rerata D = 10,29; SD = 3,54; SD = 144; SD² = 1,646.

Fourteen students experienced an increase in scores without exception, with a difference range of 4 to 16 points and an average increase of 10.29 points or equivalent to 37.32% of the initial score.

Descriptive Statistics

Table 9. Pre-Test and Post-Test Descriptive Statistical Results

	N	Minimum	Maximum	Rerata	SD
Pre-test	14	20	37	27,57	5,140
Post-test	14	32	49	37,86	5,869
Valid N (listwise)	14				

The average score increased from 27.57 to 37.86. The lowest score shifted from 20 to 32, and the highest score from 37 to 49; the post-test minimum score (32) exceeded the maximum value of the top third of the pre-test, signaling an overall shift in the direction of higher ability.

Results of the Prerequisite Test Analysis

The normality test used Shapiro Wilk because the sample count was less than 50. The test results are presented in Table 10.

Table 10. Data Normality Test Results (Shapiro Wilk)

Variabel	N	Statistic	Say.	Remarks
Pre-test	14	0,937	0,382	Normal
Post-test	14	0,817	0,008	Abnormal
Selisih (Post – Pre)	14	0,958	0,696	Normal

Pre-test scores were normally distributed ($p = 0.382 > 0.05$), while post-test scores were not normally distributed ($p = 0.008 < 0.05$). In paired designs, the assumption of normality was applied to the distribution of difference values, not to the distribution of individual scores. The distribution of difference was normally distributed ($W = 0.958$; $p = 0.696 > 0.05$), so the paired t-test was still feasible to use.

The variance homogeneity test yielded an F-count value of 1.304 with a degree of freedom ($df_1 = 1$; $df_2 = 26$) and a significance of $0.264 > 0.05$, so that the variance of pre-test and post-test data was declared homogeneous.

Hypothesis Test Results

Tables 11 to 13 present paired statistics, correlations between measurements, and hypothesis test results.

Tabel 11. Paired Samples Statistics

Pair 1	Rerata	N	SD	Std. Error Mean
Pre-test	27,57	14	5,140	1,374
Post-test	37,86	14	5,869	1,569

Tabel 12. Paired Samples Correlations

Pair 1	N	Correlation	Sig.
Pre-test & Post-test	14	0,799	0,001

Table 13. Paired Samples Test Results

Variabel	t-count	T-Table	df	Sig. (2-tailed)	Verdict
Bottom Passing Skills	10,807	2,160	13	0,000	H_0 rejected; H_a accepted

The results of the paired t-test showed a t-count value of 10.807 with a degree of freedom of 13, resulting in a significance value of 0.000. The t-count value (10.807) exceeded the t-table (2.160) at the significance level of $\alpha = 0.05$, and the Sig. (2-tailed) value was below 0.05. The correlation coefficient between measurements of 0.799 ($p = 0.001$) signified a strong and consistent relationship between each student's initial ability and final ability.

Effect Size

The magnitude of the influence was calculated using Cohen's d by dividing the average difference by the standard deviation of the difference: $d = 10.29 / 3.54 = 2.91$. This value far exceeded the threshold of 1.2 so it was classified as a very large effect. Conversion to the percentage increase showed that the average score increased by 37.32% from the initial condition.

Summary of Key Findings

Based on all analyses, the main findings of this study are as follows. First, the average lower passing skill increased from 27.57 to 37.86, equivalent to an increase of 10.29 points (37.32%). Second, the ability category shifted from less dominant (78.6% pre-test) to moderately sufficient with a small percentage of good (78.6% adequate; 21.4% good in post-test). Third, the paired t-test produced a t-count of $10.807 > t\text{-table of } 2.160$ with a Sig. of $0.000 < 0.05$, so that an alternative hypothesis was accepted. Fourth, the magnitude of Cohen's influence of d of 2.91 showed a very large treatment effect.

DISCUSSION

Interpretation of Key Findings

The results showed a significant and huge improvement in lower passing skills after the drill variety program over 12 meetings. The question that needs to be answered is not just whether the program has an effect, the statistical test has answered it, but why the influence appears to be so large and how these findings are placed in the literature map. The following three mechanisms are the most plausible explanations.

The first mechanism comes from the quality of repetition. Before the treatment, club players practice independently and unprogrammedly, so the reps they perform are not always accompanied by correct technique and appropriate feedback. The research program changes these conditions: each repetition of the lower passing occurs in a clear training structure, with cues, targets, and the trainer's observation. According to the theory of motor skill acquisition, rapid and consistent feedback accelerates the learner's transition from the cognitive stage to the associative stage, where movement errors are systematically reduced (Magill & Anderson, 2021). An even increase in scores across subjects without a single student stagnating or declining indicates that the learning process works at all levels of initial ability.

The second mechanism is related to the integration of stimulation of physical conditions. Push-ups and pipe jumping exercises put an excess load on the arm-shoulder and leg muscles that play a direct role during ball contact, while sit-ups strengthen the abdominal muscles that stabilize the body when absorbing the

bounce of the ball. The findings of supporting studies reinforce this causal pathway: the strength of the leg and arm muscles has been shown to be related to the movement ability of volleyball techniques (Paramida et al., 2025; Reinaldi et al., 2025), and eye-hand coordination and balance are correlated with passing quality (Darmawati et al., 2025). Thus, the increase in score is not solely a product of technique repetition, but rather the combined result of neuromuscular adaptation and movement pattern formation that takes place simultaneously over 12 meetings.

The third mechanism lies in the variation of the form of the exercise itself. The movement scheme is best formed when learners experience a wide variety of tasks that demand adjustment of movement parameters (Magill & Anderson, 2021). The four variations of the pipe jump, push-up, cone run, and sit-up programs followed by passing force students to perform lower passes under different physical conditions: after jumping, after arm muscle fatigue, after moving quickly to change direction, and after core muscle fatigue. These conditions enrich the structure of the movement scheme and prepare students to execute passes in real game situations, where ball contact rarely occurs in ideal body conditions.

Big Influence

The magnitude of the effect size (Cohen's $d = 2.91$) demands careful explanation. This value exceeds the effects commonly reported in sports engineering practice studies, and at least three contextual factors explain it. First, the subject's starting point is very low: 78.6% of students are in the underperforming category with an average of 27.57, so the room for improvement is very large. In populations with more even or higher initial skills, the magnitude of the same effect is generally smaller. Second, there is the *novelty effect*: a varied exercise program with simple tools of pipes, cones, balls is a new experience for students who have been practicing without a program, so that their motivation and engagement increase sharply during the treatment period. Characteristics of Generation Z who like concrete challenges and instant feedback (Jannah, 2024; Hayati, 2024) makes this novelty effect even stronger. Third, there is a compression of the distribution in the post-test of the lowest score rising from 20 to 32, while the highest score rises

from 37 to 49 which indicates that the treatment closes the gap between students and shifts the entire distribution upwards, not just improving the lower group.

The design limitations of one group still need to be taken into account when interpreting the magnitude of the effect. Without the control group, the contribution of maturation, test repeats, or routine exercises outside the program cannot be completely ruled out. However, three pieces of evidence mitigate these concerns: improvements occurred uniformly in all subjects by a minimum margin of 4 points over a short duration of three weeks; no other structured training programs ran in parallel during the study period; and the magnitude of the increase far exceeded what is commonly attributed to the effects of repeated tests in such a narrow time span.

CONCLUSION

⁶ This study aims to analyze the effect of drill practice variations on improving lower passing skills in students of the UPT Volleyball Club of SMPN 2 Ulaweng. Based on the results of the analysis of pre-test and post-test data of 14 students who participated in the treatment program of 12 meetings, the conclusions are described as follows.

First, a variety of drill exercises that integrate the repetition of the bottom passing technique with the stimulation of the physical condition of pipe jumping, push-ups, cone runs, and sit-ups was shown to have a positive and significant effect on improving the bottom passing skills. The effect was shown by the t-count value of 10.807 which exceeded the t-table of 2.160 ($df = 13$; $\alpha = 0.05$) with a significance of $0.000 < 0.05$, so an alternative hypothesis was accepted.

Second, the amount of skill improvement was large and evenly distributed across all subjects. The average score increased from 27.57 in the pre-test to 37.86 in the post-test, equivalent to an increase of 10.29 points or 37.32%, with the magnitude of Cohen's d of 2.91 which was classified as a very large effect. Fourteen students experienced an increase without exception, with a difference range of 4 to 16 points.

Third, there was a substantial shift in the distribution of ability categories. In the pre-test, 78.6% of students were in the poor category and 21.4% in the adequate

category; after the treatment, 78.6% of students were in the adequate category and 21.4% in the good category, with no more students in the poor category. This shift shows that varied training programs are effective in improving basic engineering skills in populations with low initial skill backgrounds.

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