



Development of Shoulder & Wrist Test Instruments Based on Digital

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Abstract

A test tool and measurement of shoulder flexibility and developed to be a sports lecturer's guide in teaching courses test and measurement. This research was developed by adapting the Borg & Gall educational research and development model. The development procedure used includes several stages: 1) recognizing the content of the product being developed, 2) developing the initial game product, 3) expert validation, 4) testing field The data analysis technique used in this research is done in two ways, namely quantitative and qualitative. The subjects of this study were students of the sport science faculty in the test and measurement subject. The resulting product has been evaluated by experts, tested and revised and validated by media, material and practitioner experts through a questionnaire consisting of various questions. effectiveness of the product development of digital-based shoulder & wrist test kits has the results of 85% material experts, 96% media experts and 85% by practitioners. The results of field trials show a value of 90% with a very feasible category so that it can be used for use. Thus, it can be stated that the development of digital-based shoulder & wrist test kits is effectively used as the basis for developing science and technology in the field of sports.



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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. The development of sports technology is considered very important to advance sports achievements, especially in Indonesia.

Today the development of science and technology (science and technology) is very rapid. Along with the rapid development of science and technology, there are many innovations from various studies that are growing rapidly as well. Various human activities in daily life have also been greatly helped by advances in science and technology, including in the field of sports, which have been helped in the process of training and competitions. Support from science and technology took part in helping athletes to excel, so starting from talent search, training, tests and measurements, to competitions, athletes and coaches were helped. The development of science and technology in improving the athlete's ability to kick is very necessary because it is expected that when science and technology takes part in the world of sports, especially in terms of tests and measurements, the test equipment will be more effective and efficient.

The latest advances in technological innovation in the field of sports are needed for facilities and infrastructure in the field of sports. 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 Shoulder Wrist that functions to measure shoulder flexibility using digital technology. The importance of this research

is to assist sports coaches and educators in training young athletes to develop the ability to see the flexibility of the shoulder muscles required by several sports. Physical measurements of athletes are measurements taken to determine the physical abilities possessed by athletes (Wiryan, 2017).

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 the shoulder wrist. The tool was developed using technology in recording the results of shoulder flexion.

According to (Adnan et al., 2019) Flexibility as a component of physical fitness is the ability to move the body or its parts as widely as possible without joint tension in muscle injury. (Syahrial, 2015) "A person's flexibility is influenced by: type of joints, length of muscle rest, length of rest for ligaments and joint capsules, body shape, muscle temperature, gender, age, skin resistance and bone shape. (Measurements & Measurements, nd) also adds the definition of flexibility is the area of motion of the muscles of the joints of the body. Flexibility is closely related to the natural ability of the skeletal muscles to stretch and stretch beyond their normal length at rest. Increasing flexibility will improve the appearance of the body and reduce the chance of injury.

According to (Dewi & Verawati, 2022) flexibility is one of the elements of physical condition that determines in learning movement skills, preventing injury, developing strength, speed, endurance, agility, and coordination abilities. Other terms of flexibility that are often found are flexibility, flexibility, and flexibility. According to (Gumantan & Mahfud, 2020) flexibility is the limit of the maximum possible range of motion in a

joint. Flexibility is useful for movement efficiency in carrying out motion activities and preventing possible injury. This ability is needed by all players, the ability of various joints in the body to move as wide as possible. Or it can also be interpreted that flexibility is the area of movement of a joint, and it can also be interpreted that flexibility is the capacity to move in the joint space. Based on the description above, it can also be explained that flexibility is the ability of joints, ligaments and tendons around joints to carry out the widest possible range of motion. Flexibility is also one of the components of physical fitness that is very important to be mastered by every student, with the characteristics of fast-paced, strong, flexible but powerful motion, body flexibility development must receive special attention. Flexibility also shows the maximum amount of joint movement according to the possibility of movement. People who have good flexibility are people who have a wide range of motion in their joints and have elastic muscles. Thus it is clear that flexibility plays a very large role in learning movement skills and in optimizing other physical abilities. Based on the influence of flexibility on movement skills, it can also be seen in volleyball, gymnastics, basketball, soccer, sepak takraw and so on. Almost all sports that require a high level of coordination of movements and complexes require flexibility or flexibility of the joints of the body according to the level of sports needs because each sport requires a different level of flexibility.

Body flexibility is very useful in everyday life. A flexible and well-trained body will reduce the risk of injury in performing a movement. This will be useful in mastering some of the physical skills you want to learn. Flexibility is very influential for sports that require flexibility. This has actually become an anomaly in the midst of rapidly increasing technological

sophistication (IPTEKS), of course it is necessary to design a digital-based test and shoulder wrist with the use of technology in the field of sports. Shoulder flexibility test kit (shoulder wrist) designed to be able to measure the athlete's ability to perform shoulder flexibility tests, the tool is designed to be digital based, meaning that when the tester does the test the results of the flexibility will immediately come out via the android which is paired with the test kit.

METHODS

The development method used in this research is the Borg and Gall development model which is simplified into 5 steps. This was done due to time and cost constraints. This refers to the statement put forward by (Suharta et al., 2021) (Verawati et al., 2021) which states that development research can be stopped until a final draft is produced, without testing the results. The 5 steps are described as follows: (1) information gathering (2) Product design developed (3) expert validation and revision (4) small-scale field trials and revisions (5) large-scale field trials and final product revisions.

The procedures in this study can be presented in table 1 below:

Table 1. Research Procedure

No	Stages	Implementation
1	Gathering Information	Literature study and observation
2	Design of test products developed	test instruments shoulder & wrist
3	Expert validation and revision	Conducting validity with several experts (related to shoulder & wrist

			test instruments as needed)
4	Conduct Small scale field trials and revisions	Small group trials and expert evaluations	
5	Conduct Large scale field trials and final product and revisions	Large group trials and expert evaluations and final products	

Research subjects in this study were students majoring Education and Sports Science, FIK Unimed. For small group trials consisting of 20 students. The large group trial consisted of 30 students. The trial was conducted to determine the level of validity, practicality, and effectiveness instrument test shoulder & wrist the developed

The research data were collected through descriptive qualitative and quantitative. Qualitative data in the form of written interviews with input, suggestions, and responses from validators of experts, lecturers, practitioners/soccer coaches, observers and students. This type of quantitative data is obtained from the assessment scores given by validators, lecturers, practitioners/trainers, observers, and students through validation activities and field trials. The data obtained are described in detail to determine the level of validity, practicality, and effectiveness instrument test shoulder & wrist developing a instrument testthe . in shoulder & wrist digital-based

RESULT

From the results of the expert validators used against 3 experts, namely media experts, test and measurement material experts and sports practitioners, where each expert will analyze each trial from a small and large scale. The results of the assessments of the three validators can be seen in Table 2. As follows:

Initial Draft Model		
Ali's	Expert Material	Practitioner
50%	41%	45%
Small Scale Draft Model		
Media	Expert Material	Practitioner
78%	62%	59%
Final Model Large Scale		
Media	Material	Practitioner
Expert	Expert	
96%	85%	85%

Based on the data that has been collected through material test experts, media experts and practitioners, it can be said that digital-based shoulder & wrist test products can be used to measure shoulder muscle flexibility.

Field Trial The

Results of the field trial were carried out by 30 students of the sport science faculty of test and measurement subjects in sports which have been classified in the form of a questionnaire, by grouping into 3 aspects, namely appearance, satisfaction and media quality, each of which has 5 indicators. in it so that there are a total of 15 questions, the results of 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 first phase of the test on athletes, it is stated through the formula for the percentage of answers/maximum score x 100% with the following results. Of the 30 30 students of the sport science faculty, the test and measurement subjects in sports with a total score of 2029 divided by a maximum score of 2250 x 100% resulted in a presentation of 90% with Very Eligible criteria. Can be seen in Table 3 as follows.

Sample	Number of Answers (X)	Maximum Score (Xi)	Percentage %
X30	2029	2250	90%

In **Table 3** above it can be concluded that the percentage of the results of field trials is 90% with a very feasible category so that the product can be used to measure the flexibility of the back muscles (shoulder).

DISCUSSION

The shoulder & wrist test tool uses the technology media that the researcher developed is based on android with a very easy implementation, where in its implementation it uses technology as a shoulder & wrist test tool so that the results of the tests carried out have no doubt about the level of validity due to the use of appropriate technology. will have an impact on the validity of the shoulder & wrist test. The development process through research and development procedures. 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 to the connector into 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 athletes. At the evaluation stage, material experts, IT media experts and test and measurement experts are carried out. The next stage of the research is a field trial. There are several studies related to the development of test and measurement tools using technology including (Baskoro, 2020), (Gumantan & Mahfud, 2020) (Akhmad et al., 2022).

In the validation process of material experts, IT media experts and test and measurement experts, it is carried out using content validity according to Saifudin (Yudha, 2016) 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 making an agreement from experts (expert judgment), namely material experts, IT media experts and test and measurement experts. 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.

The quality of "Development of shoulder & wrist test" is included in the "Very Appropriate" category. This statement can be proven from the results of the "Very Eligible" assessment analysis from the three experts, namely material experts, IT media experts and test and measurement experts as well as in the assessment one-on-one trials, field trials. Respondents or athletes were enthusiastic about this product because respondents were interested in trying it and asked questions about how it works and its use. This product can be distributed for shoulder & wrist. There are advantages and disadvantages of this tool. The advantages include (1) Providing efficiency and effectiveness to the trainer when giving muscle flexibility tests. (2) Can help adapt muscle flexibility through sensors. (3) the tool is portable. (4) Increase knowledge about technological advances. (5) This tool can also be seen to determine the flexibility of the shoulder muscles.

CONCLUSION

From the results of field trials and expert validators as well as research discussions, it can be concluded that:

(1) Based on the results of evaluations and trials that have been

carried out research on the development of digital-based shoulder & wrist test kits has an effective tool that is more efficient in its use, (2) Based on expert validation and trials, a digital-based product for the development of a digital-based shoulder & wrist test kit has been produced which is suitable for use in the shoulder muscle flexibility measurement test. This is based on the discussion of the results of the product trial analysis, which includes the convenience factor, the attractiveness of the usefulness and safety of the tool. (3) Based on the effectiveness of the development tool, the product has a very good effectiveness. This is based on expert validation data which has an average result of more than 80%.

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