

Development of Ball Launcher Training Devices for Drill Smash, Block, Passing in Volleyball Sports

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Abstract

Achievement sports are carried out through a planned, graded, and sustained coaching and development process with the support of sports science and technology. The aims of this study were to: (1) produce a ball launcher training device design for drill smash, block and passing in volleyball; (2) Analyzing the effectiveness of ball throwing training devices for drill smash, block and passing in volleyball; (3) Analyzing the acceptance of ball launcher training devices for drill smash, block and passing in volleyball. This research used development research. The development technique used covers 10 steps, including; potential and problems, data collection, product design, design validation, usage test, product revision, trial, design revision, product revision, mass production. The data analysis technique in this study used descriptive percentages. The outcomes of this study resulted in a ball launcher devices for drill smash, block and passing in volleyball. Test the effectiveness of small-scale group items with an average overall score of "very good" which is 85 percent . Test the effectiveness of large-scale items with the average overall score is "Very Good" that is 98 percent . Product acceptance by the trainer earned an average overall grade of "Very Good" which is 95 percent . Product acceptance by athletes earned an average overall score of "Very Good" which is 98 percent . It was found that the product in the form of a volleyball launcher devices that can be used for drill smash, block and passing in volleyball is feasible and acceptable.

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INTRODUCTION

Human existence is inseparable from technology advancements, and these advancements also have an impact on the world of sports, particularly sports accomplishments that cannot be isolated from the infrastructure used to carry out exercises (Ngula, Bayo, Tapo, & Wea, 2021). Technology must be one of the main contributors to the progress of national sports achievements, which must be meticulously managed (Anggraini & Komalasari, 2019). In order to improve athletic performance, it is essential to develop and advance science and technology (Ahmadan, Nasuka, & Pramono, 2018). The rapid advancement of science and technology is demonstrated by the rising sophistication of sports tactics, techniques, and equipment, which contribute significantly to the development and progression of sports.

Article 74, paragraph 2 of Law No. 03 of 2005 pertaining to the National Sports System states that the government, a regional government, or a community may establish research and development institutions of sports science and technology that contribute to the advancement of national sports coaching and development. The advancement of science and technology in conjunction with better human resources in the sphere of sports is an effective strategy for achieving goals in the form of achievements (Panji, 2015). The use of technology can have a significant impact on the development and advancement of sports achievements worldwide, particularly in Indonesia.

Article 3 paragraph (13) of Law No. 03 of 2005 concerning the national sports system defines sports achievement as a sport that fosters and develops athletes in a planned, tiered, and sustainable manner through competitions aimed at achieving accomplishments with the aid of sports science and technology. There are many factors that can affect the improvement of athletes' training results, such as the creativity of the coach in developing training programs, proper training to improve athlete achievement,

and many things that can be developed, such as training models and infrastructure, to ensure that training runs smoothly and achieves the best results (Setiawan, 2018).

Support for science and technology has a significant impact on the continuing training process and competitions, as measured by Sports Achievements. Many have discovered that devices established in the sporting sector can make training more practical (Albab, Rahayu, & Sugiharto, 2016). Achievements in the realm of sports do not belong to individuals; they are already tied to a nation's honor (Anam, Nasuka, & Aji, 2015). Many factors, including training programs, training materials, training methods, and clear training coaching, must be taken into account when evaluating the success of a coaching process in terms of sports achievements (Wijayati, Soegiyanto, & Rahayu, 2015).

The development and growth of volleyball is a shared responsibility between the center and the regions. Volleyball is a complex game that is not easy for everyone to play because it requires a high level of motion coordination that can be depended upon to execute all the actions contained within the game (Abidin, Darmawan, & Bujang, 2020). Volleyball is a well-known game and one of the most popular sports in the world (Soedjatmiko & Mulyono, 2018). Volleyball is no longer merely a recreational sport; it has evolved into an achievement sport involving exercises that can help a person achieve high accomplishments (Adzalika, Soegiyanto, & Rumini, 2019). To achieve maximum performance in volleyball games, it is also necessary to have supporting facilities and infrastructure so that exercises can run according to what is targeted, and to acquire the perfect technique. Drills are performed by coaches on athletes to enhance technique and refine abilities; drills demand consistency, power, and ball speed; and correct training and drills are necessary for volleyball games.

Achieving a high level of success necessitates the creation of supporting facilities and infrastructure for game development (Candra & Rumini, 2014). In order to get optimum results, it is necessary to use the

devices created by the advancement of science and technology in order to aid the trainer in training.

Passing is an attempt by a player to use a technique, particularly to pass the ball that is being played to his colleagues so that they can play on their own field. Therefore, an athlete must master the passing technique in order to develop an effective offensive strategy. The fundamental passing method in volleyball, comprised of lower passing and higher passing (Juharman, 2015).

A smash is a powerful hit in which the hand makes complete contact with the ball at the top, causing it to go steeply at great speed; if the ball is higher than the net, it can be smashed down. The act of hitting the ball onto the field constitutes a smash. Timing and precision impact the success of a person's smash, including precision when forming a prefix, precision when jumping, and precision when striking the ball (Arte, Nasuka, & Wahyudi, 2020).

A block is an attempt to prevent an opponent's attack by jumping and putting up one's hands; during a block, the player does not touch the net. This technique is crucial to a team's ability to win a match. In line with the progression of the game, the service is the initial stroke to begin play. However, when considered from a strategic point of view, the service is an early attack to gain value (Anggi Susanto, 2015).

Researchers are considering constructing a Volleyball launcher Device (TirtoApriyanto and GilangFirmanto) with the following flaws: 1) This thrower is only capable of producing its maximum throw with Mikasa MV 2200 series volleyballs. 2) The noise created by a volleyball launcher that may impede delivery 3) This object cannot be lifted by the trainer.

Ball launcher Training Devices intend to create a smash drill, a block, and volleyball passing devices are: Can facilitate the coach's performance during smash, block, and passing drills so that the repetitions are executed in accordance with the training schedule. 1) Accuracy becomes steadily more concentrated, hence enhancing the athlete's skills. 2) The use of devices increases the efficiency of exercise time

3) Maximum force is produced 4) The created ball gets more consistent 5) Athletes get more inspired to perform workouts Therefore, the author's inspiration to create "Development of Ball launcher Training Devices for Drilling Smash, Block, and Passing in Volleyball Sports" stems from the existence of numerous challenges. It is envisaged that the development of this media will be extremely beneficial, simplify, and reduce the workload of trainers to obtain maximum results.

METHODS

This study aimed to develop a volleyball drill that can assist coaches in the training process by training volleyball players' movement skills. The development technique consisted of two main goals: (1) producing a product, and (2) testing the product's success in accomplishing the aim (Siregar, Soegiyanto, & Rustiadi, 2021). This study employs a descriptive procedural development model, which is a thnique that defines the procedures that must be followed to produce the product and is intended to facilitate the achievement of maximum performance.

This research identified Research and Development as the steps of development (R&D). In development research, the appropriate steps can be determined based on the situations faced by researchers, and research processes are not required to adhere to a standard. Based on this opinion, the procedure that will be selected for this study is depicted below:

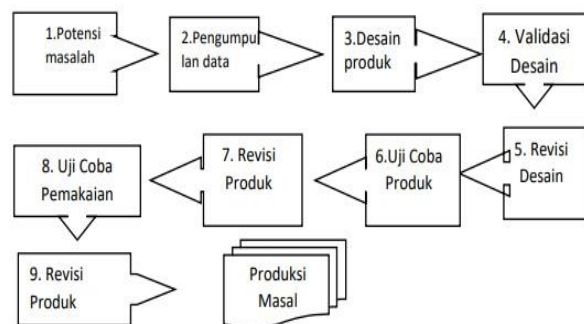


Figure 1. Steps for using the Research and Development Method (RnD)(Siregar et al., 2021)

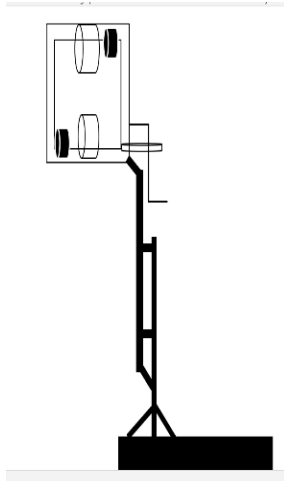


Figure 2. Initial Product Design New Innovations Development of Volleyball Drills



Figure 3. Power Supply

The power supply functions as a single power for all dynamos, both magazine dynamos or ejection dynamos.

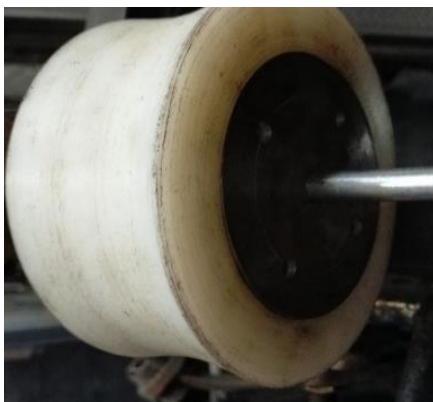


Figure 4. Roller

Roller or Pully are installed together with the ejecting dynamo and have the function of throwing the ball.



Figure 5. Launching Dynamo

The launching dynamo is attached to the roller and has the function of throwing the ball



Figure 6. Level Knobs

The level knobs functions as a speed controller for volleyball drills.

This volleyball drill device has a function to train positions in volleyball games such as tosser, smasher, defend, receive and block, how to use the device as follows :

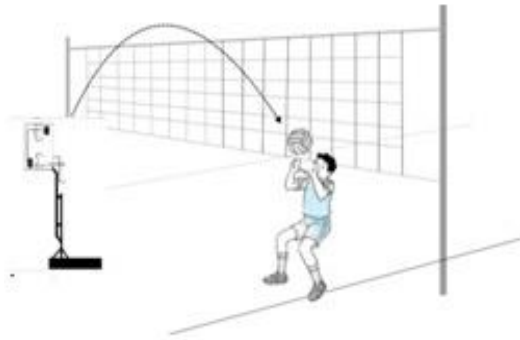


Figure 7. Initial Product Design Innovation Volleyball Drill Device for Training Tosser

This device can be used to learn the following tosser or feeder skills:

The device is activated by connecting the wire to the contact stock. Device height at level 6 speed top wheel 43 dan bottom wheel 40.

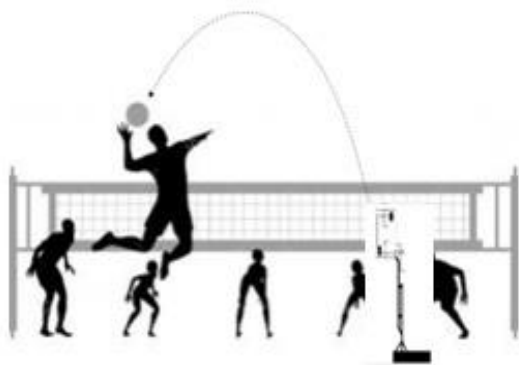


Figure 8. Initial Product Design of Volleyball Drill Device Innovation to Train Smashers

The volleyball drill device can train a smasher or attacker, to use the device when training a smash as follows:

1) The device is activated by connecting the wire to the contact stock. 2) Device height at level 3. 3) Smash ball open wheel speed top 42 bottom 32, top wheel semi ball 20 bottom wheel 22, quick ball top wheel 20 bottom wheel 12.



Figure 9. Initial Product Design of Volleyball Drill Device Innovation to Train Blockers

This volleyball drill device can be used to train blockers by using the following methods:

1) The drill device is activated by connecting the cable to the socket. 2) Device height at level 3. 3) Top wheel speed 100 and bottom wheel 30. 4) Speed is adjusted to the desired ball.

Design validation can be accomplished by presenting multiple professionals or experienced experts to evaluate the newly designed product:

1) Volleyball Expert: National Coach Udi Hermanto, S.Pd (Trainer Atlas Semarang), National Coach Missile Pradini, S.Pd (Coach Atlas Semarang). 2) Electrical Expert: Dr. Ir.I Made Sudana M.Pd.IPM (UNNES), Khoirudin Fathoni, S.T., M. T. (UNNES).

This study's data was collected through interviews with five nationally certified trainers from Central Java. According to the trainers, the volleyball game's drill device helps the coach in the training process, and the coaches concur that this volleyball drill development device can assist the coach in improving the technique and performance of athletes, with the caveat that the device's security and reliability must be verifiable to train the skills needed.

In this study, the research subjects were separated into two groups. One group in phase 1 of the experiment and the other in phase 2 of the trial. 30 athletes were the subjects of this research study. At this stage of the Phase 1 experiment, the test subjects were ten volleyball players. In the second stage of the trial, forty volleyball players served as test subjects.

Table 1. Criteria for the Range of Assessment Used

Research Scale	4	3	2	1
Interpretation 1	Very Good	Good	Deficient	Poor
Interpretation 2	Very Good	Agree	Disagree	Don't Agree

This study used qualitative approach and model development methods. According to Borg and Gall in (Sugiyono, 2007: 89), data analysis is the act of locating and compiling data collected through interviews, field notes, and other sources. By comparing nominal data, descriptive percentage analysis was utilized to determine the validity of the experts and the acceptance reaction of experts and trainers to volleyball drill improvement products via a questionnaire. Using qualitative analysis approaches, data in the form of answer selection recommendations are studied.

Used formula for processing percentage data:

$$P = \frac{\sum X_i}{\sum X_j} \times 100\%$$

Keterangan :

P = Presentase

$\sum X_i$ = Jumlah Skor Penilaian Oleh Pelatih atau Atlet

$\sum X_j$ = Jumlah Skor Maksimal

100% = Konstanta

The percentage obtained is then classified to obtain data conclusions.

Table 2. Percentage Classification

Presentage	Classification	Significance
75 – 100	Very Good	Very feasible using
50 – 75	Good	Proper to use
25 – 50	Deficient	Fix
0 – 25	Poor	Not feasible using

RESULT AND DISCUSSION

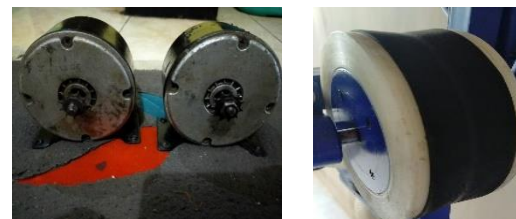
This study's product is a ball-throwing device that can be used for volleyball drills involving smashing, blocking, and passing. The

height, speed, and direction of the ball may be modified to accommodate the abilities of athletes performing drills involving smashing, blocking, and passing. This ball launcher utilizes a cable. After revisions by electrical and volleyball experts, there were modifications to the content and appearance of the initial draft of the product design.

After verifying the product using a questionnaire-based instrument, it has been determined that this instrument can be tested. The questionnaire utilized in the study process as product validation data and device efficacy will be examined using the product effectiveness formula, which will yield usable or unusable product data. Similarly, data verification was conducted utilizing various data gathering methods, such as documentation and conversations on other sources, namely the observations of researchers and experts. The conversation that took place following the trial procedure on a small scale and a big scale creation of this ball-throwing mechanism is one of the strategies used by professionals to verify the veracity of the data. Throughout the duration of the study, descriptive notes are employed to document and record all occurrences that occur. During the trial, audio and photographic documentation was conducted.

This study's initial product was a ball-throwing exercise device for smashing, blocking, and passing. This product design was the result of an investigation of existing device observations. The following are the product component specifications to be developed.

Table 3. Device Components Used in Research



Launcher Dinamo

Wheel

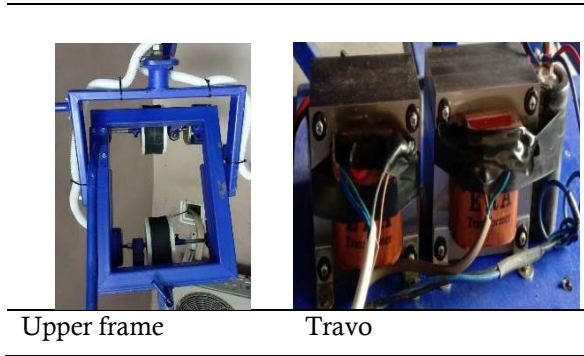


Figure 10. Ball Launcher Products before being validated by experts

Initial Product Specifications of the Ball Launcher are:

Ball launcher as a smash, block and passing drill device in volleyball sport. The device comprised 3 parts of the frame. The device can be directed to the right and left side. The device can be raised and lowered to adjust the height of the ball. Device can be elevated as needed. Device can be adjusted speed. Device can adjust ball size.

Before the Ball launcher was tested on a big and small scale, volleyball experts confirmed the product. This research investigates the sport of volleyball. Since UdikHermantoS.Pd and RudalPradiniS.Pd are national volleyball coaches, he was selected as a volleyball expert by researchers. Dr. Ir. Made SudanaM.Pd. IPM and Mr. KhoirudinFathoni, S.T. M.T. were asked to teach electronics at Semarang State University by the research electronics expert. In this study, the validator saw the ball-throwing equipment and filled out the evaluation form. This validation was performed to revise the device before to small-scale testing.

Table 4. Presentation Classification

Percentage	Classification	Significance
75 – 100	Very Good	Very feasible using
50– 75	Good	Proper to use
25– 50	Deficient	Fix
0 –25	Poor	Not feasible using

Design of Ball Launcher Device for Smash, Block and Passing Drills

First Stage Validation

For the development of ball-launcher devices, the researchers' interviews and questionnaires with electricians and volleyball experts provided the fundamental guidelines. Volleyball experts UdikHermantoS.Pd and RudalPradiniS.Pd participated in the first stage of validation in February 2022 in Semarang, which resulted in a report that this device was feasible to be further developed. However, the first validation stage still had weaknesses, including a decrease in wheel speed and a coating on slippery nylon. Here are the initial validation results from volleyball experts:

Table 5. Validation Results of Initial Stage Volleyball Experts

Expert Validator	Total Score	Perce ntage	Criteria
Udi Hermanto, S.Pd	89	89	Very good and feasible using
RudalPradini, S.Pd	91	91	Very good and feasible using

The first stage of validation was carried out to an electro expert, namely Dr. Ir. Made SudanaM.Pd. IPM and Mr. KhoirudinFathoni, S.T., M. T.

Table 6. The results of the first stage of the validation of the electronics expert

Expert Validator	Total Score	Percentage	Criteria
Dr.Ir.I Made Sudana,M.Pd	95	95	Very good and feasible using
Khoirudin Fathoni, S.T., M. T.	92	92	Very good and feasible using

Second Stage Validation

If the first stage of validation has been examined by experts, both volleyball and electrical experts, the second stage can be conducted. The second validation stage held in March 2022.

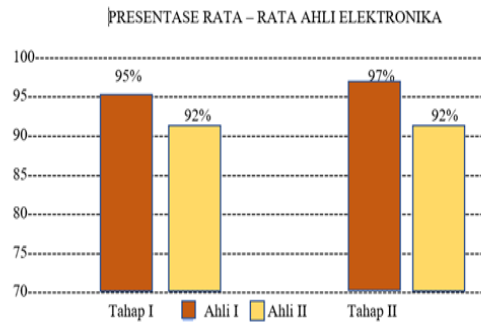
Table 7. Results of Phase II Product Validation by Volleyball Experts

Expert Validator	Total Score	Percentage	Criteria
Udi Hermanto, S.Pd	91	91	Very good and feasible using
RudalPradini, S.Pd	92	92	Very good and feasible using

Table 8. Results of Phase II Product Validation by Electro Experts

Expert Validator	Total Score	Percentage	Criteria
Dr. Ir. I Made SudanaM.Pd	97	97	Very good and feasible using
Khoirudin Fathoni, S.T., M. T.	92	92	Very good and feasible using

The average percentage of electronics experts, for the first expert Dr. Ir Made Sudana, M.Pd and the second expert Khoirudin Fathoni, S.T., M.T and the results of the percentage that has been done by the researcher for Phase I, expert I received a total of 95% and the second expert obtained a score of 92%, whereas in the second stage of validation there was an increase for experts the first receives a score of 97% and the second receives a score 92%.



Gambar 11. PerbandinganPresentase Hasil Validasi Ahli ElektronikaTahap I Dan Tahap II

Effectiveness of Ball Launcher Device for Smash, Block and Passing Drills Small-Scale Trial

A small-scale trial was conducted on February 25, 2022 for 10 volleyball athletes. Small-scale trial data are presented in the following table:

Table 9. Small-Scale Trial

Subject	Score Obtained	Max Score	%	Category
PBV Vokan Semarang Athlete	77	90	85	Very Feasible

The data obtained in a small-scale trial involving 10 athletes consisting of 5 male athletes and 5 female athletes obtained a score of 77 and received a percentage of 85% so that it was included in the very feasible category.

Large-Scale Troials

A large-scale trial was performed on March 2 and 5, 2022 to 40 volleyball athletes consisting of: 1) PBV Atlas Club Semarang. 2) Taruna Merah Putih Club Semarang.

The results in large-scale trial research are as follows:

Table 10. Large-scale Trial

Subject	Score Obatained	Max Score	%	Category
PBV Atlas Semarang Athletes	175	180	97	Very Feasible
Athletes of PBV Taruna Merah Putih Semarang	179	180	99	Very Feasible
Total Score	354	360	98	Very Feasible

The large-scale trial involved 2 clubs, namely 1) PBV Atlas Semarang and 2) PBV Taruna Merah Putih for the score obtained from PBV Atlas Semarang was 175 with a percentage of 97% so it was included in the "Very Eligible" category and for PBV Taruna Merah Putih got a score 179 with a percentage of 99% included in the category "Very Feasible".

Acceptance of the Device to Coaches and Athletes

Volleyball Coach

A large-scale trial was performed on 4 volleyball coaches from the PBV Atlas Semarang club and the Taruna Merah Putih Club Semarang with the results of the large-scale test research data as follows:

Table 11. Results of Large-Scale Trial Against Trainers

Subject	Score Obtained	Max Score	%	Category
Volleyball Coach	38	40	95	Very Feasible

In a large-scale trial of trainers, they obtained a score of 38 with a percentage of 95% including in the "Very Eligible" category".

Volleyball Athletes

The large-scale trial in the table above can be seen in the assessment of 40 athletes from 2 different club groups getting a score of 354 out of a maximum score of 360 with a percentage of 98% included in the "Very Feasible" category

Table 12. Results of Large-Scale Trial Against Athletes

Subject	Score Obtained	Max Score	%	Category
Volleyball Athletes	354	360	98	Very Feasible

DISCUSSION

The ball launcher device satisfies the criteria very good, but it still can't be tested on a small scale because there are still certain aspects that need to be addressed on the device, thus the experts advocate undertaking a small scale test after making modifications to the ball throwing device. Based on the findings of the second stage of validation, there were not many adjustments because it was regarded sufficient and better than the previous product, adding one step of height to make it easier to drill blocks for the men's volleyball net and the cable fireplace in the ball launcher. Based on the small-scale trial table above, it can be seen that the assessment of 10 athletes scored 77 from a maximum score of 90 with a percentage of 85 percent . With this percentage, the product development of ball throwing equipment for drill smash, block and passing in volleyball is included in the "Effective" category. Achievement sports are activities that are administered professionally with the purpose of gaining best performance in sports. With good and effective technology applied, it can support the successes of athletes, notably volleyball(Kurniawan & Ramadan, 2016).

The large-scale trial table shows that the assessment of 40 athletes from two distinct groups of athletes yielded a total score of 354. From a maximum score of 360, 98 percent was obtained. Effective". The effectiveness test was conducted by first utilizing a ball-throwing product for drills involving smash, block, and pass, and then having the athlete complete an evaluation questionnaire on the product. The results of the questionnaire will serve as a crucial benchmark for determining a product's level of efficacy. The new product is highly effective because it can be tailored to the needs of the

athlete. This remark is consistent with (Swandana, Sugiharto, & Wahyu, 2021), which states that the produced device has a high level of effectiveness since it is simple to use and meets the needs of athletes.

Based on the large-scale trial table, the assessments of four coaches from 2 different sets of coaches can be seen: two PBV Atlas Semarang coaches and two Merah Putih Taruna Club coaches. The total acquired score is 38. From a maximum score of 40, 95 percent was obtained. With this percentage, the development of volleyball equipment for throwing the ball falls into the "Highly Accepted" category. The significance of facility renewal and the application of science and technology in the realm of sports coaching, particularly volleyball drills for smashing, blocking, and passing (Abrian & Nasuka, 2021). With this proportion, the development of volleyball equipment for throwing the ball is included in the category of products with the greatest acceptance.

CONCLUSSION

The following conclusions can be derived from the research and discussion regarding the creation of a volleyball launcher device for smash, block, and passing drills in volleyball: The research showed a "volleyball launcher device for drill samsh, block, and passing in volleyball sports," which has been validated by volleyball and electronics experts. The efficiency of the ball launcher device can be determined by the results of the questionnaire, in which 98 percent of the athletes scored "Very Effective" The acceptability of this volleyball launcher device is demonstrated by the fact that 95 percent of trainers and 98 percent of athletes rated the item as "Highly Accepted".

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