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## **Effectiveness of a modified TGfU program in enhancing volleyball skills among elementary school students**

**Yuyun Ari Wibowo<sup>12\*</sup>, Sugiyanto<sup>1</sup>, Agus Kristiyanto<sup>1</sup>, Slamet Riyadi<sup>1</sup>**

<sup>1</sup>Sebelas Maret University, Indonesia,

<sup>2</sup>Universitas Negeri Yogyakarta, Indonesia

\*Corresponding Author: [yuyun\\_ariwibowo@uny.ac.id](mailto:yuyun_ariwibowo@uny.ac.id)

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### **ABSTRACT**

This research is aimed at determining the effectiveness of the modified TGfU volleyball learning model in enhancing the technical skills of male senior students at elementary schools. The research method used to test effectiveness was an experimental research method by comparing the modified TGfU volleyball learning model with traditional physical education classes typically taught by teachers at school. This research was conducted at Kepuh Elementary School with the subjects of 20 male senior students as the experimental group and Patalan Baru Elementary School using the same 20 male senior students as the control group. The instruments used were the American Alliance for Health, Physical Education, and Recreation (AAHPER) Serving Accuracy Test and the Brumbach forearm pass wall-volley test. The application of the modified TGfU volleyball learning model shows the differences in results between the experimental group and the control. The results of the research show that there were differences between the experimental and control groups in the forearm serve ( $p < 0.001$ ), overhead serve ( $p < 0.001$ ), and forearm passing skills ( $p = 0.004$ ), with a p-value of less than 0.05 indicating that the difference is statistically significant. The findings demonstrate that the modified TGfU volleyball learning model outperforms the traditional PE teaching method in enhancing the forearm serve, overhead serve, and forearm passing skills.

**Keywords:** effectiveness, mini volleyball learning model, technical skills

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## **INTRODUCTION**

Physical education teachers aim to create an enjoyable and demanding learning experience that can enhance cognitive, emotional, and psychomotor domains (Shih, 2022). Developing such a learning model may pose a challenge for educators, alongside various other challenges teachers face in the learning process, such as the emergence of student passivity, distraction, and lack of interest in class (Åsebø et al., 2020). Upon closer examination, this phenomenon may arise from a boring, monotonous learning process (Baños et al., 2020), and may even be caused by outdated learning models that no longer align with the characteristics and interests of the current generation of students (Galván et al., 2023). Additionally, other studies have shown a tendency for students in this generation to participate in PE classes reluctantly, merely complying with existing educational requirements. This may also stem from a lack of intrinsic motivation to engage in the learning process. These issues may increase the complexity of the problem and lead to new challenges in the future.

Meanwhile, one of the challenges to acquiring proficiency in volleyball is mastering the skill of effectively volleying the ball. This skill often results in a sensation of heightened warmth

and reddening of the arm, which might lead to students being more reluctant to participate in volleyball sessions in the future. Some students who initially dislike volleyball may perceive these negative experiences as something to avoid, thus discouraging them from delving deeper into learning the sport. According to González-Calvo (2020), an excessive reaction to negative experiences may potentially lead students to experience a situation of "learned helplessness." In contrast, students who participate voluntarily and enjoy learning volleyball skills do not consider reddened forearms, for example, from underhand passing practice, a significant issue. Therefore, cultivating an enjoyable learning experience for young students is important (Harackiewicz et al., 2016). Physical education teachers should allow children to engage in activities without the fear of making mistakes, thereby fostering an environment conducive to learning (Niu et al., 2021). Nonetheless, this learning model also presents challenges that can stimulate children's cognitive and physical capacities, promoting their overall development (Kolovelonis et al., 2022).

According to Yuan et al. (2022), the game of volleyball presents challenges in terms of strategic gameplay. These challenges include the need to effectively execute diverse attacking techniques to prevent opponents from anticipating them and the requirement to successfully defend against both opponent attacks and serve. Consequently, players must skillfully identify and exploit open areas on the court while executing powerful smashes or serves (González-Silva et al., 2020). Furthermore, learning volleyball skills, particularly tactical skills, can be facilitated through various methods, including the Teaching Games for Understanding (TGfU) method (Stojanović et al., 2023). TGfU makes learning volleyball tactics easier by providing an engaging learning environment, encouraging students to think creatively, and effectively addressing tactical problems (Gil-Arias et al., 2020). However, it is important to understand that good tactics should be supported by good technical execution (Błach et al., 2021). According to Ortiz et al. (2023) TGfU develops tactical skills and enhances technical skills, teamwork, social interaction abilities, and more. The capability of the TGfU method to foster development across three educational dimensions—cognitive, affective, and psychomotor—may account for its applicability to technical skill learning.

The specific attributes of male senior students in elementary school may align with implementing the TGfU learning model. As a result, applying the TGfU learning paradigm to teaching volleyball skills to male senior students in elementary school is highly feasible and may maximize their development more effectively. Furthermore, this research aims to serve as a precursor study for developing a TGfU model that specifically enhances volleyball playing skills (techniques). Additionally, this study seeks to determine whether training designed according to the TGfU concept can improve elementary school children's playing techniques more effectively than traditional techniques commonly applied by teachers in physical education classes.

## **METHOD**

The research employed an experimental methodology to assess efficacy, specifically by comparing the mini volleyball-modified TGfU model with the traditional approach (traditional PE teaching style) typically provided by teachers in school settings. This study involved a total of 40 male students and a height of  $136 \pm 4.32$  cm, the weight of  $38 \pm 3.26$  kg, who were enrolled in two different schools: Patalan Baru Elementary School ( $n = 20$ ) and Kepuh Elementary School ( $n = 20$ ). Both schools in this study represented the experimental group (Kepuh Elementary School) and the control group (Patalan Baru Elementary School).

All participants involved in this study met the inclusion criteria, namely: 1) sixth-grade students aged 11–12 years; 2) male gender; 3) never participated in volleyball training outside of Physical Education Class before or during the study (did not participate in extracurricular activities or club training outside of school); and 4) obtained parental or guardian permission to participate in the study from start to finish through signing consent to participate in the research. All participants, through their signed consent forms, demonstrated their understanding and comprehension of the potential risks associated with participating in this study.

The TGfU model in this study adopts the model developed by Nieves & Oliver (2019), who implemented TGfU through mini-volleyball games. However, unlike the TGfU model in the

study, which aimed at improving volleyball tactical skills, this study modifies the model to focus on enhancing volleyball playing techniques through mini-volleyball sessions. Nevertheless, the stages of TGfU in this study resemble those in Nieves & Oliver's (2019) study, with each session comprising: (1) Introduction, (2) Game, (3) Game Appreciation or Technical Awareness, (4) Skill Execution, and (5) Performance.

During the game, the teacher observes students' playing techniques and occasionally interrupts the game to inquire about any technical issues students are experiencing, providing brief instruction tailored to the specific problems encountered. This approach encourages students to think interactively about how to execute volleyball-playing techniques correctly. The mini volleyball TGfU model framework in this study consists of three components: (1) the underhand serve learning model, (2) the underhand serve learning model, and (3) the overhead serves learning model, with each component being covered in one session per week. Overall, the mini-volleyball TGfU sessions are conducted for 60 minutes per session, three times a week, for a total of 12 sessions over a full month.

In the control group, all research participants attended regular PE classes three times a week for one hour each session over one month. For each session within a week, the teacher provided all students different materials related to volleyball playing techniques according to the selected technique (underhand serve, upper hand serve, or overhead serve). The sequence of learning sessions consisted of (1) a warm-up and introduction regarding the learning objectives, (2) a teacher demonstration of the technique to be learned, (3) Drills performed by students, (4) a 6v6 game, and (5) cooling down and evaluation.

The statistical analysis of this study was conducted in two stages: assumption testing and hypothesis testing. In the assumption testing stage, the Kolmogorov-Smirnov test was used to determine whether the data followed a normal distribution. Subsequently, hypothesis testing began using paired sample t-tests or Wilcoxon tests to ascertain if there were significant differences between the serving and passing score results in the pre- and post-tests within each group. Then, the final hypothesis testing employed independent sample t-tests or Mann-Whitney tests to determine if there were significant differences between the two groups. All data analyses were conducted based on a significance level of 0.05. The data analysis in this study was performed using SPSS version 27.

## **FINDING AND DISCUSSION**

### **Finding**

The findings from the descriptive analysis of the pretest and posttest data for the EG and CON, specifically in the aspects of underhand serving, overhead serving, and underhand passing techniques, revealed the presence of a minimum value, a maximum value, and an average that demonstrated an overall rise. The research results in pretests or posttests for both groups can be seen in Table 1.

Additionally, a normality test was conducted to ascertain the notable rise within each group. The one-sample Kolmogorov-Smirnov test was employed to determine the normality test in this study. Data is considered to exhibit a normal distribution when the calculated significance value (p) exceeds the threshold of 0.05. The normality test in the experimental group showed that the pre-post-test variables for underhand serving, overhead serving, and pre-test underhand passing had a significance value of  $p > 0.05$ , indicating that the data can be considered normally distributed. However, this group's post-test underhand passing variable was the only one that was not significant at  $p < 0.05$ . On the other hand, the normality test in the control group showed significance values of  $p > 0.05$  for the pre-test underhand serving variable and the pre-post-test overhead serving variable, indicating that these data can be considered normally distributed.

However, the post-test underhand serving variable and the pre-post-test underhand serving variable in the control group showed  $p < 0.05$ , indicating that these data cannot be considered normally distributed. The complete results of the normality test can be seen in Table 2.

**Table 1. Experimental and control group descriptive statistics**

Group	Variable		Minimum	Maximum	Mean	Std. Dev.
EG (N = 20)	Underhand Serving	Pre-	6.00	25.0	14.45	5.75
		Post-	8.00	27.00	16.55	5.67
	Overhead Serving	Pre-	6	25.00	14.45	5.75
		Post-	8.00	27.00	16.60	5.67
	Underhand Passing	Pre-	4.00	32.00	12.60	7.89
		Post-	7.00	36.00	13.85	7.92
CON (N = 20)	Underhand Serving	Pre-	.00	35	10.30	8.14
		Post-	1.00	35.00	10.85	7.92
	Overhead Serving	Pre-	.00	22.00	8.15	7.30
		Post-	.00	22.00	8.95	6.96
	Underhand Passing	Pre-	.00	.00	5.85	7.62
		Post-	26.00	25.00	5.90	7.06

**Table 2. Kolmogorov-Smirnov test for the experimental and control group**

Group	Variable		Statistic	p
EG (N = 20)	Underhand Serving	Pre-	.083	.200
		Post-	.080	.200
	Overhead Serving	Pre-	.083	.200
		Post-	.091	.200
	Underhand Passing	Pre-	.180	.088
		Post-	.242	.003
CON (N = 20)	Underhand Serving	Pre-	.175	.111
		Post-	.196	.044
	Overhead Serving	Pre-	.165	.157
		Post-	.165	.160
	Underhand Passing	Pre-	.288	.000
		Post-	.260	.000

The data from both the experimental and control groups were further analyzed to determine if there were significant changes between the pre- and post-tests using paired T-tests or Wilcoxon tests. If the analysis results showed a p-value < 0.05, it can be interpreted that there is a significant difference between the pre- and post-tests. The analysis for underhand serving in the EG, overhead serving in the EG, and overhead serving in the CON through the Paired Sample T-test showed that the p-value < 0.05, indicating a significant difference between these variables in the pre-and post-tests. Significant results were also indicated by the underhand passing variable in the EG and the underhand serving variable in the CON through the Wilcoxon test, with a p-value < 0.05. However, the underhand passing variable in the CON was the only variable that did not show a significant difference between the pre-and post-tests because p > 0.05. The outcomes of the Paired Sample T-test and Wilcoxon test are displayed in Table 3.

An independent t-test analysis was employed to examine the differences between the experimental and control groups in terms of the overhead serve skill variable, as all the data exhibited a normal distribution. Conversely, the Mann-Whitney test assessed the differences in the underhand serve and underhand passing skills, as one or all of the data did not conform to a normal distribution. Based on the results, notable distinctions were observed between the experimental and control groups in terms of their technical ability scores in the underhand serving, overhead serving, and underhand passing skills, with a statistically significant p-value of less than 0.05 (p < 0.05). The findings of this study demonstrate that the implementation of the TGfU-based mini volleyball learning model in the experimental group resulted in significant improvements for the underhand serve, overhead serve, and underhand pass skills variables compared to the control group (Table 4).

**Table 3. The difference of the pre-post-test skills in the experimental and control group**

Group	Variable		Mean	Std. Deviation	p	Information		
EG (N = 20)	Underhand Serving*	Pre-	14.45	5.75	<.001	Significant		
		Post-	16.55	5.67				
	Overhead Serving*	Pre-	14.45	5.75				
		Post-	16.60	5.67				
	Underhand Passing**	Pre-	12.60	7.89				
		Post-	13.85	7.92				
CON (N = 20)	Underhand Serving**	Pre-	10.30	8.14	<.001	Significant		
		Post-	10.85	7.92				
	Overhead Serving*	Pre-	8.15	7.30				
		Post-	8.95	6.96				
	Underhand Passing**	Pre-	5.85	7.62			.813	Non- Significant
		Post-	5.90	7.06				

\*Paired Sample-T Test

\*\*Wilcoxon Test

**Table 4. Differentiation test for the gap of control group and experiment group**

Group	Sig.	Detail
Gap in the Underhand Serve **	< .001	Significant
Gap in the Overhead Serve *	< .001	Significant
Gap in the Underhand Passing **	.004	Significant

\* Independent Samples T-test

\*\* Mann-Whitney Test

**Discussion**

The objective of this study is to determine whether there are differences before and after the treatment outcomes from the implementation of the mini volleyball modified TGfU model for volleyball skills learning in elementary students and to ascertain if there are significant differences in volleyball skills learning between the EG and CON groups. In this research, the findings indicate that the EG group, after receiving treatment with the mini volleyball modified TGfU model, showed significant improvements in all research variables, such as underhand serving (M = 16.55, SD = 5.67), overhead serving (M = 16.60, SD = 5.67), and underhand passing (M = 13.85, SD = 7.92) compared to before the treatment (M = 14.45, SD = 5.75; M = 14.45, SD = 5.75; M = 12.60, SD = 7.89, respectively) with  $p < 0.001$  for all variables. Meanwhile, the CON group showed nearly similar research outcomes, indicating significant improvement for the underhand serving (M = 10.85, SD = 7.92) and overhead serving (M = 8.95, SD = 6.96) variables after undergoing PE for volleyball skills (traditional teaching) compared to before PE (M = 10.30, SD = 8.14; M = 8.15, SD = 7.30) with  $p < 0.001$  for each variable. However, the underhand passing variable in the CON group was found to be the only research variable that did not undergo significant changes after (M = 5.90, SD = 7.06) and before (M = 5.85, SD = 7.62) participating in PE, with a p-value of 0.831. Furthermore, the effectiveness analysis results indicate that the EG group experienced more significant improvement for the underhand serving, overhead serving, and underhand passing variables at the end of the research intervention period compared to the CON group with  $p < 0.001$ ,  $p < 0.001$ , and  $p = 0.004$ , respectively.

This study's results show that both groups, namely EG and CON, significantly improved elementary school students' volleyball skills, especially in underhand serving, overhead serving, and underhand passing. Interestingly, the research found that traditional teaching, as commonly practiced in PE classes, is not sufficiently effective in enhancing underhand passing skills, unlike the significant improvement observed in the EG. Furthermore, the study also revealed that the enhancement in the EG was more significant compared to the CON, thus demonstrating that the mini volleyball modified TGfU model, adapted to improve technical abilities, can significantly enhance volleyball skills. These research findings are consistent with previous studies suggesting that the TGfU concept is superior to traditional teaching in PE classes. These may also

demonstrate that the TGfU learning model offers various advantageous aspects that contribute to skill improvement.

Since elementary school students are still in the early period of fundamental motor skill development (Zeng et al., 2019), learning proper volleyball techniques may be more necessary than learning tactics. Elementary school students, aged 10 to 11 (late childhood), are in their golden years or peak development in this period, which requires special attention. Furthermore, as we know now, TGfU not only develops tactical awareness but also decision-making, increases motor engagement time, and improves technical skills (Ortiz et al., 2023). Several researchers have also shown that games based on the TGfU idea can help students learn better in several areas, including game knowledge (Morales-Belando & Arias-Estero, 2017), psychosocial skills (Morales-Belando et al., 2018), and academic performance (Alcalá & Garijo, 2017). Therefore, we see that the TGfU concept can be further developed for other aspects of learning, including technical skill development for elementary school students. Teaching volleyball techniques through the TGfU concept may provide a solution to recent problems, making children more interested in learning volleyball techniques and fostering their skills more effectively. This is important because learning volleyball techniques is a fundamental step for helping them understand the game more deeply and serves as a foundation for developing their tactical skills in the future.

The mini volleyball learning approach using the TGfU method provides numerous opportunities for students to actively participate in physical activity (Gaspar et al., 2021). The game phase and skill execution that align with the specific attributes of students have the potential to foster active engagement and participation in the learning process. The TGfU model in this study incorporates games that require students to engage in various activities, necessitating continuous physical activity within the game. For example, the underhand pass game provides situations where students must maneuver in multiple directions, such as shifting to the right, left, or any other direction, to approach the ball while considering how to execute a volley effectively. Additionally, the skill execution stages, including drills and practical application techniques, allow students to explore problem-solving related to game techniques.

The game model used only involves 1v1 or 2v2 matches. This model is effective for improving technical learning because it increases the chances for students to receive the ball continually (Lauder & Piltz, 2013). Meanwhile, this study does not use games with more participants because games with more players are more suitable for stimulating tactical learning. As explained by Mo et al. (2024), engaging and stimulating games can enhance students' enjoyment of the educational experience, facilitating their ability to execute techniques successfully. Additionally, the model in this study allows for learning related to effectively volleying and hitting the ball through the practice of receiving the ball.

The presence of competition in games presents a significant challenge for students involved in playing (Xu et al. 2022). Winning the game instils a sense of pride, motivating students to strive for victory. teachers and peers should praise students who win the game. Meanwhile, students who win are taught to respect those who lose. Students who win the game are entitled to receive praise from both teachers and peers. Meanwhile, teachers and peers teach students who win to respect those who lose and encourage them to offer help by sharing correct techniques with others who need them. As a result, students foster a supportive learning environment. When students encounter other challenges, group discussions prompt them to engage more actively in their learning. Consequently, effective learning objectives should elicit this response from students.

The efficacy of the TGfU-based mini volleyball learning model can serve as a valuable reference for instructing male senior students in elementary school volleyball. Additionally, implementing this model has the potential to enhance the technical aptitude of male high school students at the primary school level. The mini-volleyball learning model, based on Teaching Games for Understanding (TGfU), provides insight into the pedagogy of teaching technical knowledge and skills in volleyball through mini-volleyball games and learning activities. Despite the results obtained, this study has its limitations. This study designed the TGfU model for teaching elementary school students in the late childhood age range. Applying this training model may not be suitable for other populations, such as younger children (early childhood) or

older individuals with better volleyball skills. Furthermore, in this study, the comparison group consisted only of a control group, representing the traditional teaching method in PE classes. Including additional comparison groups, such as a TGfU group focused solely on tactical training or other groups using small-sided games, is necessary. Including these various groups can help determine which teaching methods are most effective and needed for children in the late childhood age range. We also recommend including moderating variables like self-motivation, supportive environments, gender, and others, to enhance the exploration of volleyball teaching techniques in future research.

## CONCLUSION

Based on the findings derived from the analysis of the data, it can be inferred that the mini volleyball learning model based on the Teaching Games for Understanding (TGfU) approach exerts a favorable impact on the technical skills of male senior students in elementary schools in comparison to the conventional mini volleyball learning model typically administered to the control group. Based on the data, it can be deduced that the TGfU mini volleyball learning model exhibits greater efficacy in enhancing the technical aptitude of male senior students in elementary school.

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