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# Development of test devices and measurement of passing computer based volleyballs

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**Abstract**
Manually testing and measuring pass in volleyball has not yet been effective, efficient, and objective, so there is a need for the development of passing instruments of volleyball. The purpose of this research is to develop a manual volleyball passing instrument into a computer-based volleyball passing test kit. This type of research is Research and Development (R & D). Subjects are male and female volleyball athletes of Bina Darma University. The data were analyzed with descriptive qualitative and descriptive quantitative percentage. The research results are as follows: a) Expert validation of the first stage volleyball game of 65% was quite feasible, b) 62.5% first stage electronics experts was reasonable enough, c) first-stage computer expert of 59.3% was quite feasible. Result of research a) Expert validation of second stage volleyball game of 71.6% was feasible. b) electronic expert of the second stage of 75% was worth c) second stage computer experts of 71.88% was feasible. From the results of this study can be concluded that the test and measurement of underhand pass and overhand pass computer-based volleyball game is feasible to be used as a passing volleyball test tool.

**Keywords:** Development of test tools, passing volleyball, computer based

**Introduction**
Science and technology in the development process, both in the field of training or in the test of measuring volleyball productive skills. According to D'Isanto, Allavilla, *et al* (2017) [2] "Volleyball is a sportwith technical characteristics where accuracy is the most important aspect in achieving a winning action" (Volleyball is a sport with skill and precision is the most important aspect to achieve victory).

To improve skills, volleyball playing techniques must be trained and evaluated so the trainer or teacher knows the weaknesses of the technique. Today's modern volleyball is a very fast, explosive and multicomplex game of movement, action development, and situational problem solving. All of these are characterized by the level of intensity of activities that require a high level of skill from players, in terms of basic abilities and special abilities (Czerwinsky, 1995) [1]. According to Rui, Hugo *et al*. (2014: 475) [6] "The speed in which knowledge and technology evolves highlights the importance of good and up-todate education programmes in all professional fields, including sport coaching".

Volleyball players can be said a skilful player if they can master and perform various elements of movement in volleyball well, carefully, effectively and efficiently, according to applicable rules. The volleyball game is carried out on a rectangular field with a size of 9 m x18 m and with a stretch of net in the middle of the field.

Ideally, a volleyball player must have good basic technical skills, good physical and mental conditions in order to achieve something. Physical condition is one of the initial foundations for an athlete to excel. Some general physical conditions that must be possessed by an athlete are strength, resistance, agility, and flexibility.

Besides being physical, the basic technique of playing volleyball can be interpreted as a way to play the ball effectively and efficiently in accordance with applicable game rules to achieve optimal results. Basic passing techniques in volleyball games need to be trained optimally.

a. According to Nuril Ahmadi, (2007: 26) [4] playing the ball with the passing technique can also be done with various variations, including:
b. The overhand pass towards the back passes over the Player's head must be under the ball.

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c. The body and forearm and head are bent back. The wrists are bent backwards, then the body is twisted backwards and the arm movements that are very directed backward will result in the lane of the ball being flat.

d. The overhand pass to the side of the player. The player tries to place himself with the direction of the ball. Then, the body is leaned slightly towards the side where the ball is moved. The ball is then pushed to the side so that the hands, wrists, body, and legs are straight.
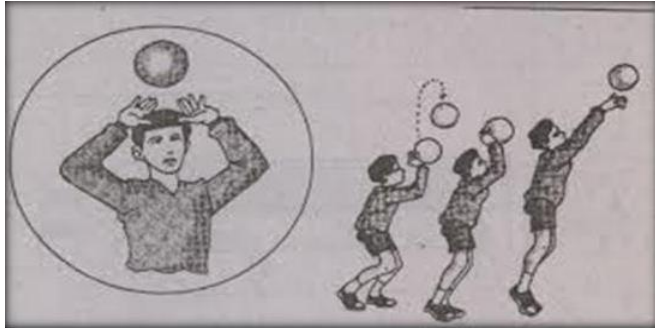


(**Source:** Yunus, M. Sports Choosing Volleyball, 1992: 84)[9]

**Picture 1:** Overhand pass volleyball

## c. Overhand pass while jumping up.

The principle of passing or jumping is not much different from ordinary passing. Only passing on this type is done when the body jumps up, adjusts the arrival of the ball, then pushes the ball in the desired direction before landing.

## d. Overhand pass while flopping to the side.

The implementation of passing techniques or dropping to the side is influenced by the player's ability to move in anticipation of the ball.

## e. Overhand pass while dropping backwards.

This technique is done if the ball cannot be made possible by another passing technique. Some mistakes occurred in doing the top passing according to Backtiar, (2007: 2-18):

a. Less precise body placement right under the ball, knees less bent or body upright, fingers too open or too tight, elbows open or too tight

b. The movement of the fingers closes at the moment of imposition of the ball so that the ball does not fall optimally.

c. The fingers are too weak when they touch, especially for women.

d. Smooth movement between the limbs, body, arms, hands and foot fingers is not harmonious so that the movement is less efficient.

e. The introduction of the ball is not on the tip of the finger but on the palm of the hand.

f. Shoulders do not lead to passing.

g. Both hands are too far above the head.

According to Nuril Ahmadi (2007: 23) playing the ball with the side of the forearm is a fairly important playing technique.

a. The usefulness of forearm techniques includes:
a. For service ball receipts.

b. For ball acceptance from opponents in the form of a smash / attack.

c. For ball picking after a block or ball occurs from the net

reflection.

d. To save a ball that sometimes bouncesfar outside the field.
For taking the ball low and suddenly coming.

**According to Nuril Ahmadi (2007: 24) there are some common mistakes when doing lower passing**

1. The beating arm is bent at the elbow so that the beater board is narrow. As a result the ball rotates and diverts its direction.

2. Too much forward punch arm movement compared to the upward movement so that the angle of arrival of the ball against the batter's forearm is not 90 degrees.

3. The ball falls on the palm of the hand.

4. Two forearms as beaters are less parallel.

5. Less bending of the knee during the preparation stage of the implementation.

6. It is less able to set the ball in accordance with the direction of the ball.

7. Too late to step aside or forward.

8. The beating arm is moved twice.

9. The paddle arm is swang higher than the shoulder.



**Source:** Yunus, M. Sports Choice of Volleyball, 1992: 79

**Picture 2:** Underhand pass volleyball

With current technological advances, one of the shortcomings experienced in conducting tests and measurements of volleyball games is that the tools used are still manual. One of the examples of a volleyball passing test. By using instruments that are still manual, of course, can reduce the effectiveness, efficiency, and the resulting data is not objective.

This situation can occur because the data obtained is manipulated because it is still manual. The passing test that will be developed is as shown in Picture 2. Therefore, there is a need for innovation by developing a volleyball passing test instrument that is still manual to be developed into a test tool and measurement of passing computer-based volleyball games. Here is the design of the development to be carried out (Picture 3).
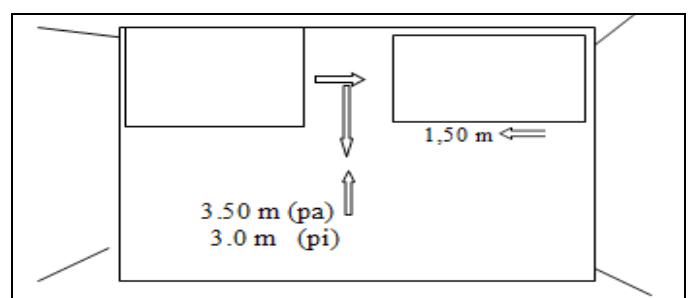


(**Source:** Nurhasan, 2009)[3]

**Picture 3:** Overhand and Lowerhand Passing volleyball Tests
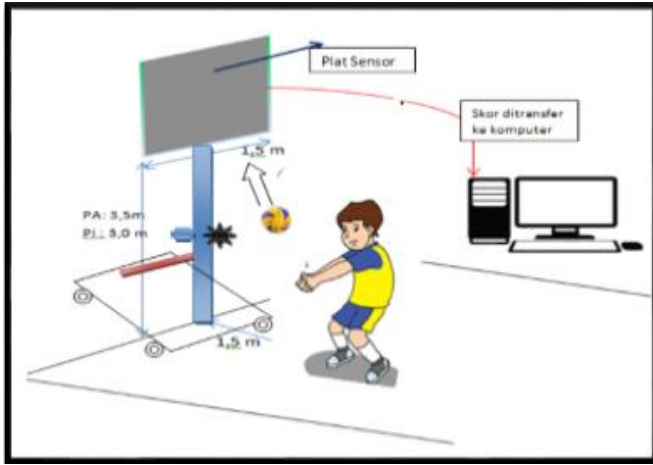
(**Source:** Arif Hidayat's Documentation, 2017)

**Picture 4:** Draft development of a volleyball Passing Test

This study aims to develop a passing instrument on computer-based volleyball with the hope that it will provide an alternative in conducting volleyball passing tests. By using a computer-based passing test the resulting data will be more object and valid. The norms for volleyball passing tests can be seen in tables I and II.

**Table I:** AAHPER Assessment Table for Overhand Passing Test

| Percentile | Sex | Male | | | | Female | | | |
|---|---|---|---|---|---|---|---|---|---|
| | age | 9-11 | 12-14 | 15-17 | 18-22 | 9-11 | 12-14 | 15-17 | 18-22 |
| 90 | | 19 | 31 | 41 | 50 | 13 | 25 | 35 | 38 |
| 80 | | 15 | 26 | 37 | 48 | 8 | 17 | 24 | 27 |
| 70 | | 12 | 22 | 34 | 44 | 5 | 13 | 19 | 20 |
| 60 | | 9 | 19 | 31 | 41 | 3 | 10 | 15 | 16 |
| 50 | | 7 | 17 | 28 | 38 | 2 | 8 | 12 | 12 |
| 40 | | 5 | 14 | 24 | 35 | 1 | 6 | 9 | 9 |
| 30 | | 3 | 11 | 20 | 32 | 1 | 4 | 7 | 7 |
| 20 | | 2 | 8 | 17 | 21 | 0 | 2 | 5 | 5 |
| 10 | | 0 | 5 | 12 | 21 | 0 | 0 | 3 | 3 |

(**Sumber:** Richard H. Cox, 1980:101)[5]

**Table I:** Brumbach Assessment Table Underhand Passing Test

| Percentile | Sex | Male | | | | Female | | | |
|---|---|---|---|---|---|---|---|---|---|
| | age | 9-11 | 12-14 | 15-17 | 18-22 | 9-11 | 12-14 | 15-17 | 18-22 |
| 90 | | 17 | 23 | 32 | 48 | 17 | 23 | 41 | 44 |
| 80 | | 13 | 19 | 28 | 42 | 13 | 19 | 34 | 38 |
| 70 | | 10 | 16 | 25 | 39 | 10 | 16 | 30 | 33 |
| 60 | | 8 | 14 | 23 | 37 | 8 | 14 | 27 | 29 |
| 50 | | 6 | 12 | 21 | 34 | 6 | 12 | 24 | 26 |
| 40 | | 4 | 10 | 19 | 31 | 4 | 10 | 21 | 23 |
| 30 | | 2 | 8 | 17 | 29 | 2 | 8 | 18 | 19 |
| 20 | | 0 | 5 | 14 | 26 | 0 | 5 | 14 | 15 |
| 10 | | 0 | 1 | 10 | 20 | 0 | 1 | 7 | 10 |

(**Sumber:** Richard H. Cox, 1980:103)

## Method
### Research design
The design used in this study is research and development. Called research-based development. According to Sugiyono (2013: 407) [7], development research methods are research methods used to produce certain products, and study the effectiveness of these products. The design of the research development model was carried out in six stages.

1. First stage, make observations about potential problems that will be developed.
2. The second stage, gathering information
3. The third stage of Product Design, the step in the preparation of the initial product design is the development of a test device for the passing and passing of computer-based volleyball games.
4. Fourth stage, expert validation stage. 1) Validation to volleyball game experts, 2) electronics experts 3) computer experts. The results of the validation are then reviewed to improve the model design before being tested.
5. The fifth stage, product revisions that have been recommended for improvement.
6. Sixth stage, Trial product development uses trials to analyze constraints that may be faced and try to reduce the constraints contained in the tools developed. With this product trial done, it is expected that the resulting tools are truly tested, empirical and feasible to use.
7. The seventh stage, finally open. At this stage the final product of the development that has been validated and tested is ready for use.

### Research Subject
The subjects in this study are classified into two parts, namely: first class, subject to expert volleyball, electronics experts, and computer experts. The second group is the test subject. The subject of this trial was carried out with the stages of small-scale trials and large-scale trials.

### Data collection technique
In this study the technique of data collection was done by giving questionnaires to experts in volleyball games, electronic experts, computer experts, and volleyball athletes. Questionnaires can be closed or open questions / statements. According to Sugiyono (2012: 172) [8] the types of questionnaires according to their forms are divided into three, namely (1) multiple choice questionnaire, (2) check list, and (3) rating scale. Questionnaires have criteria, namely (1) strongly disagree/very improper, (2) inappropriate/inappropriate, (3) appropriate/appropriate, (4) very suitable/very feasible.

### Data analysis technique
The data analysis technique carried out in this study is a quantitative analytical analysis technique using numbers. The percentage is intended to find out the status of something that is being held and presented in the form of a percentage. The formula for calculating feasibility according to Sugiyono (2013: 559) is as follows.

$$\text{Rumus:} \quad \frac{SH}{SK} \qquad \begin{array}{l} \text{Keterangan:} \\ SH: \text{Skor hitung} \\ SK: \text{Skor kriteria} \end{array}$$

The results of the calculation of the next data are made in the form of a percentage multiplied by 100%. After obtaining a percentage with the formula, then the feasibility of the test equipment and measurement of passing volleyball games in development research is classified into four feasibility categories using the Scale as follows.

| Skor dalam persentase | Kategori Kelayakan |
|---|---|
| <40% | tidak baik/tidak layak |
| 40%-55% | kurang baik/kurang layak |
| 56%-75% | cukup baik/cukup layak |
| 76%-100% | baik/layak |

The questionnaire used in this research is an assessment questionnaire or response with the form of answers and assessment information, namely. (1): Strongly disagree / very improper, (2): Not appropriate / not feasible, (3): Appropriate / feasible, (4): Very appropriate / very feasible.

**Results and Discussion**
This development research was carried out with the aim of providing a solution for testing volleyball skills. The first stage of the developed tool was named "Development of Passing Lower and Passing Test and Measurement Tools for Computer-Based Volleyball Games". This tool is made by developing a lower passing test and manual passing.
1. Results of Expert Validation
a) Validation of the first stage volleyball expert
The results of the expert validation of volleyball in the first stage are as follows:

Percentage $\quad = \quad$ Maximum Amount / Value
$\qquad\qquad = \quad 39/60\text{X}100\%$
$\qquad\qquad = \quad 65\%$

In the first phase validation of the percentage obtained 65%, it can be stated that according to the material expert, at the first validation stage the Development of Passing Lower and Passing Tests and Measurements for Computer-Based Volleyball Games developed from the feasibility aspect of the material received the category "quite decent".

b). First Stage Electronics Validation
The results of the electronic expert validation in the first stage are as follows:

Percentage $\quad = \quad$ Amount / Maximum Value
$\qquad\qquad = \quad 20/32\text{X}100\%$
$\qquad\qquad = \quad 62,5\%$

In the first phase validation of the percentage obtained 62.5%, it can be stated that according to media experts, at the first validation stage Development of Underhand pass and Passing Tests and Measurements for Computer-Based Volleyball Games developed from design feasibility aspects get the category "quite decent".

c). Validation of Computer Experts Stage Results
Computer expert validation in the first stage is as follows:

Percentage $\quad = \quad$ Maximum Amount / Value
$\qquad\qquad = \quad 19/32\text{X}100\%$
$\qquad\qquad = \quad 59,3\%$

In the first stage computer validation the percentage obtained 59.3% can thus be stated that according to the computer, at the first validation stage the Development of Passing Lower and Passing Tests and Measurements for Computer-Based Volleyball Games developed from the design feasibility aspect got the category "quite decent "

d) Validation of the second stage volleyball expert
The results of the expert validation of volleyball in the first stage are as follows:

Percentage $\quad = \quad$ Amount / Maximum Value
$\qquad\qquad = \quad 43/60\text{X}100\%$
$\qquad\qquad = \quad 71,6\%$

In the second phase validation the percentage obtained increased from 65% to 71.6% of the maximum score. It can be stated that according to volleyball game experts, the second validation stage was developed from the aspect of feasibility the contents of the material get the category "Eligible"

e). Validation of Second Phase Eletronics Expert
The results of the electronic expert validation in the first stage are as follows:

Percentage $\quad = \quad$ Amount / Maximum Value
$\qquad\qquad = \quad 24/32\text{X}100\%$
$\qquad\qquad = \quad 75\%$

Validation of the second stage percentage obtained increased from 62.5% to 75% of the maximum score. It can be stated that according to electronics, in the second stage of validation the Development of Passing Lower and Passing Tests and Measurements for Computer-Based Volleyball Games developed from the physical aspect and the deed gets the category "Eligible"

f). Validation of Computer Expert Stage
The results of the computer expert validation in the first stage are as follows:

Percentage $\quad = \quad$ Amount / Maximum Value
$\qquad\qquad = \quad 23/32\text{X}100\%$
$\qquad\qquad = \quad 71,88\%$

Validation of the second stage percentage obtained increased from 59.3% to 75% of the maximum score. It can be stated that according to computer experts, in the second stage of validation the Development of Underhand Passing Tests and Measurements for Computer-Based Volleyball Games developed from the physical aspect and the deed gets the category "Eligible".

**Product Trial**
**a) Small Scale Trials**
Small-scale trials were conducted on 6 subjects of the volleyball athletes at the University of Bina Darma. The results of the small scale trial were 62.8%. Based on these results, the Development of Passing Bottom and Passing Test and Measurement Tools for Computer-Based Volleyball Games developed from physical and design aspects received the "Quite decent" category.

**b) Large Scale Trials**

Small-scale trials were conducted on 10 subjects of volleyball athletes at Bina Darma University. The results of a large-scale trial were 73%. Based on these results, the Development of Passing Bottom and Passing Test and Measurement Tools for Computer-Based Volleyball Games developed from physical and design aspects received the "Quite decent" category.

This development research is carried out through stages that start from looking at potential problems, gathering information, designing products, conducting validations, revising products, conducting trials and finally making final products. The stages of expert validation are carried out in two stages. The first stage was used as the basis for researchers to revise the deficiencies in the tools developed.

The first stage of the volleyball game validation expert suggests that the developed tool be adjusted between the distance of the test and the sensor plate. The first stage of validation is used as a basis for improving the tools being developed.

Electronic expert validation suggests that the tools developed, especially sensors that design colors to be more attractive and that time and time are determined not manually.

The results of the first-stage computer expert validation assessment suggest that the resulting data can be immediately given a score criterion, so that the resulting data is more valid.

After being validated by experts, then the product was tested in two stages, namely small-scale trials and large-scale trials. The trial was conducted by the male volleyball athlete Bina Darma University.

After going through product testing, we can describe the advantages and disadvantages of the research "Development of the Underhand Passing and Passing Test and Measurement Tools for Computer-Based Volleyball Games" as follows. The advantages of the tool are as follows. (1) Providing efficient and effective training to trainers when providing training. (2) Giving a new variant in evaluating volleyball passing. (3) Data obtained is more objective (4). Portable portable transfer (5) a tool that has been developed like never before.

2. The lack of tools is as follows. (1) The tool uses electricity, so that it is used only in the field where there is an electrical connection. (2) Tools developed are limited to ages 18 and above. (3) The tools developed have no comparison so that it is difficult to find references.

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