Original Article

e-ISSN: 2721-7175 p-ISSN: 2089-2341

# Reconstruction of a dynamic robot-based table tennis ball launcher as a training aid for forehand stroke accuracy

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*Authors' Contribution: A – Study Design, B – Data Collection, C – Statistical Analysis, D – Manuscript Preparation, E – Funds Collection*

Abstract: A robotic-based training aid for forehand strokes in table tennis that utilizes a smartphone as a control medium has not yet been found. This research aims to understand the process of reconstructing a dynamic robot-based table tennis ball launcher as a training aid for forehand stroke accuracy. This type of research uses the ADDIE development method (analyze, design, development, implementation, evaluation). The analysis phase identifies user needs and characteristics, the design phase creates a 3D prototype design, the development phase creates and tests the product, the implementation phase tests the product on UKM members, and the evaluation phase is conducted at each product development stage. The subjects in this study included 1 media expert, 1 material expert, and 21 members of the STKIP Pasundan Table Tennis UKM, with instruments used to measure product quality in the form of questionnaires and surveys. The results of this study indicate that the dynamic robot-based table tennis ball launcher is deemed very feasible (86.65%) with a validity value of (0.510) and a reliability value of (0.518).Therefore, it can be stated that this dynamic robot-based table tennis ball launcher is "very feasible" to be used as an alternative training medium. Consequently, this tool can be recommended for use in technical training processes to enhance focus.

Keywords: Tool reconstruction, ball thrower, table tennis.

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Recevied: 2025-10-07; Accepted: 2025-12-06 Published online: 2025-12-30

Reconstruction of a dynamic robot-based table tennis ball launcher as a training aid for forehand stroke accuracy. **Jurnal maenpo: jurnal Pendidikan Jasmani Kesehatan dan Rekreasi** Vol 15 No 2(2025); Volume 15 Nomor 2 Tahun 2025

# INTRODUCTION

Table tennis is a sport that can be played individually or in pairs using a ball made of celluloid and paddles made of wood covered with rubber on both sides (Kasanrawali 2020). The game is played on a table divided by a net and is more commonly known to the public as "ping pong," which is generally played indoors (Sukma 2016). In table tennis, there are various basic techniques that players need to master, such as drive, chop, service, push, and block (Rihtiana dan Tomoliyus 2014). One important technique is the forehand stroke, which is said to be effective if the ball is fast and accurately directed to the right or left corner of the opponent's table (indrawan 2020). To achieve accuracy and speed in the forehand stroke, consistent and continuous practice is required, supported by effective training methods and programs (Suherman 2009).

Based on the observations at the UKM Table Tennis at STKIP Pasundan, the forehand stroke training method is still conducted manually, where the coach throws the ball one by one, making it less efficient, especially when the number of athletes being trained is large. This results in training being less effective and complicates the evaluation process of the athletes' stroke movements. With the advancement of science and technology (IPTEK), various innovations in sports equipment have developed to enhance training effectiveness and support athletes' achievements (Erlangga et al. 2022) The use of technology media applications is currently widely utilized in the learning process (Dhani Agusni Zakaria et al. 2023).

Several previous studies have attempted to develop training aids for table tennis, including "The creation of a low-budget table tennis ball launcher to improve the competence of table tennis athletes in Blora Regency" where the researchers designed and created a low-cost table tennis ball launcher (Yudha, Riyanta, dan Susetyorini 2022), "the development of a multifunctional ball launcher" where the researchers designed, created, and developed a multifunctional ball launcher that can adjust the speed, direction, and variation of the ball (Bimantara dan Khomariah 2021), and "the development of a learning tool for ball launching in table tennis" where the researchers designed, created, and developed a ball launcher as a learning medium for table tennis, then tested it to help improve the basic skills of students or athletes through more effective and varied training (Kes, M & Murniati 2020). One way an innovation can grow is through the use of technology (Juditya 2022). However, none have used a smartphone as a control tool; therefore, the aim of this research is to develop a model design

of a tool or media based on a smartphone that provides convenience and efficiency in time and effort for athletes, UKM members, students, coaches, and lecturers.

Based on the description above, this research aims to determine how the reconstruction process of a dynamic robot-based table tennis ball launcher as a training aid for forehand shot accuracy with a smartphone as its control tool, as an innovation that provides convenience, effectiveness, and efficiency in forehand shot training. With this research, it is hoped to become an innovation since there has not been a table tennis launcher that uses smartphone-based media as its control tool; therefore, the aim of this research is regarding "The reconstruction of a dynamic robot-based table tennis ball launcher as a training aid for forehand shots."

## MATERIAL AND METHODS

The research method used is the ADDIE development method (Robert Maribe Branch 2009). The ADDIE development model consists of Analysis, Design, Development, Implementation, and Evaluation (Sugiyono 2020). In this research and development, the focus is on producing a dynamic robot-based table tennis ball launcher as a training aid for forehand shots. In the analysis phase, the identification of needs and user characteristics is conducted through observations and interviews with the head of the UKM. The design includes a design overview and 3D prototype animation of part of the tool, followed by Development, which is divided into two: the construction of the tool according to the design approved by experts and feasibility testing by experts, and testing. Implementation occurs after the tool is declared feasible, with field trials conducted on UKM members. The final stage, Evaluation, is conducted to assess the effectiveness of the tool, with data analyzed from questionnaires and areas requiring further improvement (Da et al. 2024), (Aprial. M et al. 2023).

The sampling technique used in this research is saturated sampling (Sugiyono 2019). The population in this study consists of all table tennis members training at the UKM Table Tennis STKIP Pasundan, totaling 21 members and 2 experts, resulting in a total population of 23 individuals. The instrument used in this research is a questionnaire structured using a Likert scale. The questionnaire was given to media experts, academics, learning coaches, and athletes (Irrawan, Ade bagus and S.Pd., M.Pd, Dr. Palmizal. A and S.Pd., M.Pd 2020). The questionnaire focuses on the performance of the produced product. The questionnaire for experts consists of questions that need to be assessed for their feasibility (Sari et al. 2020). The results of the validation assessment are then calculated for their validity and reliability percentages. The data

analysis technique in this research is divided into feasibility analysis and effectiveness of the developed training aid product. The data analysis technique used is descriptive percentage analysis in the form of assessments using numbers.

# RESULTS

1. Analysis

In this stage, the researchers sought to identify existing problems through observations and interviews. The results indicated that the UKM Table Tennis STKIP Pasundan needs technology-based training aids, such as a ball launcher, to make training more effective, especially for beginners. Unfortunately, the price of such tools is quite high, making them difficult to purchase. From the perspective of UKM members, especially beginners, many are still learning the basics of table tennis. The ability to coordinate hand and eye, reflexes, and shot accuracy still needs to be trained. The shot technique is also not stable, with balls often missing or going too high. These findings serve as the basis for designing a training aid that meets the needs.

2. Design

At this stage, the researchers created two prototype designs. First, an initial prototype was made to be submitted to experts for feedback. Second, the prototype was refined based on those suggestions. One important improvement was the addition of a fan to the electronic box to prevent the device from overheating. Evaluation results showed that the addition of the fan improved the device's performance and made the internal components safer from the risk of damage due to excessive heat.

3. Development

**Figure 1**. The results of the table tennis ball launcher after revision

**Figure 2**. View of the table tennis ball launcher after revision.

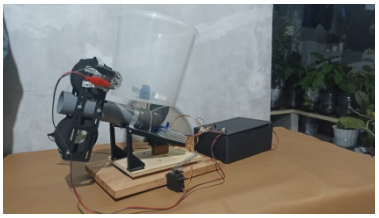

**Figure 3**. Front view of the table tennis ball launcher after revision.

In the development stage, validation of the table tennis launcher was conducted in three phases: validation by design experts, material experts, and validation by users. The aim was to identify deficiencies and improvements needed before the device was tested on UKM members. Experts were asked to assess the design so that the strengths and weaknesses of the device could be identified. The results of the validation instrument assessment and the questionnaire obtained from media experts, material experts, and UKM members are presented in the table below:

**Table 1.** Results of the validation assessment by design experts, material experts, and UKM members

| Respondent | Maximum score | Score given | Percentage Score |
|---|---|---|---|
| Media expert | 116 | 106 | 91,38% |
| Material expert | 50 | 41 | 82% |
| Members of the UKM Table Tennis at STKIP Pasundan | 1.050 | 909 | 86,57% |
| Average number from the three respondents | | | 86,65% |

4. Implementation

Next, the researchers conducted a validity test to determine the validity of the data in this study, specifically the forehand drive stroke data (Ruky et al 2018). The results of the validity test calculations for the forehand drive strokes of the members of the UKM Table Tennis at STKIP Pasundan are presented as follows:

**Table 2.** Results of the Validity Test

| Item | Validity | | Description |
|---|---|---|---|
| | $R_{xy}$ | R – Table | |
| 1 | 0,510 | 0,433 | Valid |

Then the researchers conducted a reliability test to determine the reliability of a tool developed (Suharsimi 2006). By giving a test to the same group at two different times. The results of the reliability test calculations for the forehand drive strokes of the UKM Table Tennis members at STKIP Pasundan can be presented in the following table.

**Table 3.** Results of the Reliability Test

| Item | Reliability | | Description |
|---|---|---|---|
| | $R_{xy}$ | R – Table | |
| 1 | 0,518 | 0,433 | Reliabel |

Based on the reliability results, a value of 0.518 was obtained, which is greater than the r-table value of 0.433, thus it is declared reliable. Based on the validity results, a value of 0.510 was obtained, which is greater than the r-table of 0.433, thus it is declared valid.

5. Evaluation

The evaluation includes an analysis of the implementation process, participant responses, and the results achieved to ensure that the objectives are met optimally. Feedback from media experts suggested using a power supply with a higher capacity and an additional cooling fan. Material experts recommended that the launcher be placed outside the table. Meanwhile, respondents proposed that the tool be modified to be more attractive, not heat up quickly, and be more challenging. They also suggested the development of artificial intelligence so that the tool could adapt to various playing styles and enhance interactivity. These suggestions serve as a basis for the development of better tools in the future.

## DISCUSSION

This study, the results of the testing data from media experts, material experts, and members of the UKM Table Tennis as end users were established based on the questionnaires that had been distributed. The validation results showed that the table tennis ball launcher has a very high feasibility level. The feasibility results from media experts, the data from the feasibility test of the table tennis ball launcher obtained from media experts were processed into percentage feasibility data using Microsoft Excel software. From the media experts, a

percentage of 91.38% was obtained; when categorized according to the product feasibility table, the feasibility result from media experts falls into the very feasible category. The feasibility results from material experts, the data from the feasibility test of the table tennis ball launcher obtained from media experts were processed into percentage feasibility data using Microsoft Excel software. From the media experts, a percentage of 82% was obtained; when categorized according to the product feasibility table, the feasibility result from media experts falls into the very feasible category.The feasibility results from the members of the UKM Table Tennis, the data from the feasibility test of the table tennis ball launcher were obtained through questionnaires filled out by 21 members of the UKM Table Tennis at STKIP Pasundan. The data was processed into percentage feasibility data using Microsoft Excel software; after calculation, the data from the 21 members of the UKM Table Tennis obtained a feasibility percentage of 86.57%. When categorized according to the product feasibility table, the feasibility result from the members of the UKM Table Tennis falls into the very feasible category. From the perspective of research validity, it is known that the r-table score for 21 subjects at a 5% confidence level is 0.433. This result indicates that the Rxy score = 0.510 is greater than the r-table = 0.433, thus the table tennis ball launcher is declared valid. Additionally, the reliability test calculation yielded an r-count of 0.518 while the r-table value is 0.433, thus it can be declared reliable.

The development of technology today has entered various aspects of life in different sectors. The use of technology greatly influences performance in achieving goals (Triansyah, Atmaja, dan Sepdanius 2023). The table tennis ball launcher can be used as a training aid to efficiently save time and energy for coaches, allowing them to focus on evaluating forehand strokes. The feasibility of this table tennis launcher can be explained through a motor approach and skill training. According to motor learning theory (Mustafa dan Sugiharto 2020), movement skills are greatly influenced by varied, random training stimuli that resemble real match situations (Kertamanah 2003). This tool allows users to practice movement, reflexes, and visual concentration, thus optimizing movement adaptation. The accuracy in determining the method can influence the achievement level of training objectives (Furkon 2019). In addition to training methods, one factor that affects drive strokes is reaction time and accuracy. According to (Alamsyah dan Tomoliyus 2021), reaction time is a determining factor for success in almost all sports.Reaction time is needed to hit the ball to the opponent's area and to place the ball so that it does not always go out but is always directed to a specific spot on the table that is difficult for the opponent to reach. The dosage of training greatly determines the volume (frequency,

repetitions, and sets) and intensity of the training. This tool also incorporates technology principles in sports training. By using an electronic control system and programming the launch speed, this tool supports the principles of smart training tools as explained by (Pesce et al. 2016), which are interactive tools that provide immediate feedback and can adjust stimuli according to user needs.

With high validation results, strong validity and reliability, and supporting theoretical foundations, it can be concluded that this technology-based table tennis ball launcher is suitable for use as an alternative training medium. Therefore, this tool can be recommended for use in technical training processes to enhance focus.

## CONCLUSION

The reconstruction process of the table tennis ball launcher was carried out using the ADDIE development model (Analysis, Design, Development, Implementation, Evaluation), which involved designing the tool with smartphone-based control, adjusting electronic devices, and testing on users. The validation results and trials showed that this launcher has a very high feasibility level of (86.65%) with the category of "Very Good." Based on the calculations presented in Chapter 4, the researchers conclude that the dynamic robotic-based table tennis ball launcher is declared "very feasible" based on the assessments from 3 experts. Additionally, based on the validity and reliability calculations, it is known that this tool is declared valid (0.510%) and reliable (0.518%). Thus, the instrument is declared valid and reliable for measuring the effectiveness of forehand shot accuracy training. The benefits of this launcher can save coaches' time and provide more consistent training, especially for beginners.

## REFERENCES

Alamsyah, Lefri, dan Tomoliyus Tomoliyus. 2021. "Pengaruh volume latihan dan kecepatan reaksi terhadap ketepatan pukulan drive tenis meja atlet junior." *Jurnal Pedagogi Olahraga dan Kesehatan* 2(1): 44–52. doi:10.21831/jpok.v2i1.17999.

Aprial. M, Benny, Zikrur Rahmat, Alan Alfiansyah Putra Karo-karo, dan Epenetus Giawa. 2023. "Development of the case method in anti-corruption education courses in physical education and sports." *Jurnal Maenpo : Jurnal Pendidikan Jasmani Kesehatan dan Rekreasi* 13(2): 175. doi:10.35194/jm.v13i2.3754.

Bimantara, Aditya Bhaskoro, dan Nuril Esti Khomariah. 2021. "Pengembangan Alat Bantu Pelontar Bola." *Pendidikan Kepelatihan Olahraga*: 1–7.

Da, Mohamad, Rohmad Apriyanto Bcde, Wahyu Ningsih Cde, Ita Khusnia, dan Mellati Aed. 2024. "Development of athletic learning media for elementary school students." 14(2): 118–27.

Dhani Agusni Zakaria, Sumbara Hambali, Silvy Juditya, Henry Asmara, dan Sutiswo. 2023. "The Impact of Technology Media Applications on Aspects of Student Responsibility on Physical

Education Learning." *Kinestetik : Jurnal Ilmiah Pendidikan Jasmani* 7(1): 258–64. doi:10.33369/jk.v7i1.25791.

Erlangga, Dhaniel, Muh Isna, Nurdin Wibisana, Ibnu Fatkhu Royana, Pendidikan Jasmani, Kesehatan Dan Rekreasi, Fakultas Pendidikan, dan Ilmu Pengetahuan. 2022. "Journal of Sport Sciences and Fitness MULTIBALL TENIS MEJA MEDIA Abstrak." 8(24): 49–55.

Furkon, Shutan Arie Shandi. 2019. "The Effect Of Massed Practice And Distributed Practice On The Ability In Dribbling In Football Game." *JUPE:Jurnal Pendidikan Mandala* 4(5): 178–82.

indrawan. 2020. "Cabang Olahraga Tenis Meja." 3: 244–52.

Irrawan, Ade bagus and S.Pd., M.Pd, Dr. Palmizal. A and S.Pd., M.Pd, Hendri Munar. 2020. "Pengembangan Alat Pelontar Bola Sepak Takraw Untuk Pemula."

Juditya, Silvy. 2022. "En_Pend (edukasi Pendidikan Jasmani) Menjadi Salah Satu Aplikasi Berbasis Digital Untuk Menunjang Pembelajaran PJOK Pada Pembelajaran Paradigma Baru Bagi Siswa Generasi Z." *Teknologi Metaverse Dalam Ilmu Keolahragaan*: 27–30.

Kasanrawali, Andi. 2020. "Buku Ajar Teori dan Praktik Permainan Tenis Meja." : 76.

Kertamanah, Alex. 2003. "Teknik dan Taktik Permainan Tenis Meja Dasar." *Bandung: Raja Grafindo Persada*: 54–58.

Kes, M & Murniati, S. 2020. "Pengembangan Alat Pelontar Bola Tenis Meja." *Doctoral dissertation, Fkip*: 7–30.

Mustafa, Pinton Setya, dan Sugiharto Sugiharto. 2020. "Keterampilan Motorik Pada Pendidikan Jasmani Meningkatkan Pembelajaran Gerak Seumur Hidup." *Sporta Saintika* 5(2): 199–218. doi:10.24036/sporta.v5i2.133.

Pesce, Caterina, Ronald Croce, Tal Dotan Ben-Soussan, Spyridoula Vazou, Phillip Tomporowski, dan Michael Horvat. 2016. "Variability of practice as an interface between motor and cognitive development." *International Journal of Sport and Exercise Psychology* 17: 1–20. doi:10.1080/1612197X.2016.1223421.

Rihtiana, Verandita, dan Tomoliyus Tomoliyus. 2014. "PENGEMBANGAN INSTRUMEN PENILAIAN KETERAMPILAN TEKNIK FOREHAND DAN BACKHAND DRIVE TENIS MEJA PADA ATLET USIA DINI." *Jurnal Keolahragaan* 2(2): 216–27. doi:10.21831/jk.v2i2.2627.

Robert Maribe Branch. 2009. 53 Department of Educational Psychology and Instructional Technology University of Georgia *Approach, Instructional Design: The ADDIE*.

Ruky et al. 2018. "Metodologi Penelitian: Metodologi penelitian Skripsi." *Rake Sarasin* 52: 51.

Sari, Mia Zultrianti, Agus Gunawan, Yani Fitriyani, dan Nurul Hilaliyah. 2020. "Pengaruh Minat Baca Siswa Terhadap Hasil Belajar pada Pelajaran Bahasa Indonesia di SD Negeri 1 Ciporang." *DWIJA CENDEKIA: Jurnal Riset Pedagogik* 4(2): 197. doi:10.20961/jdc.v4i2.42137.

Sugiyono. 2020. *Metodologi Penelitian Kuantitatif, Kualitatif dan R & D*.

Sugiyono, P D. 2019. "metode penelitian pendidikan (kuantitatif, kualitatif, kombinasi, R&D dan penelitian pendidikan)." *Metode Penelitian Pendidikan* 67.

Suharsimi, Arikunto. 2006. "Prosedur penelitian suatu pendekatan praktik." *Jakarta: rineka cipta* 134: 252.

Suherman, Adang. 2009. "Revitalisasi pengajaran dalam pendidikan jasmani." *Bandung: CV. Bintang Warli Artika*.

Sukma, A. 2016. *Buku Olahraga Paling Lengkap Kumpulan Macam-macam Cabang Olahraga Nasional & Internasional*.

Triansyah, Andika, Nur Moh Kusuma Atmaja, dan Endang Sepdanius. 2023. "Video-based learning media for physical education." *Jurnal Maenpo : Jurnal Pendidikan Jasmani Kesehatan dan Rekreasi* 13(2): 164. doi:10.35194/jm.v13i2.3740.

Yudha, Fitroh Anugrah Kusuma, Bambang Riyanta, dan Jurit Tri Susetyorini. 2022. "Pembuatan Robot Pelontar Bola Tenis Meja Low Budget untuk Meningkatkan Kompetensi Atlet Tenis Meja di Kabupaten Blora." *Jurnal Ilmiah Multi Disiplin Indonesia* 1(6): 817–23.