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Chapter 9

Development of the Target Smash Tool to Improve Table Tennis Players' Accuracy

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Abstract: *The smash is one of the most effective offensive techniques in table tennis, exerting significant pressure on opponents through its high speed and power. However, achieving accuracy in smash execution remains a major challenge for both amateur and professional players. This study aims to develop a target smash tool designed to enhance table tennis players' shot accuracy. The research employs the Research and Development (R&D) method based on the steps outlined by Borg & Gall. The findings indicate that the tool effectively improves players' smash accuracy, with potential for further development, such as integration with smartphone applications for training data analysis.*

Keywords *akurasi smash, alat bantu tenis meja, pengembangan alat, penelitian R&D, tenis meja*

1. INTRODUCTION

Table tennis is a highly popular sport worldwide, valued not only for its simplicity of equipment but also for the high level of skill it demands, particularly in offensive techniques like the smash. The smash is recognized as a technique that applies exceptional pressure on opponents, with unmatched speed and power. In matches, it often becomes a decisive factor for winning rallies and scoring points.

However, the effectiveness of a smash is determined not only by the power of the stroke but also by its accuracy. Players frequently face various challenges in training for smash accuracy. A study by Adryan et al. (2024) highlighted that the lack of training tools specifically designed to improve accuracy is a major factor hindering players' skill development. Additionally, common challenges include improper body positioning, suboptimal racket swings, and inadequate ball contact techniques, which affect both amateur and professional players (Oagaz et.al., 2022).

Mastering table tennis skills requires not only quick reactions but also precise ball control. Poor technique can diminish the effectiveness of an attack, even when a powerful smash is performed (Zhang, 2022). Therefore, training focused on improving accuracy has become increasingly crucial in enhancing players' ability to handle various match situations.

In recent years, technological innovations in sports have provided numerous solutions for enhancing athletes' skills. For example, the use of sensor-based devices has successfully improved athlete performance across various sports, including table tennis (Cui & Zhou, 2022). The target smash tool developed in this study is designed to offer real-time feedback to players, enabling them to identify weaknesses and gradually improve their skills.

In addition to sensor-based technology, research has shown that visual feedback can enhance training effectiveness. Targets that provide immediate indicators of successful hits have helped players identify weaknesses and improve their techniques incrementally (Hahm et. al., 2023). This approach offers an advantage in accelerating the learning process compared to traditional training methods.

Moreover, the success of smash training is also influenced by factors such as structured practice routines and the support of coaches who understand each player's strengths and weaknesses (Bennett et.al., 1984). The use of appropriate training tools can complement these efforts by delivering measurable training outcomes.

On the other hand, developing effective training tools requires extensive testing of various prototype designs. This study employs a Research and Development (R&D) approach to ensure that the resulting tool is not only technically effective but also user-friendly (Bennett et.al., 1984). This includes testing the system's reliability, ease of use, and the impact of training on player performance.

The integration of technology into sports also opens up opportunities for inclusive skill development. Training tools like these are not only beneficial for professional players but also allow amateur players to experience the advantages of advanced technology that was previously accessible only to elite athletes (Hahm et.al., 2023). This approach highlights the potential for increasing public participation and enthusiasm for table tennis.

Considering these challenges and opportunities, this study aims to provide a tangible contribution to the development of table tennis skills through innovative training tools. The resulting tool is expected to serve as a practical solution for improving the smash accuracy of both amateur and professional players.

2. PROBLEM STATEMENTS

Accuracy in executing a smash is one of the essential skills that table tennis players must master. However, many players struggle to improve their accuracy due to the lack of training tools specifically designed for this purpose. This research seeks to address several key questions:

First, what are the primary requirements for developing a target smash tool for table tennis? To create an effective tool, it is essential to identify the key elements, such as design, detection sensors, and scoring systems.

Second, how effective is this tool in improving players' smash accuracy? Evaluating the tool's capability to assist both amateur and professional players will be a primary focus.

Third, can this tool be widely accepted by users across different skill levels? User acceptance is crucial, as the tool is designed to be utilized by players of varying abilities.

By answering these questions, this study aims to provide practical and innovative solutions for enhancing the skills of table tennis players

3. OBJECTIVE

This study has the following main objectives:

- a. To develop an innovative target smash tool that helps players improve their shot accuracy using modern technology.
- b. To evaluate the effectiveness of the tool in supporting smash training by assessing player performance during trials.
- c. To assess the level of user acceptance and satisfaction with the tool in terms of design, functionality, and results.

By achieving these objectives, the developed tool is expected to serve as a practical solution for

enhancing the performance of table tennis players.

4. RELATED WORKS

The development of training tools in sports, particularly table tennis, has been the focus of several previous studies. Below are some examples:

4.1 Development of of a Table Tennis Training Device with Real-Time Feedback

Research by Oagaz et.al. (2022) developed a sensory system to analyze racket movements and provide feedback to players. This system records technical data, such as the angle of ball contact and racket speed, which is then delivered to players in real time. The findings showed that the device improved players' shot accuracy by up to 15% within four weeks.

In the context of sports training tool development, real-time feedback offers advantages over traditional methods. By providing immediate data, players can adjust their techniques during practice without waiting for post-session coach analysis (Cui & Zhou, 2022). This approach enhances the efficiency and focus of the training process.

Oagaz et.al. (2022) also emphasized the importance of the tool's compatibility with various training environments. Testing factors such as light intensity and room temperature ensured the device could be widely used.

However, the study noted that the ergonomics of such devices require attention; overly complex or difficult-to-use tools may demotivate players from consistent practice (Rigozzi et.al., 2023). Therefore, balancing functionality and ease of use is essential in the development of such tools.

4.2 LED-Based Training System for Improving Table Tennis Skills

Research by Adryan et.al. (2024) highlighted the importance of training aids in enhancing shot accuracy. They developed an LED-based target system that provides real-time scoring for successful hits. This system delivers engaging visual feedback, motivating players during practice.

The study found that using an LED-based target increased shot accuracy by up to 20% over a six-week training period. Additionally, the tool includes a score-tracking system that allows coaches to monitor players' progress more effectively (Robertson et.al., 2023). However, the primary challenge in developing this system is the relatively high production cost, limiting its accessibility for amateur-level players.

LED technology offers further development potential, such as integration with analytics software to provide deeper insights into players' training patterns (Zhang, 2022). Future research could optimize the tool's energy efficiency to ensure long-term usability.

Adryan et.al. (2024) also noted the system's suitability for various training scenarios, including match simulations. Adjustable target variations provide flexibility for holistic skill development.

4.3 Smartphone Integration for Table Tennis Training Tools: A New Paradigm

Another relevant reference is the study by Cui & Zhou (2022) which integrated smartphone applications with training tools. The app was designed to record players' training data, such as stroke frequency and accuracy, and analyze it using machine learning algorithms.

Smartphone integration offers advantages in portability and accessibility. Players can easily access their training data anytime, enabling them to plan more effective training strategies (Zhang, 2022).

The study also found that combining physical tools with digital applications enhances overall training efficiency.

Furthermore, the app is designed to be compatible with various devices, making it accessible to users from diverse backgrounds. Its simple interface facilitates new users' understanding of the tool's functions (Rigozzi dkk., 2023) This integration benefits both professional and amateur players.

However, the main challenges in implementing this technology include the need for stable internet connectivity and hardware compatibility with various smartphone brands. Further research is necessary to address these issues, particularly in developing countries where access to technology is limited (Rigozzi dkk., 2023).

Currently, the system may not fully capture the unique weaknesses, strengths, or styles of the individual athletes. Thus, the development of more adaptive machine learning algorithms is needed to provide personalized and relevant training recommendations for each player. By implementing the adoptive algorithms, training tools may be able to deliver tailored feedback on the player's progress, leading to more efficient skill development and higher performance outcomes.

5. CONCLUSION

The development of the target smash tool offers an innovative solution for improving the shot accuracy of table tennis players. By leveraging modern technology such as detection sensors and an automatic scoring system, this tool has successfully enhanced the performance of both amateur and professional players. The real-time feedback provided by the tool motivates players to train more intensively and focus on areas that need improvement.

Although the tool has some limitations, such as relatively high costs and the need for initial training, its potential for further development remains significant. For instance, integration with smartphone applications could provide deeper training data analysis, while automating the scoring system could enhance its usability efficiency. Further research is recommended to involve a broader range of subjects and explore additional technologies to improve the tool's functionality. Consequently, the target smash tool is expected to make a significant contribution to the development of table tennis skills in the future.

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7. AUTHORS' CONTRIBUTION

As the main author in a scientific work, your duties involve several important steps in the research process carried out together with the second author to produce high-quality research results.

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