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The Effect of the Teams Games Tournament (TGT) Type Cooperative Learning Model on the Learning Outcomes of Volleyball Passing for Elementary School Students

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ABSTRACT
Backgroud: This study examined the effect of the Teams Games Tournament (TGT) cooperative learning model on volleyball passing learning outcomes among fifth-graders at UPT SPF SD Inpres Bitoa
Methods: Using a quasi-experimental quantitative method with an unequal control group pretest-posttest design. Forty students from two intact classes (20 in the experimental group taught with TGT and 20 in the control group taught with conventional instruction) completed four treatment encounters. Underhand and overhand passing were measured separately with a 60-second wall passing test, and data were analyzed using Shapiro-Wilk and Levene tests, paired and independent t-tests, Mann-Whitney test, ANCOVA, d Cohen, and partial eta squares.
Results: The two groups were equal at the baseline. At posttest, the experimental group outperformed the control group in underhand passing (22.00 vs 15.55 successful passing; mean difference 6.45, 95% CI 4.70–8.20, d Cohen = 2.36) and overhand passing (19.00 vs 13.10; mean difference 5.90, 95% CI 4.40–7.40, d = 2.51), and gain scores differed significantly between groups ($p < 0.001$ for both skills). ANCOVA's assumptions about homogeneous regression slopes were not met, so the conclusion depended on post-test comparisons and gain scores.
Conclusions: These findings suggest that TGT is associated with greater improvements in passing skills, although the use of one whole class per group limits cause-and-effect conclusions. Physical education teachers may consider TGT to structure practice time and peer feedback in volleyball lessons.

Keywords: Cooperative learning; Team game tournament; Volleyball; Underhand pass; Overhand pass; Elementary school student.

INTRODUCTION

Physical education learning in elementary school plays an important role in developing students' motor skills, comprehension of movements, and active participation in sports activities (Arga & Fitri, 2025). The success of learning is determined not only by the mastery of the material by the teacher, but also by the selection of a learning model that is in accordance with the characteristics of the students and the competencies to be achieved. Sports skills require adequate practice opportunities, repetition of movements, feedback, and active involvement during the learning process. In this context, cooperative learning is one of the relevant approaches because it encourages students to learn together, exchange knowledge, and take responsibility for the group learning process (Arba et al., 2025, 2026; Saleh, 2024).

(Bores-García, Hortigüela-Alcalá, Fernández-Río, et al., 2021), through a systematic review of cooperative learning research in physical education, shows that this approach has been studied in a variety of learning contexts, including sports skills, motor skills, motivation, and social interaction. However, the authors also highlight the need for a more structured and consistent implementation of cooperative learning. In line with that, a meta-analysis (Boke &

Aygun, 2025) found that cooperative learning has a positive influence on physical education learning outcomes in the physical, cognitive, affective, and social domains. The findings provide an empirical basis for examining the application of cooperative models in sports skills learning more specifically.

One of the physical education materials that requires the mastery of specific motor skills is the game of volleyball, especially the lower passing and upper passing skills. Lower passing is used to receive and control the ball through the forearm plane, while upper passing is done through the touch of the fingers to direct the ball in a controlled manner. Both skills require movement coordination, precise body position, touch regulation of the ball, and the ability to adjust movements to the direction the ball is coming. For elementary school students, mastering these skills requires gradual learning accompanied by demonstrations, repetitive exercises, and feedback. Learning that provides limited practice opportunities has the potential to make students less experience to correct movement mistakes. Therefore, learning models that encourage active participation, cooperation, and practice opportunities need to be considered to support the achievement of volleyball passing learning outcomes (Presidential Instruction, 2023; Irfan et al., 2024; Suwardi, 2024; Suwardi et al., 2026).

One model that can be used to achieve this goal is Teams Games Tournament (TGT) type cooperative learning. This model combines teamwork, games, and tournaments as part of the learning process. Through these activities, students can learn techniques with group members, gain opportunities to practice movements, and participate in competitions designed according to learning objectives. (Casey & Quennerstedt, 2020a) emphasizes the importance of understanding cooperative learning as an educational process that involves shared experiences, interactions, and development, rather than simply dividing students into groups. Meanwhile, (Schulze & von Huth, 2022a), through a systematic review of the structure of cooperative learning in physical education, examines the benefits of such approaches on physical, social, behavioral, and psychological aspects. These two studies provide a foundation that the success of cooperative learning depends on the quality of the learning design and learning experiences that are built. In the application of TGT to volleyball learning, elements of games and tournaments need to be directed to strengthen mastery of techniques, not just encourage students to win competitions.

Previous research has examined the use of TGT and learning media to support volleyball passing learning in elementary schools. (Iswahyudi et al., 2022) developed a game card media combined with a TGT model for volleyball passing materials in grade V elementary school students. The research used a research and development approach to assess the feasibility and practicality of learning media. Its contribution lies in the development of learning tools that support the implementation of TGT, but the focus is different from experimental testing of the effect of TGT on skill learning outcomes.

Furthermore, (Muzaedi, 2023) tested the effect of TGT on the cognitive and psychomotor learning outcomes of lower passing in elementary school students with a quasi-experimental design involving 51 students in the experimental and control groups. The results reported significant differences in learning outcomes between the two groups. The findings provide more direct evidence regarding the potential of TGT to support lower passing learning outcomes. However, the study has not specifically answered whether the application of the same model provides similar results in upper passing or in different school contexts.

More recent evidence was presented by (Rijal et al., 2025a), which examined the application of modified plastic ball-assisted TGT to improve volleyball bottom passing skills in 20 elementary school grade V students. Using a classroom action research design, the study reported an increase in the percentage of learning completeness from about 50–70% in the first cycle to 85–90% in the second cycle. These results indicate that the application of TGT accompanied by media adjustments has the potential to support bottom passing learning. However, the classroom action research design did not directly separate the influence of TGT from the contribution of ball modification, action repetition, and other learning factors. In addition, the research focus on the bottom passing limits its use as direct evidence to conclude

the effectiveness of TGT on the bottom passing and the upper passing simultaneously. The study (Pohan, 2026) also discusses the influence of TGT on volleyball bottom passing skills, but the context of the students studied is junior high school students. These differences in education levels show the importance of testing the application of the model according to the developmental characteristics of elementary school students.

Although a number of studies provide positive indications, the effectiveness of cooperative and game-based learning models cannot be assumed to be uniform across all skills and educational contexts. (Saha, 2026), in a systematic review of 17 studies on collaborative and game-based approaches in physical education, found variation in outcomes in motor skills and game performance. Some studies reported improvements, some showed mixed outcomes, while others found no advantages of motor learning over comparative approaches. The authors identified the heterogeneity of study design, participant characteristics, pedagogical approaches, and measurement instruments as limiting factors limiting the comparison of outcomes. These findings are in line with (Bores-García, Hortigüela-Alcalá, Fernández-Río, et al., 2021), which highlight the need for consistent implementation of cooperative learning and careful evaluation. Thus, the general evidence on the benefits of cooperative learning needs to be complemented by testing that specifically assesses the TGT model, the skills that are targeted, and the characteristics of the students involved.

These needs are relevant to the learning conditions at UPT SPF SD Inpres Bitoa. Based on the initial observation data available, as many as 20 out of 40 students observed have not reached the Learning Goal Achievement Criteria (KKTP) in volleyball passing learning. Thus, the percentage of students who have not reached the KKTP is 50%. In the implementation of learning, teachers use demonstration, lecture, and practice methods. The school has five volleyballs, while the field conditions are relatively good. This data shows that there is still a large proportion of students who have not reached the set learning criteria. These conditions are the basis for examining alternative learning models that can provide a training structure, group interaction, and directed practice opportunities. The availability of five balls and a good court also needs to be considered in planning group divisions, practice turns, and game and tournament management. However, these preliminary observations do not prove that the learning method used or the number of balls available is the cause of the KKTP has not been achieved. The relationship needs to be evaluated through research with clear learning and assessment procedures.

Based on the synthesis of previous research, the gap in this study lies in the need for empirical evidence regarding the influence of the TGT type cooperative learning model on the learning outcomes of lower passing and volleyball above passing in elementary school students in the context of UPT SPF SD Inpres Bitoa. The research (Iswahyudi et al., 2022) focuses on the development of card-based learning media, Muzaedi et al. (2023) examines the cognitive and psychomotor learning outcomes of lower passing, while (Rijal et al., 2025b) examines the application of modified ball-assisted TGT through classroom action research. The research (Pohan, 2026) adds evidence on lower passing at the junior high school level. Meanwhile, the studies (Boke & Aygun, 2025), (Schulze & von Huth, 2022a), and (Saha et al., 2026) provide a broader foundation on cooperative learning and game-based approaches, but do not specifically answer research questions in these school contexts. The synthesis shows the need for research that specifically assesses the learning outcomes of both types of passing in elementary school students, taking into account the research design, assessment instruments, and characteristics of learning implementation.

The novelty of this research is positioned as a contextual empirical contribution, namely testing the application of the TGT model to the learning outcomes of lower passing and top volleyball passing in elementary school students at UPT SPF SD Inpres Bitoa. This study does not claim that the use of TGT in volleyball learning is completely new, because the application of the model has been studied in previous research. The expected contribution is the availability of more specific evidence regarding the learning outcomes of both passing skills in the context of

students and the learning conditions studied. Practically, the results of the study are expected to be considered for physical education teachers in choosing the appropriate learning model to develop basic volleyball skills. Therefore, this study aims to determine the influence of the Teams Games Tournament (TGT) type cooperative learning model on volleyball passing learning outcomes, which includes lower passing and upper passing, in elementary school students at UPT SPF SD Inpres Bitoa, which will be held in June 2026.

METHODS

This study uses a quantitative approach with quasi-experiment methods and a pretest-posttest nonequivalent control group design to analyze the influence of the TGT type cooperative learning model on the learning outcomes of volleyball passing students in elementary school. The study involved two groups, namely the experimental group (O_1 X O_2) that obtained learning using the TGT model and the control group (O_3 C O_4) that followed conventional learning. O_1 and O_3 are the initial measurements of learning outcomes, X is the treatment using the TGT model, C is conventional learning, while O_2 and O_4 are the final measurements after learning. This study uses classes that have been formed so that students are not randomly allocated individually. Therefore, differences in initial abilities and class characteristics are observed in the analysis and interpretation of the research results.

The research was carried out at UPT SPF SD Inpres Bitoa in June 2026. The subjects of the study were grade V students from classes V-A and V-B. The research consisted of six meetings, namely one pretest meeting, four treatment meetings, and one posttest meeting. In the first meeting, the two groups took a pretest to measure the ability of initial lower passing and upper passing. Furthermore, the experimental group followed learning using the TGT model, while the control group followed conventional learning for four meetings. At the last meeting, the two groups took a posttest with the same measurement procedure as the pretest. The duration of each meeting was adjusted to the allocation of physical education learning time at school, and the materials, learning objectives, duration, and learning facilities were tried to be comparable in both groups so that the main difference lay in the learning model applied.

The research population was all students of class V UPT SPF SD Inpres Bitoa. The study participants amounted to 40 students from two classes, namely class V-A with 20 students and class V-B with 20 students. Class V-B was designated as an experimental group (7 male students and 13 female students), while class V-A was designated as a control group (8 male students and 12 female students). Participation criteria included students enrolled in classes V-A or V-B, participating in physical education learning, obtaining permission to participate in research according to school procedures and parental or guardian consent, and being able to take part in a series of pretests, treatments, and posttests. Because the research only involved one class in each group, the initial abilities of both groups were examined through a pretest and the results of the study were interpreted taking into account the possible influence of class characteristics.

Learning in the experimental group is carried out through five stages of TGT. First, class presentation, where the teacher explains the learning objectives, the material for the bottom and upper passing, and demonstrates the implementation technique. Second, the formation of teams, where students are divided into heterogeneous teams of about 4–5 students by considering the initial abilities and characteristics of the students. Third, learning in teams (team study), where students practice lower passing and upper passing with team members, with the opportunity to practice, observe the movements of friends, and provide feedback according to the teacher's direction. Fourth, games and tournaments, where students participate in passing skills games or tournaments based on established rules and assessment criteria to encourage active participation, cooperation, and responsibility of team members. Fifth, score calculation and team recognition, i.e. scores are recorded based on predetermined criteria and awards are given to teams according to learning outcomes and rules. In the control group, learning was carried out through teacher explanations, demonstration of passing techniques, classical exercises, and corrections to student

movements, with comparable materials and objectives but without the structure of TGT games and tournaments.

The research instrument was a wall passing test to measure the skills of the bottom and the top passing separately, which was carried out during the pretest and posttest using the same procedure in both groups. Students stood behind a line 2 meters away from the wall and each type of passing was tested for 60 seconds, preceded by a brief explanation and familiarization that did not count as a score. In the bottom passing test, students passed using both forearms towards the wall, while in the upper passing test, students used the fingers of the hand. A pass is declared successful if the ball hits the wall after it has been done using a technique that matches the type of test and can be played again before touching the floor. Balls that touch the floor before being successfully replayed or balls that are played with inappropriate techniques are not counted as successful passes, and students can pick up the falling ball and continue the test while time is still available. The raw score is determined based on the number of successful passes for 60 seconds and is recorded separately for the bottom and top passes.

Data were analyzed using descriptive statistics (mean, standard deviation, minimum value, and maximum) for each skill separately. Data normality was checked with the Shapiro–Wilk test and the homogeneity of variance with the Levene test. Initial ability equivalence was tested by independent sample t-test and Mann–Whitney test on pretest scores. Changes from pretest to posttest within each group were analyzed by paired t-test and Wilcoxon signed-rank test. Intergroup comparisons were performed by Welch t-test and Mann–Whitney test on posttest scores and gain scores, as well as covariance analysis (ANCOVA) with pretest scores as covariates after checking for residual normality, linearity, and regression slope homogeneity. Effect sizes were reported with Cohen's d (and Hedges' g) and partial squared eta (ηp^2) with a 95% confidence interval (IK). Normalized gain (N-gain) analysis was not calculated because the maximum test score was not set before data collection. The analysis was performed using Python (SciPy and statsmodels) with a significance level of 0.05.

RESEARCH RESULTS

The results of the Shapiro–Wilk normality test and the Levene homogeneity test for the bottom passing and top passing scores are presented in Table 1.

Table 1. Shapiro–Wilk Normality and Levene Homogeneity Test Results

Data Groups	Bottom Passing (Sig.)	Top Passing(Sig.)	Remarks
Pretest experiment	0,484	0,523	Normal
Posttest experiment	0,837	0,542	Normal
Pretest control	0,468	0,523	Normal
Posttest control	0,756	0,440	Normal
Levene, intergroup pretest	0,889	1,000	Homogeneous
Levene, posttest antarkelompok	0,189	0,336	Homogeneous

Based on Table 1, the significance value of the Shapiro–Wilk test for all pretest and posttest data is greater than 0.05 so that the data is declared to be normally distributed, and the variance between groups is homogeneous in both the pretest and posttest. The independent sample t-test showed no difference in pretest between the experimental and control groups, either in the lower passing, $t(38) = 0.07$; $p = 0.941$, or the upper passing, $t(38) = 0.00$; $p = 1{,}000$, and the Mann–Whitney test gave the same conclusion ($p = 0.956$ and $p = 1{,}000$). Thus, both groups departed from equal initial ability.

Descriptive statistics of pretest and posttest results are presented in Table 2 and Figure 1.

Table 2. Descriptive Statistics of Pretest and Posttest Results (Number of Successful Passes per 60 Seconds)

Skills	Groups	*n*	Pretest *M* (*SB*)	Posttest *M* (*SB*)	Min–Max pre/post	Difference *M* (*SB*)	Increase (%)
Bottom Passing	Experiment (TGT)	20	12,55 (2,11)	22,00 (3,13)	9–16 / 17–28	9,45 (1,15)	75,3
Bottom Passing	Control	20	12,50 (2,16)	15,55 (2,26)	9–16 / 12–20	3,05 (0,22)	24,4
Top Passing	Experiment (TGT)	20	10,65 (1,66)	19,00 (2,62)	8–14 / 15–24	8,35 (1,04)	78,4
Top Passing	Control	20	10,65 (1,66)	13,10 (2,05)	8–14 / 10–17	2,45 (0,51)	23,0

In the pretest, the average of the two groups was almost identical in both skills. In the posttest, the experimental group had a higher average, namely 22.00 compared to 15.55 for the bottom passing and 19.00 compared to 13.10 for the upper passing. The average passing below the experimental group increased by 9.45 passing (75.3%), while the control group increased by 3.05 passing (24.4%). In the upper passing, the experimental group increased by 8.35 passing (78.4%) and the control group increased by 2.45 passing (23.0%). The average comparison of pretest and posttest is presented in Figure 1.

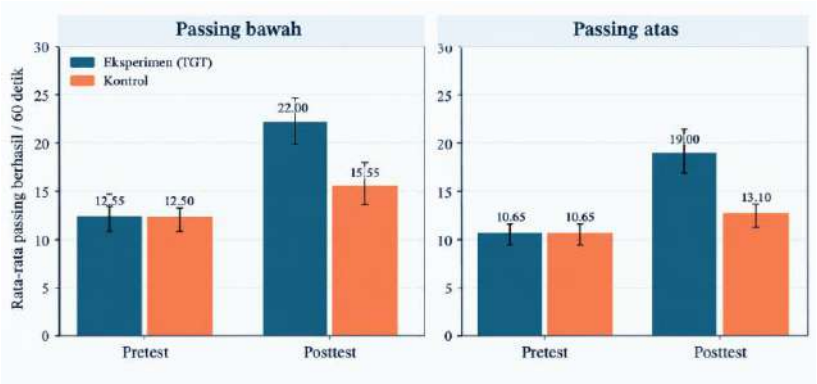


Figure 1. Comparison of Average Lower Passing and Upper Passing in Pretest and Posttest (error bar = standard deviation)

The paired t-test results for the change from pretest to posttest within each group are presented in Table 3.

Table 3. Paired T-Test Results (Posttest – Pretest)

Skills	Groups	Difference *M*	I 95%	*t*(19)	*p*
Under Passing	Experiment (TGT)	9,45	8,91–9,99	36,88	< 0.001
Under Passing	Control	3,05	2,95–3,15	61,00	< 0.001
Top Passing	Experiment (TGT)	8,35	7,86–8,84	35,91	< 0.001
Top Passing	Control	2,45	2,21–2,69	21,47	< 0.001

Both groups improved significantly on both skills, and the Wilcoxon signed-rank test gave consistent results (all $p < 0.001$). Because the control group also improved significantly, the significance within the group could not be used as a basis for concluding TGT superiority, so the conclusions rested on the intergroup comparison in Table 4.

Comparisons between groups through posttest, difference scores, and ANCOVA are presented in Table 4.

Table 4. Intergroup Comparison (Experiment – Control)

Analysis	Under Passing	Top Passing
Average difference posttest (IK 95%)	6,45 (4,70–8,20)	5,90 (4,40–7,40)
Uji-t Welch posttest	$t(34.6) = 7.47$; $p < 0.001$	$t(35.9) = 7.94$; $p < 0.001$
Mann–Whitney posttest	$U = 383$; $p < 0,001$	$U = 387$; $p < 0,001$
Cohen's *d* posttest	2,36	2,51
Average *gain difference* (IK 95%)	6,40 (5,86–6,94)	5,90 (5,37–6,43)
Uji-t Welch *gain*	$t(20.4) = 24.51$; $p < 0.001$	$t(27.7) = 22.78$; $p < 0.001$
Mann–Whitney *gain*	$U = 400$; $p < 0,001$	$U = 400$; $p < 0,001$
ANCOVA: group effect (a)	$F(1, 37) = 944,99$; $p < 0,001$; $\eta p^2 = 0,962$	$F(1, 37) = 1217,44$; $p < 0,001$; $\eta p^2 = 0,971$
Corrected posttest average (TGT vs control)	21,97 vs 15,58	19,00 vs 13,10

(a) The assumption of regression slope homogeneity is not met; the ANCOVA results are interpreted as supportive.

The experimental group obtained a higher posttest than the control group on the lower passing (6.45 passing difference) and the upper pass (5.90 passing difference), and the difference was significant according to both parametric and nonparametric tests. The U = 400 value on the Mann–Whitney test for the gain score was the maximum possible value for two groups of 20 students, meaning that each student in the experimental group experienced a greater improvement than the entire control group students on both skills. Examination of ANCOVA assumptions showed normal distributed residual (p = 0.946 for the bottom passing and p = 0.393 for the upper passing), but the regression slope homogeneity assumption was not met, i.e. the pretest interaction × the group was significant in the lower passing, $F(1, 36) = 29.96$; $p < 0.001$, and the upper passing, $F(1, 36) = 13.26$; $p = 0.001$, and the residual variance of the lower passing differed between groups (Levene p = 0.047). Therefore, ANCOVA was reported as a supporting analysis. The results remained in line with the other analyses, with a corrected difference of 6.39 for the lower pass (95% IK 5.97–6.81) and 5.90 for the upper pass (95% IK 5.56–6.24).

The effect size of the difference in posttest between groups was very large, namely d = 2.36 for the lower pass and d = 2.51 for the upper pass (after Hedges correction, g was about 2.31 and 2.46 respectively), while ηp^2 in ANCOVA was 0.962 and 0.971. The effect size on the gain score was even larger (d = 7.75 and 7.20) because the standard deviation of the gain of the control group was very small (0.22 and 0.51); this value should not be interpreted literally and read together with the mean difference and its confidence interval. N-gain was not calculated because the maximum score of the test was not set before data collection.

DISCUSSION

The results of this study showed that after four treatment meetings, the group that studied with TGT achieved a much higher number of successful passes than the conventional group on the lower and upper passes, with the same initial ability. Thus, the results of this study support the hypothesis that TGT has a positive effect on the learning outcomes of lower passing and passing for grade V students in the studied schools.

These findings are in line with (Muzaedi et al., 2023) who reported significant differences in lower passing learning outcomes between the TGT and control groups in elementary school students, as well as with (Muhammad Taufiq Hidayat., 2019.) who reported an increase in the completeness of learning lower passing after the implementation of TGT with a modified ball. This study adds to the evidence on upper passing, which in these studies has not been tested, so that similar improvements in both skills suggest that the benefits of TGT are not limited to one technique. These results are also consistent with a meta-analysis (Boke et al., 2025) that found a positive influence of cooperative learning on physical education learning outcomes, including the physical domain, as well as with (Pohan et al., 2026) which examined TGT in lower passing at the junior high school level.

Several mechanisms could be considered to explain these differences, but this study did not measure them directly so the following explanations are interpretive. First, the learning stages in teams and tournament games give students more opportunities to repeat movements and receive feedback from peers. This is relevant in the context of schools with only five volleyballs, as dividing students into small teams with structured practice turns can increase each student's active time compared to classical practice. Second, elements of game, team scores, and rewards can encourage team member involvement and responsibility, as emphasized by (Casey & Quennerstedt, 2020b) and (Schulze & von Huth, 2022b) that the value of cooperative learning depends on the design of the learning experience. Third, heterogeneous team composition allows students with better abilities to set examples and corrections for other members. In the control group, teachers provide demonstrations and corrections, but feedback per student is likely to be more limited.

The control group remained significantly improved, with about 3 passes for the bottom pass and 2–3 passes for the upper pass. This is natural because conventional learning consisting of demonstrations, exercises, and corrections still provides learning opportunities, and some of the improvement can also come from the effect of practice or familiarity with the test. Therefore, the value of this study lies in the difference in improvement between groups, not in the improvement within the experimental group alone. The increase in the experimental group was about three times the increase in the control group. It should also be noted that (Mulyaningsih et al., n.d.) and (Bores-García, Hortigüela-Alcalá, Fernandez-Rio, et al., 2021) show that the results of cooperative and game-based approaches vary between studies, so the strong results in this study should be understood as results on a particular context, instrument, and duration of treatment, not as evidence that TGT will always excel. This study also did not test the cause of the KKTP not being achieved in the initial observation, so the suspicion that the method or number of balls was the cause could not be concluded from this data.

The study has a number of limitations. First, the quasi-experimental design with one class in each group makes the influence of the TGT model inseparable completely from class characteristics, differences in classroom atmosphere, and other events during the study; pretest equivalence reduces, but does not eliminate, the possibility of differences in unmeasured factors. Second, the sample size is small (20 students per group) and the study was conducted in a single school so generalizations are limited. Third, the assumption of regression slope homogeneity in ANCOVA is not met so that the main conclusions rely on posttest analysis, gain scores, and nonparametric tests, and the very small variation of the increase in control groups makes the test statistics and gain-based effect sizes so large that they need to be read carefully. Fourth, the validity and reliability of the pass-to-wall test and the consistency of the assessors need to be reported separately in order for the quality of the measurements to be assessed.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results and discussion, it can be concluded that the application of the Teams Games Tournament (TGT) type cooperative learning model during four meetings had a positive effect on the learning outcomes of bottom passing and volleyball passing of class V UPT SPF SD Inpres Bitoa. After treatment, the experimental group achieved an average of 22.00 bottom passes

and 19.00 upper passes per 60 seconds, higher than the control group (15.55 and 13.10), with a difference of 6.45 and 5.90 passes that were statistically significant ($p < 0.001$) and large effect size ($d = 2.36$ and 2.51). The increase in the experimental group (9.45 and 8.35 passing) was also about three times the increase in the control group (3.05 and 2.45 passing), and all students of the experimental group increased more than the students of the control group. Thus, the research objectives were achieved. Because this study used one class in each group without randomization, this conclusion is interpreted as strong evidence of a relationship between the implementation of TGT and improved learning outcomes in the context of this school, rather than as generally accepted causal evidence.

For physical education teachers, the TGT model can be considered for learning to lower and top passing volleyballs, especially in schools with a limited number of balls, by dividing students into small heterogeneous teams, organizing practice turns in a structured manner, and designing games and tournaments to focus on mastering technique rather than just winning. For schools, these results can be considered in physical education learning planning and the use of available resources. For subsequent researchers, it is recommended to use more than one class in each group or class randomization, involving more than one school and a larger sample count, setting a maximum test score from the beginning so that N-gain can be calculated, reporting the validity and reliability of instruments and suitability between assessors, adding retention tests to assess the resilience of learning outcomes, and measuring learning processes, such as active practice time and student engagement, to test suspected mechanisms.

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