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Need analysis of digital technology-based push up test: Instrument of arm muscle strength

I Wayan Artanayasa[abcde*], Ketut Chandra Adinata Kusuma[abcd], Ketut Udy Ariawan[abde]

Universitas Pendidikan Ganesha, Indonesia

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ABSTRACT

The rapid development of science and technology has an impact on the development of sports, both achievement sports, educational sports, and recreational sports. The use of technology and sport science is very important for the advancement of sports achievements. One of these implementations is the stage of testing and measuring physical conditions using instruments with a low level of human error. The purpose of this study was to analyze the need for the development of a digital technology-based push up test as an instrument for arm muscle strength. This research is a survey research that uses a quantitative descriptive approach. 256 respondents with a background as a lecturer at the Faculty of Sports and Health Undiksha, as well as athletes from Buleleng Regency, Badung Regency, Bangli Regency and Denpasar City filled out a questionnaire consisting of six statements. Questionnaires are used to determine the opinion of respondents on the needs of the developed instrument. Based on the results of the survey, the majority of respondents experienced difficulties in doing push up according to the procedure, and they stated that the manual push up test was prone to human error during calculations. Thus, all respondents agree with the development of digital technology-based arm muscle strength instruments. Referring to the results of the research above, this data can be one of the basic considerations in the development of a digital technology-based push up test which is intended in the process of measuring arm muscle strength with a good level of validity.

Keywords: Need analysis; digital technology; push-up test; arm muscle strength

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Corresponding Author: I Wayan Artanayasa, Department of Physical Education, Health and Recreation, Faculty of Sport and Health, Universitas Pendidikan Ganesha, Singaraja, Indonesia
Email: wayan.artanayasa@undiksha.ac.id

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INTRODUCTION

The development of science and technology takes place rapidly from year to year, including in the world of sports. Various findings related to the use of technology in sport development have been found, such as the underpass test in a sensor-based volleyball game (Indrakasih et al., 2022), a tool for measuring arm muscle strength and endurance for archery athletes named the "Holding Bow Digitec Test" (Prasetyo et al., 2022), multimedia-based soccer learning media (Kusuma et al., 2022), the application "Sports App" about basic motion in sports (Priyambada et al., 2022), a camera that assists the performance of volleyball referees in a match or competition (Szelag et al., 2019), MyJump2 application as a leg power measurement tool (Rogers et

al., 2019). The rapid development of science and technology is very helpful for athletes and coaches in training and competition (Hidayat et al., 2019). In addition to helping the performance of athletes and coaches' performance, the use of technology can also help the referee's work in a match (Szelag et al., 2019). So the presence of technology in the world of sports has a positive impact.

Sport is a physical activity that is carried out in a programmed manner and a comprehensive improvement process in order to improve the components of physical fitness, improve physical quality, functional abilities of body organs, and healthy psychological qualities (Fathir et al., 2021). Basically, exercise in the context of sports is a process of loading the body so that it causes a response (Cassemiro et al., 2017), and adaptation to the body (Doma & Deakin, 2013). Physical fitness is defined as a person's ability to perform physical activities without causing excessive fatigue (Sinuraya & Barus, 2020). The level of physical fitness of each person is influenced by the activities he does daily (Yulianti et al., 2018). This means that a person's fitness is a reflection of his daily activities. The level of physical fitness has a linear relationship to the level of success, work success, and other physical activities (Widiyanto & Hartono, 2018). The main components of physical fitness include muscle strength, speed, agility, and cardiovascular endurance (Mora-Gonzalez et al., 2019). One indicator of physical fitness is muscle strength which is defined as the ability of the neuromuscular system to generate force against an external resistance (Bompa & Buzzichelli, 2019), especially the arm muscles (triceps) which can be tested or measured using the 30 seconds push up test (Kellner et al., 2021).

Until now, push ups are not only an exercise method for developing arm muscle strength and/or endurance (Hassan, 2018), shoulders, and upper body, but also used as an instrument of physical condition both in the military and civilian sectors (Kellner et al., 2021; Hartono et al., 2019). The basic concept of the push up movement, among others, requires the testee's body to remain upright both when the body position goes down and up alternately (Cureton et al., 2013; US ARMY, 2012). While the orientation of the push-up test is the number of correct repetitions recorded by the tester during the time interval.

Research on manual push up tests has been done before, including in assessing objectivity and reliability (Fielitz et al., 2016), the reliability of the one-minute push up test conducted by the Indonesian Air Force physical tester (Arifin et al., 2020). The weakness in the implementation of the manual push up test is the large amount of human error when calculating the push up movement. Research result Putranta and Supahar (2019) shows that the total score of the manual push up test from the assessment between testers, then the scores are always not identical. This means that it is difficult to avoid differences in perceptions between testers, even though the perception has been equalized. Moreover, with the implementation of mass tests (the number of testees is very large), what the tester can do is anticipate the smallest possible errors (Putranta & Supahar, 2019). So that the tester's subjectivity is still very large when using a manual push up test (Irawan & Sandiyudha, 2018). Whereas scientific instruments must contain elements of validity and reliability as well as objectivity (Kellner et al., 2021; Teixeira et al., 2014; Hachana et al., 2014). The objectivity in question is the same as the reliability of the tester, meaning the extent to which the instrument is able to be free from the tester's subjectivity (Gwet, 2014).

The utilization of the combination of technology and sport science is manifested in the process of testing and measuring physical condition, including measuring arm muscle strength using a sensor-based push up test instrument. Although a push up measuring instrument based on a microcontroller with an ultrasonic sensor has been successfully developed Rosadi et al. (2018 and Ramdhon et al. (2020), however, redevelopment is needed to improve the instrument, both in terms of how it works and the design of the instrument. The purpose of this research is to reveal the need for the development of push-up tests based on digital technology. Due to, to become a nation that has global sports achievements, then creating technology (not consumers) is one solution (Bäckström et al., 2013). Although it is stated that limited funds have resulted in technology-based sports aids not being able to run as needed in the field (James & Petrone, 2016). All the limitations and obstacles become a challenge in developing push up tests based on digital technology that have good validity and reliability values, as well as affordable prices in Indonesian society. Based on these problems, we are interested to develop a push up test based on digital technology. So that later this device can be owned by everyone, easy to carry anywhere, can be used for measuring arm muscle strength and the results produced are more valid and reliable.

METHOD

This research is a survey research with a quantitative descriptive approach. Questionnaires are instruments that researchers use to obtain information or data from research subjects. The questionnaire that prepared consisted of six questions (Table 1). The questionnaire used was adapted from previous research on needs analysis of development of digital-based vertical jump test (Yusfi et al., 2022). The data that has been collected based on the contents of the questionnaire by all respondents is quantitative data which is calculated using percentage descriptive technique.

Table 1. Questions from Needs Analysis of Digital Technology-Based Push Up Test Development Questionnaire

No.	Question
1	What is your job?
2	Do you know about the arm muscle measuring device (triceps)?
3	How much have you used the push up test in the last 1 year?
4	Are you having trouble doing the push up test?
5	How far is the accuracy level of the manual push up test?
6	Do you agree if this push up test is developed from a manual model to be based on digital technology?

The researcher used purposive sampling in determining the respondents who would be given a questionnaire/involved in this research. A total of 256 respondents were selected to fill out a questionnaire consisting of 10 lecturers from the Faculty of Sports and Health Undiksha who teach at the Ganesha Sport Center, 246 athletes consisting of athletics, basketball, volleyball, judo, karate, archery, rock climbing, pencak silat, swimming, football, tennis, boxing, and yong moodo, which came from KONI of Badung Regency, KONI of Buleleng Regency, KONI of Bangli Regency, and KONI of Denpasar City who were preparing to take part in PORPROV Bali XV 2022. All respondents received information about the objectives, procedures method of filling, and approval.

RESULTS AND DISCUSSION

The answers from all respondents who filled out the questionnaire sent via google form became the result of data analysis of product development needs. These results become the scientific basis for the development of push up tests based on digital technology. Tables 2 to 7 show the results of all respondents' answers.

Table 2. Percentage of Answer Based on Respondents' Jobs

No.	Respondent Cluster	Amount	N(%)
1	Lecturer of the Faculty of Sports and Health	10	3.9%
2	KONI Athletes of Badung Regency	70	27.3%
3	KONI Athletes of Buleleng Regency	64	25%
4	KONI Athletes of Bangli Regency	44	17.2%
5	KONI Athletes of Denpasar City	68	26.6%
	Number of Respondents	**256**	**100%**

If you look at table 2 above, from the 256 respondents who have a background as a lecturer at the Faculty of Sports and Health, 10 people (3.9%) athletes from KONI Badung Regency, 70 people (27.3%), athletes from KONI Regency. There are 64 people from Buleleng (25%), KONI athletes from Bangli Regency 44 people (17.2%), and athletes from KONI Denpasar City totaling 68 people (26.6%).

Table 3. Percentage of Answer Based on Knowledge of Arm Muscle Strength Instruments (triceps)

No.	Answer	Amount	N(%)
1	Know about the name of the arm muscle strength instrument (triceps)	256	100%
2	Don't know about the name of the arm muscle strength instrument (triceps)	0	0%
	Number of Respondents	**256**	**100%**

Table 4. Percentage of Answer Based on Frequency of Performing Manual Push Up Tests

No.	Answer	Amount	N(%)
1	Sometimes	33	12.9%
2	Very Often	223	87.1%
3	Never	0	0%
	Number of Respondents	**256**	**100%**

Then, all respondents stated that they knew the name of the instrument used to measure arm muscle strength/triceps (Table 3). In the last 1 year, it was revealed that as many as 33 respondents or 12.9% sometimes do manual push up tests, and 223 respondents or 87.1% who say very often in doing manual push up tests (Table 4).

Table 5. Percentage of Answer Based on Having Trouble in Performing Manual Push Up Tests

No.	Answer	Amount	N(%)
1	Sometimes	21	8.2%
2	Yes	197	77%
3	No	38	14.8%
	Number of Respondents	**256**	**100%**

Table 6. Percentage of Answer Based on Opinion Level of Manual Push Up Test Accuracy

No.	Answer	Amount	N(%)
1	Quite Accurate	30	11.7%
2	Very Accurate	4	1.6%
3	Not Accurate	222	86.7%
	Number of Respondents	**256**	**100%**

Table 7. Percentage of Answer Based on Approval to Develop Manual Push Up Test to Digital

No.	Answer	Amount	N(%)
1	Yes	256	100%
2	No	0	0%
	Number of Respondents	**256**	**100%**

Table 5 reveals data about respondents experiences in doing manual push up tests. It turned out that 21 respondents or 8.2% stated that they sometimes experienced trouble or difficulties, 38 respondents or 14.8% said they did not experience trouble or difficulties, and 197 respondents or 77% said they had trouble or difficulties. Meanwhile, their opinion on the accuracy of the manual push up test revealed that 30 respondents or 11.7% stated quite accurate, 4 respondents or 1.6% stated very accurate, and 222 respondents or 86.7% stated not accurate (Table 6). What is interesting from the results of the answers to the last question is that all respondents agreed with the development of the manual push up test to be digital (Table 7).

The main point of the data above is that there are problems or difficulties experienced by respondent in doing the manual push up test (77%). When doing a manual push-up test, the testee cannot ensure the position of the body is puhsed up correctly and consistently. The assessment of the tester who is not steady and inconsistent causes this to happen as well. So, the answers given by all respondents to the six questions on the questionnaire lead to the need for a push up test that is more valid and reliable. That is, the testee can ensure that when his body is down and when it is pushed up it is clearly detected that it is wrong or right, not based on the tester perception or subjectivity in measuring. This result becomes one of the bases in continuing the research phase on the development of manual push up tests into digital technology-based ones. The purpose of this research is of course to analyze the needs related to the development of innovation tools for push up tests based on digital technology. The analysis stage in a development research is a process of defining what the learner will learn, in this case the user, and identifying problems (Destriana et al., 2022). It should be reported that many coaches are looking for an easily accessible, inexpensive, and reliable measuring tool, to assess the impact of a muscle strength training exercise for young athletes. (Bergeron et al., 2015; Lloyd et al., 2016).

The respondents who have a background as athletes feel the importance of developing a manual push up test to be digital-based. Those who often take manual push up tests during the preparation for the PORPROV Bali event in 2022, consider that human errors in calculating manual push up tests often occur, so they judge that manual push up tests are less accurate as the data in table 6 above. In a test and measurement process, it becomes very important for every tester to be able to take accurate measurements to produce accurate data as well (Arifin et al., 2020). Utilization of technology that can streamline the performance of sports players with the principle of developing a prototype that is low cost and easily accessible (Mertens et al., 2018).

When quoting a statement Widianingsih and Listyaningrum (2019) regarding the consideration of conducting a needs analysis in relation to developing a product, the needs analysis must target the objectives and content of the learning materials and needs analysis to reveal what students already know and what students want to know. This means that the above results about revealing the needs of athletes and sports practitioners for more valid and reliable push up tests have been fulfilled. Based on this, it was concluded that in the process of testing and measuring arm muscle strength, especially the triceps muscle, in testing and measuring the physical condition of athletes both at the provincial and national levels, the development of digital technology-based tools was urgently needed. The product must be able to identify the correct number of push ups, the results of the movement and the timer are clearly visible and audible to both the tester and the testee, as well as the instructions for the procedure for carrying out the test, both of audio and visual. Ideally in the measurement process there is no bias between one tester and another when the measurement process is large.

CONCLUSION

Based on the above findings, the need for the development of digital technology-based push up tests is urgently needed in an effort to improve the quality of tests and measurement of arm muscle strength (triceps). The limitation of this study is the characteristics of the sample involved, which only involves male athletes. It is expected that further research can target non-athlete elementary school to high school students. Because the procedur for push up for athlete and non-athlete is different, especially for students to be able to lean on both of palms and knees. These results also become one of the foundations in conducting the next research stage, both the prototype design stage, to product trials in the field. It is recommended that future research be carried out to design prototypes of arm muscle strength instrument based on digital technology.

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CONFLICT OF INTEREST

The author believes that all forms of writing and the contents of this article do not contain a conflict of interest.

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