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The Effect of the Jigsaw Cooperative Learning Model on Learning Outcomes in Underhand Volleyball Passing Among Grade X Students at SMA Negeri 15 Palembang

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Abstract

Objectives. The main problem addressed in this study is the low learning outcomes in volleyball underhand passing among Grade X students at SMA Negeri 15 Palembang. The objective of this research is to investigate the effect of the cooperative learning model of the Jigsaw type on improving students' learning outcomes in volleyball underhand passing. This study aims to contribute to the field of physical education by evaluating the effectiveness of an interactive and student-centered learning model and providing insights into alternative teaching strategies to enhance students' practical performance.

Materials and Methods. This study employed a quantitative research approach with an experimental method using a one-group pretest-posttest design. The population consisted of all Grade X students at SMA Negeri 15 Palembang, with a sample of 34 students selected through cluster random sampling.

The data collection technique involved administering a volleyball underhand passing skills test both before (pretest) and after (posttest) the application of the Jigsaw cooperative learning model. The data were analyzed using statistical techniques including normality and homogeneity tests, followed by a paired sample *t*-test to determine significant differences between pretest and posttest scores. The statistical analysis was conducted using SPSS version 2

Results. The results showed a notable improvement in students' learning outcomes. The average pretest score was 70.50, which increased to 81.91 in the posttest after the implementation of the Jigsaw model. The results of the paired sample *t*-test revealed a significance value of 0.000 ($p < 0.05$), indicating a statistically significant difference between pretest and posttest scores.

Conclusions. Based on the data analysis and findings, it can be concluded that the cooperative learning model of the Jigsaw type has a significant positive effect on improving underhand passing skills in volleyball among Grade X students at SMA Negeri 15 Palembang. This model promotes active student participation and collaborative learning, which enhances both understanding and skill performance. Therefore, the Jigsaw model can be considered an effective alternative teaching strategy in physical education settings.

Keywords: Jigsaw Cooperative Learning Model, Learning Outcomes, Underhand Passing, Volleyball

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Introduction

(Cooper et al., 2024) Physical education, according to is a structured learning process that incorporates physical activities to promote physical, cognitive, and emotional development. It is often misunderstood as merely physical activity, but it also encompasses understanding body function and developing motor skills and coordination. The key components of physical education include competencies to be achieved by students and the integrated concept of learning "through" and "about" movement. Improving the quality of learning and teaching processes remains one of the critical challenges in physical education. To address this, the use of instructional models has been proposed, including cooperative learning strategies like the Jigsaw model (Riyanto & Kuswoyo, 2019).

(Riyoko, 2019) Cooperative learning, as described is a student-centered teaching approach that organizes students into diverse groups, requiring collaboration and accountability. (Abduh et al., 2024)The Jigsaw method, a well-known form of cooperative learning, encourages students to actively engage with the material and with each other through expert and home group discussions. Its structure allows students to share knowledge and support one another in understanding complex concepts, which enhances classroom interaction and collective problem-solving (Flynn et al., 2017).

Learners play a central role in the educational process, not only in acquiring knowledge and skills but also in developing character, personality, and social competencies. Teachers, especially in senior high schools, are responsible for guiding students by delivering effective instruction and fostering a motivating learning environment (Maemunawati & Alif, 2020). An ideal teacher also functions as a role model, demonstrating positive behavior and professionalism. In the context of physical education, especially during online and in-person instruction, teachers must be able to effectively communicate material and maintain students' interest and participation (Acar, 2023).

According to Agustiawan et al. (2021), volleyball is a popular team sport involving strategic movement and technical skill. The game begins with a serve and involves six players on each team aiming to pass the ball over the net. One of the most fundamental and frequently taught skills in volleyball is the underhand passing technique, which is essential for controlling and directing the ball. As noted by Yasmaun et al. (2023), this skill involves coordinated body movements—such as correct foot placement, body positioning, and arm usage—that must be performed precisely to achieve effective results.

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However, observational data from SMA Negeri 15 Palembang revealed that many Grade X students struggle with underhand passing, resulting in poor learning outcomes. Although the facilities and equipment are adequate, many students fail to demonstrate the correct technique and exhibit low engagement during practice. These issues contribute to achievement scores that fall below the expected standard.

To address this problem, it is necessary to apply innovative instructional approaches that promote active learning. The Jigsaw cooperative learning model is considered an effective alternative to traditional methods, encouraging students to work together in structured groups to master volleyball techniques. This model not only facilitates peer teaching but also motivates students to evaluate and improve their own skills through collaboration and observation.

Therefore, this study aims to examine the effect of the Jigsaw cooperative learning model on the learning outcomes of underhand passing in volleyball among Grade X students at SMA Negeri 15 Palembang. The central hypothesis of this research is that the Jigsaw model will significantly improve students' technical skills and learning performance in physical education.

Materials and Methods

Study Participants.

(Sugiyono, 2012)This study involved Grade X students from SMA Negeri 15 Palembang, South Sumatra, Indonesia. The total population consisted of 183 students (86 male and 97 female), enrolled in six different science classes. The sample was selected using cluster random sampling, wherein one class was randomly drawn from six available clusters. The selected sample class, X IPA 2, consisted of 34 students. The inclusion criteria required that students be actively participating in physical education classes and capable of performing volleyball skills, particularly underhand passing. There were no specific exclusion criteria. The sampling technique ensured a representative distribution of students in terms of gender and academic characteristics (Arikunto, 2010).

Study organization.

This was a quantitative experimental study using a one-group pretest-posttest design. The primary aim was to assess the effectiveness of the Jigsaw cooperative learning model on improving underhand passing skills in volleyball. The study was conducted over a period of six weeks in February 2025 at SMA Negeri 15 Palembang.

The experimental procedure was as follows:

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1. Pre-test phase: Participants completed an underhand passing skill test to establish a baseline performance score.
2. Treatment phase: The Jigsaw cooperative learning model was applied during volleyball instruction for four consecutive physical education sessions. Students were assigned to diverse small groups and engaged in peer-teaching and group discussions focused on volleyball techniques.
3. Post-test phase: After the intervention, students repeated the same underhand passing skill test to assess improvement.

Data Collection Instruments

To assess learning outcomes, three domains were measured:

1. Psychomotor skills: A performance test on underhand passing, using observation checklists and scoring rubrics based on movement quality and accuracy.
2. Cognitive skills: A five-item written test assessing conceptual understanding of underhand passing.
3. Affective domain: An observation-based checklist assessing sportsmanship, cooperation, enthusiasm, honesty, confidence, and respect during the learning process.

Scores from each domain were combined using the following weighted formula: Final Score = (Cognitive × 30%) + (Affective × 20%) + (Psychomotor × 50%).

Statistical analysis.

The collected data were processed using **SPSS version 26**. The analysis included:

1. **Normality Test**: The Lilliefors test was used to determine whether the data followed a normal distribution.
2. **Hypothesis Testing**: A **paired sample t-test** was conducted to compare pretest and posttest scores and assess the statistical significance of improvement. The significance level was set at $\alpha = 0.05$.

The test statistic was computed using the formula:

$$t = \frac{\bar{X} - \mu_0}{s/\sqrt{n}}$$

Where:

1. X¯\bar{X}X¯ = sample mean difference
2. μ0\mu_0μ0 = population mean difference (assumed to be 0)
3. sss = standard deviation of the sample

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4. nnn = number of participants

The null hypothesis (H_0) was rejected if tcalculated>ttablet_{calculated} > t_{table}tcalculated>ttable, indicating a significant effect of the Jigsaw learning model on volleyball passing skills

Results

This study aimed to determine the effectiveness of the Jigsaw cooperative learning model in improving underhand passing skills in volleyball among Grade X students at SMA Negeri 15 Palembang. The results are presented below, including descriptive statistics, frequency distributions, and statistical analyses conducted using SPSS version 26.

Descriptive Statistics Pretest Results

The initial measurement of students' volleyball underhand passing skills was conducted through a pretest that assessed three domains: psychomotor, affective, and cognitive. Based on the pretest scores of 34 students, the average score was 70.50, with a minimum score of 54 and a maximum of 87 (Table 1). The standard deviation was 9.563, indicating a moderate spread in student performance prior to the intervention.

Table 1. Pretest Score Statistics

N	Minimum	Maximum	Mean	Std. Deviation
34	54	87	70.50	9.563

The frequency distribution (Table 2) shows that 44% of students were categorized as "Fair," 35% as "Poor," and 21% as "Good." None of the students reached the "Very Good" category at this stage.

Table 2. **Frequency Distribution of Pretest Scores**

Score Interval	Category	Frequency	Percentage
< 59	Very Poor	0	0%
60 – 69	Poor	12	35%
70 – 79	Fair	15	44%
80 – 90	Good	7	21%
> 91	Very Good	0	0%

Posttest Results. After implementing the Jigsaw cooperative learning model during four instructional sessions, students completed the same volleyball passing test as a posttest. The average score significantly increased to 81.91, with a standard deviation of 8.00, a minimum score of 64, and a maximum score of 100 (Table 3).

Table 3. Posttest Score Statistics

N	Minimum	Maximum	Mean	Std. Deviation
34	64	100	81.91	8.00

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The frequency distribution (Table 4) illustrates a notable improvement. 41% of students were categorized as "Good," 41% as "Fair," and 15% reached the "Very Good" category. Only one student remained in the "Poor" category.

Table 4. Frequency Distribution of Posttest Scores

Score Interval	Category	Frequency	Percentage
< 59	Very Poor	0	0%
60 – 69	Poor	1	3%
70 – 79	Fair	14	41%
80 – 90	Good	14	41%
> 91	Very Good	5	15%

Normality Test. To ensure the data met the assumptions for parametric testing, the Shapiro-Wilk normality test was applied. The results indicated that both pretest and posttest scores were normally distributed, with significance values of 0.275 and 0.495, respectively (Table 5).

Table 5. Shapiro-Wilk Normality Test

Variable	Statistic	df	Sig.
Pretest	0.962	34	0.275
Posttest	0.971	34	0.495

Hypothesis Testing (Paired Sample t-Test). To determine the statistical significance of the learning gains, a paired sample t-test was conducted. The results revealed a mean difference of -11.41 between pretest and posttest scores, with a t-value of 10.708 and a significance level (p-value) of 0.000 (Table 6). Since the calculated *t* exceeds the critical *t-table* value of 2.034 at a 95% confidence level (df = 33), the result is statistically significant.

Table 6. Paired Sample t-Test Results

Pair	Mean Difference	Std. Deviation	Std. Error Mean	t	df	Sig. (2-tailed)
Pretest - Posttest	-11.411	6.213	1.065	10.708	33	0.000

Summary of Results. The implementation of the Jigsaw cooperative learning model significantly improved students' underhand passing skills in volleyball. The mean score increased by 11.41 points, and the shift in frequency distributions showed a transition from lower to higher performance categories. The findings validate the effectiveness of this model in enhancing students' learning outcomes in physical education settings.

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Discussion

This study examined the effectiveness of the Jigsaw cooperative learning model in enhancing students' underhand passing skills in volleyball. The findings revealed a statistically significant improvement in student performance following the intervention, confirming that the application of this learning model has a positive impact on motor skill acquisition in physical education. The average posttest score (81.91) was notably higher than the pretest average (70.50), and the paired sample *t*-test results (t = 10.708, Sig. = 0.000) demonstrated a clear and significant difference in learning outcomes.

The success of the Jigsaw model in this context can be attributed to its structured cooperative format, which promotes student accountability, interaction, and peer teaching. Each student becomes responsible for a portion of the material, contributing to group understanding and facilitating deeper learning. This aligns with the theoretical foundations of cooperative learning, where knowledge construction occurs through meaningful social interaction and collaboration.

The results of this study are consistent with prior research. For instance, Hamzah et al. (2019) found that the Jigsaw model improved psychomotor skills in gymnastic routines, while Sriyantin et al. (2018) reported increased performance in kicking and passing in soccer. Similarly, Affandy & Sudarso (2017) concluded that Jigsaw enhanced dribbling and passing skills. These studies, like the current research, highlight the model's effectiveness in promoting technical mastery in physical education settings.

From a pedagogical standpoint, the findings emphasize the importance of engaging, student-centered learning models in achieving higher learning outcomes. The Jigsaw approach not only fosters psychomotor development but also supports cognitive and affective growth by encouraging communication, leadership, and responsibility. Students learn from both their teacher and their peers, making the classroom environment more dynamic and participatory.

In practical terms, applying the Jigsaw model in volleyball instruction provides students with greater opportunities to master essential skills like underhand passing. It also allows educators to facilitate differentiated instruction and inclusive practices, as each group member contributes according to their ability and understanding. However, it should be noted that this model requires careful planning, time management, and monitoring to ensure all group members are actively involved.

Despite its advantages, some limitations exist. The model can be time-consuming and may place additional demands on teachers in terms of group management and lesson design.

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Additionally, in group-based assessments, accurately evaluating individual contributions remains a challenge.

Overall, the results confirm that the Jigsaw cooperative learning model is an effective instructional strategy for improving underhand passing skills in volleyball and has the potential to enhance learning in other sports-related subjects. It also demonstrates that well-designed collaborative approaches can significantly impact students' motivation, engagement, and skill performance in physical education.

Conclusions

Based on the data analysis and previous discussion, it can be concluded that the use of the Jigsaw cooperative learning model had a significant effect on improving underhand passing skills in volleyball among Grade X students at SMA Negeri 15 Palembang. The average pretest score was 70.50, while the posttest score increased to 81.91, indicating that the Jigsaw learning model effectively enhanced students' passing performance.

The normality test results confirmed that the data were normally distributed. Furthermore, the results of the paired sample *t*-test showed a calculated *t*-value of 10.708, which was greater than the critical *t*-table value of 2.034. The significance value (Sig. (2-tailed)) of 0.000 was below the threshold of 0.05, indicating a statistically significant difference between pretest and posttest scores.

Therefore, the alternative hypothesis (Ha) is accepted, suggesting that the implementation of the Jigsaw cooperative learning model has a significant positive effect on the improvement of volleyball underhand passing skills among students. These findings support the use of collaborative learning strategies in physical education to enhance student engagement and skill development.

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Conflict of interest

The author declares **no conflict of interest** regarding the publication of this study. All procedures and analyses were conducted objectively and without any financial, institutional, or personal influence that could affect the results or interpretation of the research.

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