

Analysis of Technology Utilization to Measure The Throw Distance of The Ball on Hammer Throw

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Abstract-The focus of the problem in this study is how to use a digital distance metre instrument and how it works in measuring the distance from falling to the ball. This study aims to find out how the digital distance metre measuring instrument works in measuring the distance of a hammer throw. This study uses the Research and Development method. The place to make a digital distance metre tool was conducted at the State Vocational School of Patumbak for 6 weeks. Furthermore, the implementation of the tools and data collection would be carried out at the Medan State University Stadium for 30 days; the trial would be carried out 1-2 times a week. Subjects in this study were 4 athletes from the student education and training centre athletes and 2 from the North Sumatera Gold Programme at Medan State University, for a small group trial of 3 athletes and a trial of a large group of 6 athletes. A data collection technique to obtain the data needed in this study which was then analyzed, was by a literature study, functional test, and measurement error test. Data analysis techniques used were data from the results of questionnaires classified into two groups of data, namely qualitative and quantitative data. Qualitative data was obtained through expert validation activities and trial activities in the form of input, responses and criticism and suggestions. While quantitative data in the form of difference comparisons, collected through field trials, were analyzed with descriptive quantitative analysis. To find out whether there were differences between tools and meters in small group trials and large groups used t-test analysis with a significance level of 5%.

Keywords: Digital Distance Metre, Hammer Throw

I. INTRODUCTION

The progress of science and technology has greatly facilitated human in various activities as well as has been considered a solution to each existing problems. Likewise, technological advances in the field of sports have greatly contributed to the increase in training and performance of athletes. The use of technology as an effort to improve performance in sports has been carried out in developed countries in Asia such as Japan, China and Australia. This is evidenced by the presence of various sports science laboratories, including in Japan, the JISS (Japan Institute of Sport Science), in Australia there is the AISS (Australia Institute of Sport Science), in China there is a BISS (Beijing Institute Of Sport Science) and many in the country other advanced [3].

Technology also has an important role to help progress in the field of sports, one of them is athletic. Athletics is one of the oldest sports branches when compared to other sports. Syarifuddin states that "athletics is one of the branches that are competed consisting of street numbers, running, jumping and throwing" [6]. In sports, the athletics throw and jump numbers such as javelin throwing, disc throwing, bullet throwing, hammer throw, long jump, and arms jump in which numbers that require measurement away a throw and jump to determine the athlete's performance. The measurement results are determined by how far the throw and jump range is carried out by the athlete. Thus, the farther the results of the throw and jump, the better the level of achievement of the athlete will be. Repelling bullets is one of the athletic sports that are often competed in every athletic event, both domestically and abroad. In the sport of bullet repelling it is very important to analyze the measurement of the distance of an athlete's repulsion. The results of measuring away repulsion are very necessary to see the achievements and performance of athletes both during training and matches.

In Indonesia, the development of test equipment and the measurement of a bullet is still underdeveloped. This was evident during the North Sumatra Regional Sports Week (Porwil) event held in Batubara Regency in April 2018, where the measuring instrument in the bullet-proof match was still using a manual measuring instrument (meter). Therefore, the problem that occurs in the measurement of the distance from the repulsion of the bullet is still using a distance measuring device using a steel measuring tape or ordinary meter. Uneven soil can also cause measurement results using manual measuring devices to be incorrect. So that this can cause measurement activities to be less effective and efficient. From the results of the acquisition of measurements using the tool is also still less accurate, it must be converted again into data in accordance with the expectations of the coach. Therefore it is necessary to develop modifications to the measuring device so that it can save energy and time. To facilitate training and competition activities, advanced technology is needed that can help athletes, coaches, and judges more easily in analyzing the results of measurements of a bullet made by an athlete.

Therefore, the study this time will make a productivity tool that serves to measure the results of a shot. The results of this analysis are in the form of calculating the distance of the fall of the bullet repulsion at a distance between 0-100 meters

according to the needs of the researcher. A series of Digital Distance Meter devices with Arduino and GPS Module as supporting equipment used to measure the distance of this bullet repulsion are applied with the intention of being able to replace the steel measuring tape (meter) with a manual system. Steel measuring tape (meter) is replaced with a device called Digital Distance Meter. In addition, this tool can also be used to measure other athletic sports related to distance, such as athletic throwing and jumping numbers.

II. METHODS

This study uses research with the Research and Development (R & D) method. R & D is a research method used to produce a particular product, and test the effectiveness of the product. Research and Development, according to Sujadi is "a process or steps to develop a new product, or perfect an existing product that can be accounted for" [2]. This study aims to change the steel measuring tape using Digital Distance Meter, its operation makes it easy for users such as athletes, judges, and trainers both in training and in competitions. Following is a picture of the research steps:

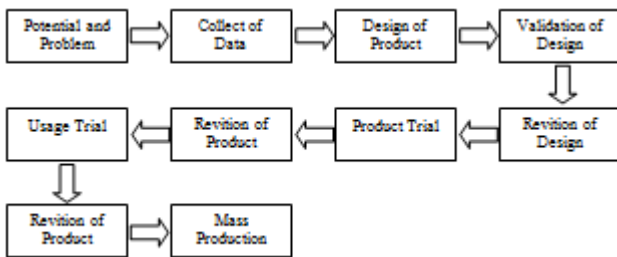


Fig 1. Steps for using the method 'Research & Development' (R&D) [5]

The act of making a bullet-proof distance measuring device will take place at State Vocational School of Patumbak (SMK Negeri 1 Patumbak) which is made from a set of distance detection devices consisting of a GPS Module, the main Arduino circuit, and a battery for 6 weeks. Furthermore, the implementation of the tools and data collection will be carried out at the Medan State University Stadium for 30 days, the trial will be carried out 1-2 times a week.

Subjects in this study were 4 athletes from the student education and training centre, 2 athletes from the North Sumatera Gold Programme in which 3 athletes for a small group trial, and for a large group trial will require 6 athletes.

Data collection technique

Data collection techniques are used to obtain the data needed in this study which is then analyzed. The technique used in data collection is by way of:

1) Library Studies

Data is also taken from literature studies related to the object of research so that later it is expected to be able to help researchers to make a decision on the results of the research that has been conducted.

2) Functional Test

This functional test is carried out in order to find out whether each athlete works according to its function properly or not. Includes: testing Digital Distance Meter tools, the accuracy of Digital Distance Meter tools, and use of measuring sticks.

3) Measurement Error Test

Measurement error measurement is done by comparing the results of manual measurements with the measurement results on the device. Data is taken by testing in the field. Testing the measurement error by comparing the results of manual measurements of steel tape measuring instruments with the measurement results of Digital Distance Meter devices.

The tool used for data collection in this study was a questionnaire. The questionnaire is used to find out the opinions of respondents to the Digital Distance Meter tool. Data from the results of questionnaires that have been collected will then be analyzed.

Data analysis

Data from questionnaire results have been collected, then the data is classified into two groups of data, namely qualitative and quantitative data. Qualitative data is obtained through expert validation activities and trial activities in the form of input, responses and criticism and suggestions. While quantitative data in the form of difference comparisons, collected through field trials, were analyzed with descriptive quantitative analysis. To find out whether there are differences between tools and meters in small group trials and large groups used t-test analysis with a significance level of 5%. The percentage is intended to find out the status of something presented and presented as a percentage. After being disseminated, it is then translated into qualitative sentences.

The questionnaire used to obtain data in this study is an assessment or response questionnaire. The questionnaire used is in the form of "Agree" and "Disagree" answers. Based on the number of opinions or answers, then the researcher squeezes each answer using a formula.

The formula for calculating the feasibility according to Sugiyono[4] is as follows:

$$P = \frac{X}{X_1} \times 100\%$$

Description:

P = Percentage of evaluation results of trial subjects

X = Number of answer answers by trial subjects

Xi = Number of maximum answers in aspects of assessment by test subjects try

100% = Constantan.

The results of the questionnaire were analyzed with the following criteria:

TABLE 1. SKALA LIKERT CATEGORY

Assessment	Value
Worthy	4
Decent enough	3
Inadequate	2
Not feasible	1

Source: Sugiyono [4]

Data obtained through questionnaires were then tested using a percentage test. The percentage test will be tested using the formula:

$$P = F / N \times 100\%$$

Description:

P = Percentage

F = Amount obtained

N = Number of respondents

The collected data were analyzed with quantitative descriptive analysis techniques which were revealed in the distribution of scores and percentages on the categories of the predetermined rating scale. After presenting it in percentage form, the next step is to describe and draw conclusions about each indicator. Appropriate aspects of media development tools can use the following table:

Table 2. Percentage Category

Percentage of Achievement	Interpretation
76-100%	Worthy
56-75%	Decent enough
40-55%	Inadequate
0-39%	Not feasible

Source: (Suharsimi Arikonto) [1]

The table above states the percentage of achievement, value scale and interpretation. To determine the feasibility of using media tools. The table above is a reference for assessing data generated from expert validation.



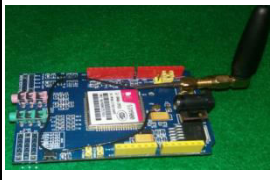

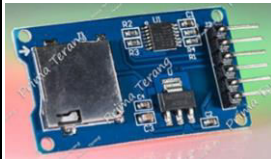
III. DISCUSSION

The concept of this research is to develop a bullet-proofing device with Digital Distance Meter which can be used as a training tool and an athletic match. This development will support sports achievement and become more economical than previous manual measuring devices. The product in this development research attempted to make a distance measurement tool for bullet repulsion using media technology, besides that it could also be used to measure other athletic sports related to distance, such as athletic sports throwing and jumping numbers.

Then this product is expected to be the latest innovation in measuring instruments that are more effective and efficient when used for training or competition and can be used as a solution to the problem of measurement with manual measuring devices.

The research that will be developed has the following specifications:

TABLE 3. DIGITAL DISTANCE METER TOOL SPECIFICATIONS

No.	Name	Picture	Function
1	LCD Keypad Shield 16x2		To display digital data to the LCD display. And the button/keypad/button functions to execute the specified task/choice.
2	Module GPS Neo-6m		To receive and send data to the satellite to determine the GPS position.
3	GSM GPRS SHIELD Sim900		To receive and send data to the intended mobile number, in the form of message data.
4	Arduino Uno SMD		As open source electronics that are made to facilitate us in developing or creating electronic devices that can interact with other electronic devices.
5	Modul Micro SD Card Reader Writer		To save and read data in SD Card.

The research process is carried out in various ways according to the needs that are needed, measuring the results of repulsion in the field of athletics, namely by using a special set of digital devices equipped with Arduino and GPS Module so that the results of calculation of the distance of the fall of the bullet repulsion by the athlete can be immediately known. The use of this tool is also facilitated simply by pressing the START button on the edge of the bullet field beam, after the

athlete has repelled the falling bullet then put the digital device and press the Finish button, then the distance of the falling bullet that has been done by the athlete can be seen immediately until millimetres. This tool is also accompanied by the transfer button where its use can transfer data obtained by the digital device to the Laptop / PC / Smartphone automatically if we press the Transfer button. So that the calculation of the measurement results can be directly seen by athletes, coaches, and judges.

IV. CONCLUSIONS

Analysis of the use of Meter Measuring Technology through Digital Distance Meters to Measure Reject Distance in Reject Bullets is expected to facilitate athletes, coaches, and judges in training activities or competitions in athletic sports, number of bullets. In addition, this tool can also be used to measure other athletic sports related to distance, such as athletic throwing and jumping numbers.

Some suggestions from researchers for the next research is that it can be developed to be even better and develop more advanced technology in accordance with the times. Repair the system again or how it works more than the existing tool.

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