



Development of Sensor Based Standing Board Jump Test Equipment

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Abstract

The purpose of this research is to produce a standing board jump sensor -based. This research was carried out on students of the sports science faculty in April 2022. The type of research used in this study was development research with a Research & Development (R&D) research design from Borg and Gall. This research was conducted with 9 stages of research, namely, (1) Research and information collecting, (2) Planning, (3) Develop preliminary form of product, (4) Preliminary field testing, (5) Main product revision, (6) Main field testing, (7) Operational product revision, (8) Operational field testing, (9) Final product revision. The population in this study using the students of the faculty of sports science. sampling technique used was purposive sampling with a Phase I trial of 20 FIK students and a Phase II trial of 30 FIK students in the soccer course. Furthermore, from the Phase I trial, which amounted to 20 people, it showed a figure of 96% with the Very Eligible, then from the Phase II trial, which amounted to 30 students, it showed a figure of 91% in the Very Eligible. So from the results of this study it can be concluded that the development of a standing board jump can be used to measure leg muscle power through a standing board jump. Based on the data obtained, the development of a standing board jump is declared feasible to be developed as a sensor-based standing board jump test tool.



INTRODUCTION

Sports achievement is a complex phenomenon, because many factors influence it. One of the influencing factors is the development of sports technology. In today's modern era, the development of technology in sports is very rapid. It is proven by the many changes starting from sports infrastructure, sports learning methods and others (Suharta et al., 2021). The development of sports technology is considered very important to advance sports achievements, especially in Indonesia (Mustafa & Dwiyo, 2020).

In modern, technology and knowledge are growing rapidly to support human life in an advanced direction and there is a need for a new breakthrough for the development of digital tools in the field of sports so that they can easily achieve something that has been expected with the development of sports equipment. more advanced and modern (Supriadi et al., 2022). Facilities and infrastructure are very important for the development and achievement of sports. (Measurement & Measurement, nd)

Recent advances in technological innovation in the field of sports are urgently needed for facilities and infrastructure in the field of sports (Akhmad, 2016). Technological innovation in the field of sports is expected to increase effectiveness, efficiency, and accuracy so that it can assist in more valid tests and measurements. The new technology in this study is a sensor-based vertical jump test and measurement technology that functions to measure the height of a jump designed using digital technology (Haryono & Pribadi, 2012). The importance of this research is to assist sports coaches and educators in training young athletes to develop jumping abilities, because jumping is a fundamental technique in almost all sports (No Title, nd). In addition, the overall definition of

this research is to change the manual test and measurement tools towards the use of technology so that it is expected to be able to increase the level of validity of the test equipment. One of the test tools that will be developed by the researchers is power the leg muscle

The limb is one of the most important parts of the human body which is very crucial in supporting daily activities. In the world of sports, the legs are the driving force for athletes and/or other sportsmen. Legs have power that is the focus of athletes in pursuing the specialization of the sport they are involved in (Exercise & Jambi, 2019).

Standing broad jump and vertical jump is one of the tests which is used to determine the amount of power in centimeters (Sports & Jambi, 2019). So far, the problem that has become a concern for athletes and other sports practitioners is how to find out the size of power, especially athletes (Measurements & Measurements, nd). So far, the amount of power is only measured based on the ability to jump high or the distance of a successful jump. The measurements carried out are still limited to conventional technology, namely manual measurements using a tape measure. In fact, this method is less effective as an evaluation material for athletes and coaches in optimizing limb abilities (Sports & Jambi, 2019).

Then the researchers conducted a needs analysis to 10 athletes who often did tests and measurements, the analysis of needs here meant to see how far the test equipment and measurements that the researchers designed were needed by user (users). From the needs analysis carried out by the researchers through a questionnaire compiled by the researchers, it can be seen that 100% of athletes have done tests and measurements of standing broad jumps, 100% of athletes are still doing tests and measurements of standing broad jumps in

the conventional way, 100% of athletes want to get tests measurement using technology and 100% of athletes want new test and measurement tools.

Based on the researcher's observations at the time of measuring and evaluating power leg power measured based on the ability of the successful jump distance. The measurements carried out are still limited to conventional technology, namely manual measurements using a tape measure or ruler. This method is less effective to be used as a measurement and evaluation material for athletes and coaches in optimizing the ability of power leg. Based on the observations above, the researcher wants to make an innovative tool in the form of a digital base to measure and evaluate power leg. Researchers tried to make a tool to measure power leg. This tool is made by using a combination of sensors to measure power so that the results can be maximized. The integration of sensors will produce data that can be used as a reference for the evaluation and measurement of standing broad jump.

METHODS

The type of research in this research is qualitative research with development studies used in a study that must be based on the problem raised. The variables raised in the background of the problem will require a development and method to solve it, even though the research problem is the same but sometimes a researcher can choose one or more types of research development that can be used to solve the problem.

Determining the subject in this study using the Nonprobability Sampling technique. The preparation of the test subjects in this study involved as many as 30 subjects, both students from the Faculty of Sports Science. The preparation of the test subjects in this study with the stage 1

test (small group) and stage 2 test (large group) aimed at:

- a. In the stage 1 test (small group), this study involved 20 subjects consisting of FIK students.
- b. In the second stage of the test (large group), the researchers involved as many as 30 people consisting of FIK students of the soccer specialization course.

Research and development in this process uses a quantitative approach and uses a Research & Development (R&D) research design from (Putri & Wardoyo, 2018) which consists of ten steps, among others.

- 1) Preliminary Study (Research and Information Collecting)
- 2) Planning Research (Planning)
- 3) Design Development (Develop Preliminary of Product)
- 4) Preliminary Field Testing
- 5) Revision of Limited Field Test Results (Main Product Revision)
- 6) Main Field Test

RESULT

There are several types of ways to measure power, one of which is standing board jump. The standing board jump itself can be used as a reference in conducting tests and measuring the distance of a person's jump by not doing a prefix, but standing board jump still uses manual methods in measuring it without the use of Science and Technology in its utilization even though. In this all-digital era, there should be the use of appropriate technology in the field of sports, especially to measure the distance of the jump without a prefix, so that it is hoped that the tool will be able to answer the challenges of science and technology and sports development (tests and measurements). In addition, in order to answer the challenges of increasingly rapid technological

developments in the field of sports, it is necessary to conduct a scientific study (research) using appropriate technology in producing an innovative product that is able to answer challenges in the digitalization era.

Information Gathering of Standing Board Jump Test Equipment

Researchers conducted a needs analysis of 10 athletes who often did tests and measurements, the needs analysis here meant to see how far the richness of the test and measurement tools that the researchers designed was needed by user (users). From the needs analysis carried out by the researchers through a questionnaire compiled by the researchers, it can be seen that 100% of athletes have done tests and measurements of standing broad jumps, 100% of athletes are still doing tests and measurements of standing broad jumps in the conventional way, 100% of athletes want to get test measurement using technology and 100% of athletes want new test and measurement tools.

Design of Standing Broad Jump Test Equipment

Based on the observations of researchers during the measurement and evaluation of power leg power measured based on the ability of the successful jump distance. The measurements carried out are still limited to conventional technology, namely manual measurements using a tape measure or ruler. This method is less effective to be used as a measurement and evaluation material for athletes and coaches in optimizing the ability of power leg. Based on the observations above, the researcher wants to make an innovative tool in the form of a digital base to measure and evaluate power leg. Researchers tried to make a tool to measure power leg. This tool is made by using a combination of sensors to measure power so that the results can be

maximized. The integration of sensors will produce data that can be used as a reference for the evaluation and measurement of standing broad jump.

Revision of Design for the Development of Standing Board Jump Sensor-Based

After the researchers made the design of the standing board jump researchers then submitted the design to test and measurement experts, IT experts and sports lecturers. The goal is to get input and revisions related to the design of the standing board jump sensor-based

The design that the researcher gave to the expert did not get a revision, so that the researcher could proceed to the next stage, namely the manufacture of the product because according to the expert, a trial should be carried out first to see the extent of the weaknesses and strengths as well as the effectiveness and efficiency of using the tool that the researcher had designed.

Initial Product of Standing Board Jump Sensor-Based



Figure 1. Standing Board Jump Test Equipment

Product Trial Phase I

The trial was conducted on 20 students of the Faculty of Sports Science, this aims to provide input and assessment on the results of trials conducted on samples to see the level of usefulness of the tool and the effectiveness of standing board jump ,

so that it meets the criteria for theoretically and empirically feasible.

The data obtained is then used as a basis in an effort to make revisions at a later stage. The results obtained in the field after conducting the Phase I trial are test tool standing board jump sensor-based used can work quite well and the results of the jumps carried out are read perfectly by the distance calculation sensor (cm) connected to the IOP system on Android. well. From the results of trials conducted by researchers on 20 FIK students, it can be seen that they have been classified in the form of a questionnaire, by grouping them into 2 aspects, namely, material clarity, material aspects so that a total of 20 questions are answered, the athletes' answers are grouped into 5 categories, namely SS (Strongly Agree), S (Agree), SD (Medium), TS (Disagree), STS (Strongly Disagree) with an assessment of 5,4,3,2,1. The results of the first stage of the trial for FIK students are stated through the formula for the presentation of the maximum number of answers/scores x 100% with the following results. From the 20 small group trial samples with a total score of 1,938 divided by a maximum score of 2,000 x 100%, it resulted in a presentation of 96% with the Very Eligible criteria. During the Phase I trial, the researchers found findings in the field regarding the standing board jump sensor-based Table 4.

Table 4. Research

No	Findings
1	The sample often shifts the standing board jump form of a box that is exposed to the back of the sample
2	The tool in the form of a box standing board jump is too light so it is often shifted by the sample's feet which will jump
3	Sensors attached to the box standing board jump is not perfect in capturing sample jumps
4	Sunlight effects in capturing jumps through the sensor

5	It is better to make a mat for the jump mat so that the sensor is easier to capture long jumps
6	The jump meter through the sensor connected via android iop takes too long to produce jump

Results Test Results Phase II

A trial was carried out on 30 students of the sport science faculty of the soccer specialization course. This aims to provide input and assessment of the results of the trials conducted on the sample to see the level of usefulness of the tool and the effectiveness of the standing board jump is sensor-based, so that it meets the criteria of being feasible theoretically and empirically test kit standing board jump sensor-based. The results that can be obtained in the field after conducting the Phase II trial are the work of standing board jump sensor-based whether it is feasible to use and meets the criteria referred to in the standing board jump sensor-based. From the results of the trials carried out, it can be seen and classified in the form of a questionnaire, by grouping into 2 aspects, namely, material clarity, material aspects so that a total of 20 questions are answered, the athletes' answers are grouped into 5 categories, namely SS (Strongly Agree), S (Agree), SD (Medium), TS (Disagree), STS (Strongly Disagree) with an assessment of 5,4,3,2,1. As for the results of the second phase of the trial for athletes, it is stated through the formula for the presentation of the maximum number of answers/scores x 100% with the following results. Of the 30 samples of Phase II trials with a total score of 2,743 divided by a maximum score of 3,000 x 100% resulting in a presentation of 91% with Very Eligible criteria.

From the results of research that has been carried out through stage I trials and stage II trials which function to see the usability of the standing board jump test equipment developed by the researcher, then the results of the trials that have been

carried out can be seen in Figure 1 diagram as follows.

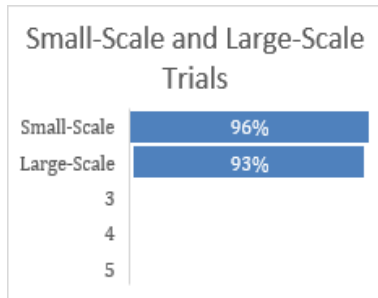


Figure 2. Small Group Trial Results and Large Group Trial Results for

Final Products

From the results of the assessment and the results of the second phase of product trials above, it becomes the material for improving the final product of the standing board jump sensor-based test standing board jump sensor-based. The researcher went through several processes for research refinement, while the stages of the process that were passed were (1) Determining the problem and collecting information as a rationale for making a development research concept, (2) Determining what form of development would be an object of research, (3) Creating a development research in collaboration with a team of experts, (4) Revising the design of the developed test and measurement tools, (5) Initial product of standing board jump, (6) Phase I trial, (7) Revision of trial phase I to the experts, (8) Phase II trials and assessments by experts, (9) The final product.

Furthermore, due to the limitations of the researchers, the research carried out was only up to the Phase II trial phase, where at that stage the experts consisting of test and measurement experts, IT experts, and sports academics experts revised and validated the standing board jump sensor-based with the Very Eligible category.

The test tool standing board jump can later be used by coaches and athletes, especially in North Sumatra province and adds to the treasury of test and measurement tools within the Unimed Faculty of Sports Science. The final product that has passed the entire series of development flows so that it becomes a vertical jump is as follows:



Figure 3. Samples When Testing Products

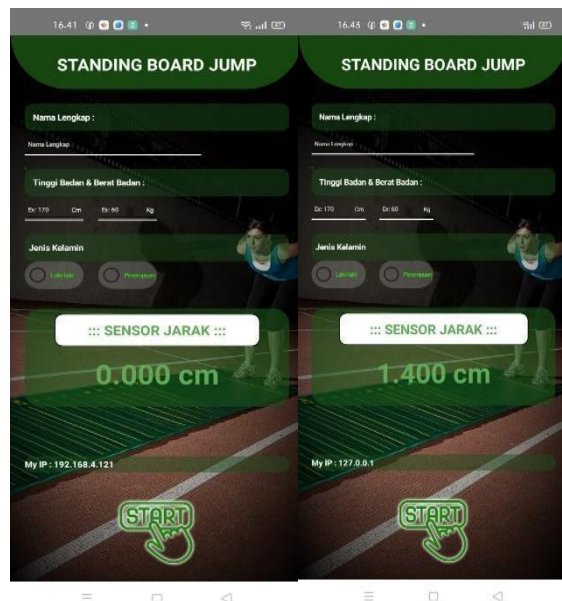


Figure 4. Application Display on Android IOP

How to Implement:

Objective: Measuring components power muscle
 Equipment: Mats/boards in which there are several sensors jump distance meter (beginning-end), Android System

Implementation : The sample stands on the starting board or the end of the mat with knees bent to form an angle of approximately 45 degrees, both arms straight back. Then the sample rejected forward with all his might and landed on two feet. Sample given 3 chances to do.

Score : The best jump distance measured from the inside edge of the starting board to the foot/body closest to the starting board from 3 attempts.

DISCUSSION

The test and measurement standing board jump sensor-based that the researcher developed is digital-based with the calculation of the jump distance connected to the android system with a very easy implementation, where in its implementation it uses technology as a test and measurement tool so that the results of the tests carried out have no doubts about the level of validity again because the use of appropriate technology will have an impact on the level of validity test and measurement of standing board jump sensor-based. The development process through research and development procedures is in line with research conducted by (Baskoro, 2020) (Bayu, 2020) (Haryono & Pribadi, 2012) (Dewi & Pakpahan, 2018). Through some planning, production and evaluation, this product was developed with the help of a person who mastered electronics and mechatronic engineering.

This development goes through various stages, namely the design stage, the tool frame stage and the installation stage of the tools until they are connected to the android system. After the initial product is produced, it needs to be evaluated to experts through expert validation and needs to be tested on samples. At the evaluation stage, it was carried out on test and measurement experts, IT media experts and sports

academics. The next stage of research is the product trial Phase I and Phase II trials.

In the validation process of test and measurement experts, IT media experts and sports academics experts are carried out using content validity content validity, namely validity based on expert opinion that the instrument is feasible to be used as a data collection tool. Evidence of content validity is obtained by agreeing with experts (expert judgment), namely test and measurement experts, IT media experts and sports academics. Based on the results obtained, it can be continued to the next stage because the tool is declared feasible and there are no revisions to this test tool.

Test and Measurement Tools Standing Board Jump Sensor-Based "Very Eligible" category. This statement can be proven from the results of the "Very Eligible" from the three experts, both test and measurement experts, IT media experts and sports academics. as well as in the assessment of trials, Phase I trials, and Phase II trials. Respondents or samples were enthusiastic about this product because respondents were interested in trying it and asked questions about how it works and its uses, this product can be disseminated as standing board jump a sensor-based

If you look at the findings of the research results when the researchers conducted Phase I and Phase II trials, there were advantages and disadvantages of this tool. The advantages include (1) Providing efficiency and effectiveness to samples in conducting tests and measurements, especially standing broad jumps. (2) Can help the sample in knowing the distance of the jump. (3) The tool is portable, meaning it can be taken anywhere. (4) Increase knowledge about technological advances. (5) The jump result is connected through the android system. (6) Changing manual tools towards the use of technology. Disadvantages include (1) Must be done in

a closed room so that the sensor is easy to catch and measure the distance of the jump. (2) Mattress media must be made so that the sensor is able to win and process data quickly and then send it via android.

CONCLUSION

From the results of the research that has been done, the researcher concludes that the standing board jump sensor-based standing board jump test tool standing board jump sensor-based stakeholders can more easily see the standing board jump and can also be used as evaluation material, especially in increasing the jump from the tester. This development research produces a test kit standing board jump sensor-based, which is expected to work effectively and efficiently so that it can be an attraction for athletes and coaches in activities to determine the athlete's jump as well as for future researchers.

This test tool is expected to provide convenience in measuring the athlete's jump height as well as accuracy in seeing the results of the athlete's ability to jump. In the implementation of tests and measurements, the data will go directly to the IOP device in the Android system.

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