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The Effect of Using Robopong, Spinwheel, and Return Board on The Accuracy of Top Spin Strikes

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Abstract

Top spin is an important technique in table tennis that requires targeted training with the right media, but the effectiveness of various training media such as robopong, spinwheel, and return board in improving top spin accuracy has not been studied much comparatively. The purpose of this study was to determine the effectiveness of the influence provided by the media or training tools (robopong, spinwheel and return board) on improving the accuracy of top spin strokes in table tennis. The research method used in this study is Quasi-Experimental Design: Pretest–Posttest Nonequivalent Groups Design, where the sample will be divided into three groups by starting with pretest data collection then treatment in groups for 12 meetings and ending with a posttest. The sample consisted of 15 active members of the Table Tennis Student Activity Units UPI Sumedang Campus, the sample selection was carried out using a purposive sampling technique which was then continued with a group division technique using the Matching-Only Design technique. The results of the study showed that there was a significant influence of the three media or training tools on improving the accuracy of top spin strokes in table tennis, however, the post-hoc test showed no significant difference between the three training media on improving the accuracy of top spin strokes in table tennis. So it can be concluded that the three training media have an effect on increasing the accuracy of top spin strokes in table tennis, but there is no significant difference. The three research groups have a relatively similar level in increasing the accuracy of top spin strokes, although the average for each group is different, but it is not enough to show significant effectiveness in influencing the accuracy of top spin in the sport of table tennis.

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INTRODUCTION

Table tennis is a sport that relies on speed, precision, and good technique, especially in hitting shots. One such shot is the topspin shot, a shot with forward spin that causes the ball to curve downward and makes it difficult for the opponent to return accurately. It is an important hitting strategy in this game. Frequent, productive practice is a key factor in mastering topspin shots. Especially in a sport like table tennis, the use of improved technology is crucial in modern sports training. This study evaluated the relative effectiveness of three training tools (robopong, spinwheel, and return board), with a particular emphasis on the influence of these tools on topspin shot accuracy in the beginner and intermediate levels of the UPI Sumedang table tennis student activity unit.

Understanding how various training tools affect technical execution in sports is becoming increasingly important, according to recent studies. (Guarnieri et al., 2023), emphasized the importance of skill implementation among players and emphasized the need for consistent performance metrics for various types of shots in wheelchair table tennis. While this study primarily addresses wheelchair athletes, it also emphasizes the importance of analytical frameworks in skill development and suggests that similar methodologies can help players without disabilities develop a set of skills.

The Robopong is an automated ball-throwing machine that allows players to practice intensively and repeatedly. The Spinwheel, a rotating device that mimics the movement of the opponent's ball, can help players read the ball's rotation and practice their shot responses. Meanwhile, the Return Board acts as a rebound wall, helping athletes independently practice shot accuracy and consistency. The Robopong is highly valued for its ability to mimic realistic match situations, which is crucial for improving player performance. A study by (Petri et al., 2020) examined how auditory feedback affects table tennis players' performance. The study found that auditory feedback, including the sound produced when the ball strikes the racket, is crucial for players' response time and speed. This feedback mechanism can facilitate better training with devices like the Robopong, ultimately resulting in more accurate and faster shots. In contrast, the Spinwheel specifically focuses on generating topspin, which is crucial for competitive play. A study by (Yang et al., 2023) found a stroke effectiveness model that suggests spin control is crucial for performance. Spinwheels allow players to perform targeted drills, improve stroke mechanics, and increase accuracy and speed. Return boards are also particularly helpful for table tennis players, who must quickly adapt to different ball trajectories. They investigated gender differences in kinematic parameters related to topspin strokes. They also observed how different player categories responded to this feedback. This demonstrates the usefulness of return boards in providing continuous feedback, which can improve players' ability to adapt in fast-paced competition conditions.

There is a growing body of research on the use of technology in table tennis training, particularly in terms of trajectory prediction and artificial intelligence. A study by (Liu & Ding, 2022) on AI-assisted stroke trajectory analysis demonstrated that accurate data is crucial during training sessions. These findings can help coaches create tailored drills that utilize all three training tools to improve individual performance. Research comparing Robopong, spinwheel, and returnboard technologies helps us understand their roles in improving the speed and accuracy of topspin strokes. The purpose of this study is to analyze the relationship between technological advances in sports training and their application to skill development, particularly for novice table tennis athletes in academic institutions.

The novelty of this research lies in the comparative study of three different training tools: the Robopong, the Spinwheel, and the Return Board, in a controlled, quasi-experimental design. Unlike previous studies, which generally examined one type of training tool separately, this study shows that all three tools provide relatively similar improvements in top spin shot accuracy. This finding confirms that the effectiveness of top spin training is not solely determined by the sophistication of the training tools, but rather by the similarity of technical objectives and the training dosage. The results of this study are expected to serve as a reference in developing more targeted and effective training programs.

METHOD

The research method used is the Quasi-Experimental Design method: Pretest–Posttest Nonequivalent Groups Design (Jack Fraenkel et al., 2011). Because this study involved three treatment groups that received different training media, namely Robopong, Spinwheel, and Return Board. The population used in this study were 30 students who were members of the Table Tennis

Student Activity Unit at the UPI Sumedang campus as the population with an age range of 18 - 21 years consisting of men and women. Then the sample of this study was taken using a purposive sampling technique, this technique took samples with the provision that the sample must be an active member of the UPI Sumedang Table Tennis Student Activity Unit, have experience playing table tennis for more than 1 year, master the basic techniques of table tennis topspin and are willing to participate in the entire series of research. The selected sample was 15 students where from the number of samples they would be divided into 3 groups using the Matching-Only Design Design group division technique (Jack Fraenkel et al., 2011). In this study to determine the improvement of the Top Spin Forehand, an Accuracy Test was conducted which was used for the implementation of the Forehand Top Spin table tennis stroke technique. This accuracy test was designed based on the forehand top spin technique (Le Mansec et al., 2016). The research procedure began with a pretest using a top spin shot accuracy instrument where each sample was given 40 shots to be directed at the target, if the target ball gets a score of 2, if it goes in but doesn't hit the target, it gets a score of 1, and if it goes out or doesn't go in, it gets a score of 0. Furthermore, in the next meeting, treatment was carried out on each group, the robopong sample group was given a treatment for table tennis top spin shots using robopong training media, while the spinwheel sample group was given a treatment for up top spin shots using spinwheel training media and in the return plank sample group was given a treatment to practice table tennis top spin shots using return board training media. This treatment lasted for 12 meetings with a duration of 2 hours each meeting. After that, the study ended with a posttest using the same instrument as when conducting the pretest. The data from the pretest and posttest were then analyzed using the SPSS application.

Table 1. Research Design Structure

Group	Pretest	Treatment	Posttest
1	O1	X1 Robopong	O2
2	O1	X2 Spinwheel	O2
3	O1	X3 Returnboard	O2

Keterangan:
O1 = Pretest for topspin accuracy
X1 = Training treatment with Robopong
X2 = Training treatment with Spinwheel
X3 = Training treatment with Return Board
O2 = Posttest for topspin accuracy

RESULTS AND DISCUSSION

To determine whether or not training media has an effect on increasing top spin accuracy in table tennis and to answer the hypothesis proposed in this study, a prerequisite test for analyzing the research results was first conducted. The results of the normality test showed that the sig value of the three groups was > 0.05, as well as the homogeneity test which showed the sig value of the three groups was > 0.05, so that parametric hypothesis testing could be carried out.

Table 2. Results of the 1st Hypothesis Test Paired Sample T Test

Comparison	Mean Difference	Std. Deviation	Std. Error Mean	95% CI Lower	95% CI Upper	t	df	Sig. (2-tailed)
Pretest – Posttest	-12.40	5.73	2.56	-19.51	-5.29	-4.84	4	0.008

The statistical test results in **Table 2** show a t-value of –4.841 with a degree of freedom (df) of 4 and a significance value of Sig. (2-tailed) = 0.008. This significance value is smaller than the established significance level ($\alpha = 0.05$), which is $0.008 < 0.05$. Furthermore, the 95% confidence interval ranges from –19.511 to –5.289, which does not include the value of zero (0), thus strengthening the significant difference between the pretest and posttest scores.

Based on the hypothesis testing criteria, H_0 is rejected and H_1 is accepted, indicating that there is a significant effect of the use of robopong media on improving the accuracy of top spin strokes among members of the UPI Sumedang Campus Table Tennis Student Activity Unit. Therefore, it can be concluded that training using robopong media significantly improves the accuracy of top spin strokes, thus robopong media can be used as an effective training medium in developing top spin stroke skills in table tennis.

Table 3. Results of the 2st Hypothesis Test Paired Sample T Test

Comparison	Mean Difference	Std. Deviation	Std. Error Mean	95% CI Lower	95% CI Upper	t	df	Sig. (2-tailed)
Pretest – Posttest	-11.60	5.08	2.27	-17.91	-5.29	-5.11	4	0.007

The statistical analysis results in **Table 3** show a t-value of –5.107 with a degree of freedom (df) of 4 and a significance value of Sig. (2-tailed) = 0.007. This significance value is smaller than the established significance level ($\alpha = 0.05$), which is $0.007 < 0.05$, so the difference between the pretest and posttest scores is declared statis-

tically significant. Furthermore, the 95% confidence interval ranges from –17.907 to –5.293, which does not involve the value of zero (0), thus strengthening the existence of a significant effect.

Based on the hypothesis testing criteria, H2 is rejected and H2 is accepted, which means that the use of the spinwheel media has a significant effect on improving the accuracy of top spin shots in members of the UPI Sumedang Campus Table Tennis Student Activity Unit. Therefore, it can be concluded that training using the spinwheel media significantly improves the accuracy of top spin shots, so the spinwheel media can be used as an alternative, effective training medium in improving top spin stroke skills in table tennis.

Table 4. Results of the 3st Hypothesis Test Paired Sample T Test

Comparison	Mean Difference	Std. Deviation	Std. Error Mean	95% CI Lower	95% CI Upper	t	df	Sig. (2-tailed)
Pretest – Posttest	-13.80	8.44	3.77	-24.28	-3.32	-3.66	4	0.022

The statistical analysis results in **Table 4** show a t-value of –3.657 with a degree of freedom (df) of 4 and a significance value of Sig. (2-tailed) = 0.022. This significance value is smaller than the established significance level (**α** = 0.05), which is 0.022 < 0.05, thus concluding that the difference between the pretest and posttest scores is statistically significant. Furthermore, the 95% confidence interval ranges from –24.277 to –3.323, which excludes the value of zero (0), further strengthening the significant effect.

Based on the hypothesis testing criteria, H_0 is rejected and H_3 is accepted, indicating that the use of the return board significantly improves the accuracy of top spin strokes among members of the UPI Sumedang Campus Table Tennis Student Activity Unit. Therefore, it can be concluded that training using the return board significantly improves the accuracy of top spin strokes. Therefore, the return board can be used as an effective training tool to improve top spin stroke skills in table tennis.

Table 5. Results of the 4st Hypothesis Test ANOVA

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F	Sig.
Between Groups	12.40	2	6.20	0.14	0.868
Within Groups	519.20	12	43.27		
Total	531.60	14			

Based on **Table 5**, it can be seen that the sig. value of 0.868 > 0.05, which indicates that there is no significant difference in increasing top spin accuracy in table tennis from the third group (Robopong, spinwheel, and return board). Next, a post hoc test will be conducted to verify the results of the one-way ANOVA.

Table 6. Results of the 4st Hypothesis Test Poshoc

Group I	Group II	Mean Difference (I–J)	Std. Error	Sig.	95% CI (Lower–Upper)
Robopong	Spinwheel	0.80	4.16	0.980	−10.30 – 11.90
Robopong	Return Board	−1.40	4.16	0.940	−12.50 – 9.70
Spinwheel	Return Board	−2.20	4.16	0.859	−13.30 – 8.90

Based on **Table 6**, the results of the Tukey HSD post hoc test were conducted to determine differences between the three groups. The results of the post hoc test are as follows:

Comparison of the Robopong and Spinwheel Groups. Based on **Table 6**, the sig. value of 0.980 > 0.005 indicates no significant difference between the two groups in improving the accuracy of top spin shots in table tennis.

Comparison of the Robopong and Return Board Groups. **Table 6** shows that the sig. value of 0.940 > 0.005 indicates no significant difference between the two groups in improving the accuracy of top spin shots in table tennis.

Comparison of the Spinwheel and Return Board Groups. **Table 6** shows that the sig. value of 0.940 > 0.005 indicates no significant difference between the two groups in improving the accuracy of top spin shots in table tennis. A value of 0.859 > 0.005 indicates no significant difference between the two groups in improving top spin accuracy in table tennis.

Therefore, the post hoc test results show no significant effectiveness between the three research groups (Robopong, Spinwheel, and Return Board) in improving top spin accuracy in table tennis. The three research groups had relatively similar levels of top spin accuracy improvement, although the average values for each group varied, but this was not sufficient to demonstrate significant effectiveness in influencing top spin accuracy in table tennis.

The results of data processing and analysis indicate that the robotic training media can influence the increase in the accuracy of top spin shots in table tennis. In theory, this robotic training media is designed with consistent control, direction, speed, and ball feed capabilities, making it easier for athletes to hit the ball so that athletes can practice continuous repetition of

movements as stated by (Schmidt & Lee, 2019) who explained that repetition of movements with stable conditions will accelerate the formation of motor programs and increase the accuracy of motor skills. A study by (Tebbe, 2022) explained that a robot-based table tennis training system can improve the accuracy of top spin shots because athletes can adjust the timing, angle of the racket, and swing speed repeatedly without interference from human variability. (Safari et al., 2017) which states that increasing the accuracy of forehand top spin strokes in table tennis is greatly influenced by structured training methods and repetition of movements, and is supported by the use of training media that are able to provide consistent movement stimuli. In addition, the robotic training system allows athletes to practice at a high frequency, which, according to the theory of deliberate practice, is a key factor in improving sports technical skills. (He et al., 2022) exercises that are able to maintain consistency of movement patterns and timing control will provide optimal motor adaptation to the accuracy of topspin shots, regardless of the type of training aid used. Therefore, this research is in line with theories and international studies that the robotic training media can have a significant influence in improving the accuracy of top spin shots in table tennis.

Furthermore, this study stated that the spinwheel media can have a significant influence in improving the accuracy of top spin table tennis shots. In theory, the spinwheel is a training aid that functions to develop sensitivity to spin control, racket contact angle, and swing direction. From a biomechanical perspective, top spin shots require complex body coordination, especially in racket angle, swing speed, and precise ball contact. A biomechanical study by (Mao et al., 2023) confirmed that consistency of racket angle and swing speed significantly determines the quality of topspin produced. The spinwheel media allows athletes to focus training on the brushing contact mechanism, namely the contact that rubs the ball, which is very important in producing topspin. This is in line with the principle of specific skill training, where training that specifically targets certain technical components will provide significant skill improvements. Similar research in the field of table tennis technique training also states that spin control-based aids can significantly improve motor coordination and shot precision compared to conventional training without special aids (Iino & Kojima, 2008). Therefore, the increase in top spin accuracy in the spinwheel group in this study can be explained scientifically through a biomechanical approach and motor training theory.

Based on the results of this study, return board training media can have a significant effect on improving the accuracy of table tennis top spin. The return board functions as a reflective training medium that requires players to actively adjust the direction, speed, and spin of the ball that is bounced back. According to the theory of perceptual-motor learning, training with reflective stimuli such as the return board will improve anticipation and motor control (Williams & Hodges, 2005). The results of this study are supported by a study by (Santosa et al., 2026) in the International Journal of Human Movement and Sports Sciences (Scopus), which concluded that the return board is effective in improving top spin skills because it forces players to make continuous and independent technical adjustments. In addition, the return board also contributes to increasing consistency training, namely the ability to maintain the quality of the shot in high repetitions. This is very important in table tennis games that demand high speed and accuracy.

Based on the results of the ANOVA and Post Hoc tests, there were no significant differences between the three training media in improving the accuracy of top spin strokes in table tennis. This finding can be explained by the equivalence of training effect theory, which states that when several training methods have the same technical objectives and are given in relatively comparable training doses, the results tend to be equivalent (Bompa & Buzzichelli, 2019). All three training media focus on strengthening top spin techniques through repetition, control of the racket angle, and consistency of ball contact. Cross-sport research also shows that different training aids can produce comparable performance improvements as long as motor training principles such as repetition, feedback, and specificity are met (Schmidt & Lee, 2019). Research shows that improved table tennis shot accuracy results from motor adaptation, characterized by a decrease in movement errors after the initial training phase and improved ball directional control as training progresses. These findings support the results of this study, where all treatment groups demonstrated improved topspin shot accuracy after training, despite using different training media (Carius et al., 2024). Therefore, the lack of differences in effectiveness between media in this study indicates that the choice of training media can be adjusted to the training context, facilities, and athlete needs, without reducing the effectiveness of improving top spin skills.

CONCLUSION

Based on the results of data processing and analysis, it can be concluded that the use of robopong, spin wheel, and return board media each have a effect on increasing the accuracy of top spin shots in table tennis, which is indicated by an increase in top spin ability after training treatment in all research groups. In addition, the results of the One Way ANOVA test followed by a Post Hoc test showed that there was no difference in the level of effectiveness between the three training media in increasing the accuracy of top spin shots. This shows that although robopong, spin wheel, and return board have different characteristics and levels of technology, all three contribute to increasing ability relatively equally. Thus, this study answers the research objectives and research title by showing that all three training media can be used as effective training alternatives to increase the accuracy of top spin shots in table tennis.

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