

## Development of Taekwondo Physical Instruments: Test Ages of 14-17 Years Old

SINGGIH HENDARTO<sup>1</sup>, TANDIYO RAHAYU<sup>2</sup>, SOEGIYANTO<sup>3</sup>  
<sup>1,2,3</sup>Sport Education Doctoral Program, Universitas Negeri Semarang, INDONESIA

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### Abstract:

The purpose of this study was to develop a physical test model of taekwondo athlete category (kyorugie) age 14-17 years. This type of research is R and D research (Research and Development). The research was conducted in several places, namely: Purwokerto, Yogyakarta, Sukoharjo and Surakarta in 2017, a sample of 300 athletes consisting of 150 male athletes and 150 athletes of the castle. Confirmatory factor analysis technique through SPSS program 23.00 with the provision if the measure of sampling adequacy ( $MSA > 0.5$ ) then the instrument is feasible to use and ( $MSA < 0.5$ ) then the instrument is not feasible to use with significant level  $\alpha = 0.05$ , for confirmed the latent variables that determine the physical quality of taekwondo athletes in the category of matches (kyorugie) ages 14-17. In this development study, the steps to be taken include: (1) preliminary study (literature study and field study), (2) planning (conducting analysis), (3) initial draft design, (4) draft validation (5) small group trial and revision, (6) large group trial and revision, (7) final result. Validity uses content validity, reliability using Retrone's Alpha test retest and  $T_{\text{skor}}$  to equalize units. The result of this research are 10 physical test indicator ata taekwondo athlete category (kyorugie) age 14 - 17 year old son and daughter consist of reliability test obtained result (1) sit and reach test 0,719 and 0,609; (2) The reaction rate test (ruller drop test) of 0.674 and 0.540; (3) Coordination test (eye, hand and foot coordination) of 0.809 and 0.712; (4) The stroke balance test of 0.640 and 0.731; (5) Triple-jump test of 0.801 and 0.749; (6) Hex test (hexagon obstacle test) of 0.608 and 0.608; (7) The maximum velocity test (30m hurdles) of 0.817 and 0.740; (8) Hand Grip strength of 0.771 and 0.737; (9) Muscle endurance test (push up) of 0.871 and 0.737; and (10) Cardiorespiratory endurance test (multi-stage run) of 0.799 and 0.814. The resulting product is a guidebook, test model and norm of physical test t taekwondo category of match (kyorugie) age 14-17 years.

**Key Words:** development, physical instrument test, taekwondo

### Introduction

Humans in essence have limited ability, both in physical, skill and psychic. Because of that limitation, people often experience failures. Failures that occur include those occurring in physical activity as in exercising. Sport has many advantages over the idea of exercise as medicine; the most important of these is that sport is grounded in the innate human capacity for play (Nesti, 2004). We play sport, badly or well, gently or with intensity, but usually with passion. In contrast, we do exercise, or participate in physical activity, and it is very rarely described as a passion. Another important shift might be that researchers begin to use a greater range of methodologies and methods, for example phenomenology, that emphasize the importance of an individual's subjective experience, and attempt to shape research questions based on the lived concrete reality of a phenomenon rather than its theoretical description (Nesti, 2016).

Every sport has unique characteristic that appeal to different interests, abilities and expectations; their impact on players' health is enormously varied. Consider a list of the most popular sports in the world. All forms of sport and physical activity carry different levels of risk and health-related rewards, and are associated with different attitudes to violence and abuse (Parnell & Krustup, 2017). Sport is the most intensely physical thing that humans do, or do in public, anyway (Barnes, 2007). Physical activity is defined as any bodily movement produced by skeletal muscles that result in energy expenditure beyond resting expenditure. Exercising is the physical exertion of the body making it to physical activity which results in a healthy or healthier level of physical fitness both mental and physical health (Matiba, 2015:3). Physical education is an individualized program including physical and motor fitness, fundamental motor skills and patterns, skills in aquatics and dance, and individual and group games and sports designed to meet the unique needs of individuals (Winnick & Porreta. 2017:4).

Laker (2012:4) says that sport has a common core of shared meaning and a periphery of additional meanings that are very much context-dependent. In other words, although most of us have a common understanding of what sport is, it can still mena different things to different people. These factors need to be improved through training, it is important to support performance when in the field. In fact, our early ancestors relied on physical endurance, agility, balance, core strength, proprioceptive awareness, neuromuscular

coordination, and other functional fitness attributes to eat and live. This requirement has changed significantly as the high-tech revolution eliminated many challenging multidirectional physical work tasks (Roy, 2014). These activities may be well performed in a manner that is health enhancing like physical exercise, if relevant muscle groups are involved, the intensity is sufficient, and recovery appropriate. However, in this context it is important to recognize that actually not all Physical Activity does correlate with good health (Sjogaard, et.al. 2016). Physical activity appears to elicit long-term beneficial effects on adiposity and selected markers of cardiovascular health (Cheng & Mao, 2016). More extensive research is required into the physical and physiological characteristics of taekwondo athletes to extend existing knowledge and to permit specialised conditioning for different populations within the sport (Saadatin, et al. 2015).

In the sports world the achievement of evaluation of instrument test is rare, because they assume that the instrument is not a reference to attract athletes who have better performance. However, the reality of a test instrument in attracting athletes is necessary because the test instrument is the main capital in addition to the physical state of ability in every performance in the arena of competition or race. Therefore the development of test instruments is necessary. The evaluations performed by the trainers are dominant in terms of aspects of the physical condition whereas for the instruments used only in accordance with experience and needs alone or sometimes neglected. This is understandable for several reasons including: (1) the time to conduct the test and measurement activities is not sufficient; (2) the trainer does not have standardized test forms; (3) the test instrument does not match the characteristics of the athlete; (4) the test instrument is monotonous; and (5) the test form does not resemble the actual game form, or (6) the limited facilities and infrastructure of the test implementation and others. Because knowing the physical condition of a sport that is owned through the development of an instrument is important, the existence of a measuring instrument is absolutely necessary. Measuring tools in the activity of motion is generally a test, the action test. While there are similarities in various groups' approaches to the development and validation of such instruments, the procedures are not fully consistent partially due to the fact that, to our knowledge, no one has written down the process for this specific type of instrument in its entirety (Adams & Wiemans, 2010).

The evaluation process is a decision-making based on measurement results and criteria standards. Measurement and evaluation are two sustainable activities. Evaluation is done after the measurement and evaluation decision is done based on the measurement result. Measurement involves the operationalization of these constructs in defined variables and the development and application of instruments or tests to quantify these variables (Kimberlin & Winterstein, 2008). Measurement is a process of quantifying observations. Measurement can be done in a variety of ways; using standardized instruments to conduct measurement is one way and an essential component of scientific inquiry in science education. A measurement instrument is a standardized tool with its associated procedures to quantify observations, is possesses empirical technical qualities (Liu, 1962).

McAulay and Kalman (2005) says that taekwondo is a martial art, or a method of fighting often used for self-defense. Taekwondo started in Korea. In Korea, the word "taekwondo" means the art of kicking and punching. Tae Kwon Do is about self-defence, but if you enter the backrooms of its history, you'll discover a killing art-and an empowering art (Gillis, 2016). Pawlett and Pawlett says that tae kwon do is a physical art. In every physical movement skill, whether it is martial arts, dance, or sports, there is an element of risk (2004). Most of the written accounts of the beginning of Tae Kwon Do, if any ever existed, have been lost or destroyed (Rhee, 2004:7). As a direct result of these high number of injuries chest protection and head protection are now required for participation in Kyorugi. With this in mind the evaluation of chest gear and head protection must be considered (O'Sullivan, et. All. 2009). Furthermore, especially for younger readers, some of the older terms used in taekwondo literature be completely unfamiliar (Moeing, 2015:3). Taekwondo has recently been declared an official Olympic sport with the first competitions held during the Olympic Games in Sydney, Australia, in 2000 (Lucas, 1992). The athletic performance in taekwondo may be determined by a competitor's technical, tactical, psychological, and physical characteristics (Oliveira, 2015:131). Taekwondo training can increase strength and muscle tone, reduce body fat, improve cardiovascular conditioning and endurance, improve balance and coordination, reduce stress, improve concentration and focus, improve performance in one's job, school, or sports, provide a structured program of advancement with achievable goals, and improve self discipline and self confidence (Bell, 2008). Taekwondo practitioners rely on core strength in minimizing injury and maximizing strength and speed while training in all aspects of taekwondo. The particular group of "Core Muscles" refers to the abdomen, back and oblique, or side muscles, and even the thigh muscles (Zirogiannis, 2015:9).

Taekwondo as a sport of achievement in order to achieve high achievement requires a valid and reliable physical test in order to be used as a guide based on physical indicators so as to improve the performance of Taekwondo athletes. However, until now the system of guidance, guidance and development of regular and continuous Taekwondo sport achievements are still felt to experience obstacles such as: (1) the absence of adequate evaluation system; (2) time and budget constraints in efforts to improve national sports performance; (3) the handling in the performance improvement process has not been done continuously; (4) an athlete's guidance and recruitment is often conducted through observation or by the experience of the trainer; (5) selection of prospective athletes by means of selecting them through a championship or match; (6) human resources that carry out athlete training, (7) environmental tools and facilities, (8) coaching methods used, (9) sport

management, (10) culture and map of regional potential and finance and many problems need to be studied through scientific research. The development of skills and the ability to exercise were divided into three groups, namely: (1) the practical group started the sport, (2) the age group of specializing, and (3) the group for the highest performance period Bompa (2009: 64).

Currently, many types of physical tests are used for the identification and development of the Taekwondo athlete's physical test for sons and daughters, but have not tested how effective they are for the appearance of Taekwondo athletes. The test should be relevant to the athlete's characteristics, reliably and specifically as a measuring instrument, either individually or team. So the validity level of a test indicates to the user that the test is capable of distinguishing the physical characteristics of the athlete. The selection of physical test elements is usually based on theoretical logic that the test element matches the physical needs of Taekwondo games that have not been tested empirically. At this time the form of measurement test of Taekwondo aspiring athlete aspect that is measured and known through the test, among which are; 1) Posture, related to anthropometrics, 2) flexibility, 3) strength, 4) power, 5) endurance, 6) agility, and 7) speed. The development of the Taekwondo athlete's physical test at the age of 14-17, was the focus of the study due to the wide gap of achievement between the top athlete and the under coat athlete so that the age guidance received more attention from the Central Java Provincial Youth and Sports Office for the projection of the leading athlete prepared at the National Student Sport Olympiad, National Student Sports Week, National Student Sports Week as a representative of Central Java, as well as to prepare achievement opportunities in junior and senior age groups. With proper athlete recruitment, the aging process of Taekwondo athlete ages 14-17 in Central Java becomes clear, carried out continuously to reach the peak of achievement.

In an effort to approach science and technology for the purpose of evaluating the ability of Taekwondo athlete's more accurate physical component in the future, it is necessary to conduct research and development of measuring instrument in the form of "Development of Taekwondo Physical Test Instrument".

## **Material & methods**

### *Participants*

Subjects in this study were taekwondo athletes aged 14-17 years in Surakarta. The subjects were taken in Surakarta because many athletes came from the area. They participated in Taekwondo dojang registered in Pengprov Taekwondo Central Java. Sampling technique used is purposive sampling, that is sampling technique by using certain criterion. Certain criteria in this study were athletes aged 14-17 years old so that the samples used in this study were athletes aged 14-17 years spread across 4 regions in Central Java, consisting of 247 athletes for small group trials and 300 athletes for the group great experiment.

### *Procedure/Test protocol/Skill test trial/Measure/Instruments*

Procedure / step of research and development consists of 10 steps of implementation, in this study simplified into 7 steps, namely: (a) Preliminary study, preliminary study conducted in two forms, namely literature study and field study of empirical research conditions. After conducting a theoretical study then conducting a field survey to find out the real conditions in the field as a place of activity that is the center of attention of researchers, (b) Analysis of information that has been collected, after the preliminary study, The next step is to analyze the information obtained. In this study information was obtained from field observations in the form of discussions with taekwondo trainers discussing what physical components are required in taekwondo sport, (c) Development of initial prototype / product, after development model based on preliminary studies established. , then discussed with experts through Focus Group Discussion (FGD) to determine the physical components used in taekwondo sport. Furthermore, we prepare physical items of 14-17 years. The initial product of this research is: 1) shoulder flexibility, 2) sit test and achieve 3) ruller fall test, 4) eye coordination, hands and feet, 5) standing standing test, 6) throw basketball 7) three 8) Run back and forth 3 meters, 9) Test hexagonal resistance, 10) Jump dexterity, 11) Run 30 meters, 12) Hand grip strength, 13) Sit 1 minute, 14) Push up 1 minute 15) Reserve 1 minutes and 16) Run Multi langap. The product in this study is a battery test that has a test norm of test items tested for the subject of the study.

The test to be a product is done in sequence according to the prescribed post flow. The initial product in this study was, (d) Validation of the initial product, after the preparation of the test item was completed, followed by the assessment of the material expert. In the validation process, materials experts assess and provide input on the original product. Based on the initial product that researchers have prepared the opinion that some test items are not suitable for taekwondo sports or test items are arranged too much. The essence of instrument development research is that the instrument must be effective and efficacious in accordance with the character of the sport. The instruments that should be eliminated are 1) shoulder flexibility, 2) Throw basketball 3) Run back and forth 3 meters, 4) Jump dexter, 5) sit 1 minute, and 6) Reserve 1 minute and adjust to post test execution and based on suggestion from expert researcher rearrangement of new test product like post 1 sitting and range, post 2 ruller drop test, post 3 pus up, heading 4 hand grip strength, heading 5 eye coordination and accomplice, heading 6 balance standing, heading 7 triple hoop jump, hexagon barrier checkpoints, heading 9 30 meters, and post 10 multi-stage trials then validated for experts. This revision process is done until the initial product is valid and feasible. (e) Field Test and Small Scale Revision, at this stage the product is tested on a small scale with the number of athletes 242 later revised. In the small-scale pilot phase is directed to identify problems that arise

related to the implementation of the test, such as how the implementation of the test, the response of the testee. After getting input and revision from the experts then do a large-scale trial.

The results of observation evaluation and improvement suggestions on small-scale trials are used by researchers as a reference of product improvement to be tested on a large scale. (f) Large-scale and revised field trials, in a large-scale pilot phase aimed at testing the validity and reliability of testing and formulation of assessment norms. In a large-scale field test phase similar to a small-scale process. scale field trial. What distinguishes lies in the larger number of large-scale field test subjects than the small-scale field trials of 300 athletes. (G) Preparation of the final product, from two trials obtaining a test that meets eligibility, so that the test form is considered final. The last term here does not mean that tests need not be tested again. After going through various revision process, then made development compilation after doing small scale and large scale field test, which is end product or end product in the form of physical test model and physical test of sport taekwondo age 14-17 year.

In sports taekwondo the main physical components are formation, reaction speed, coordination, balance, explosive power, agility, running speed, strength, muscle endurance and cardiorespiratory endurance. In this research, there are 10 items of physical component needed in taekwondo sport that is formation test using elasticity test using sit and reach, test of reaction speed using ruller drop test, coordination test using eye and foot coordination test, balance using Stork standing balance, power test explosive leg muscle strength using triple hoop jump test, agility test using obstacle hexagon test, arm muscle power test using push up test, and cardiorespiratory endurance test using multistage run. Data is taken on each post, where each post is taken one test item. Post inter breaks up to 3 minutes.

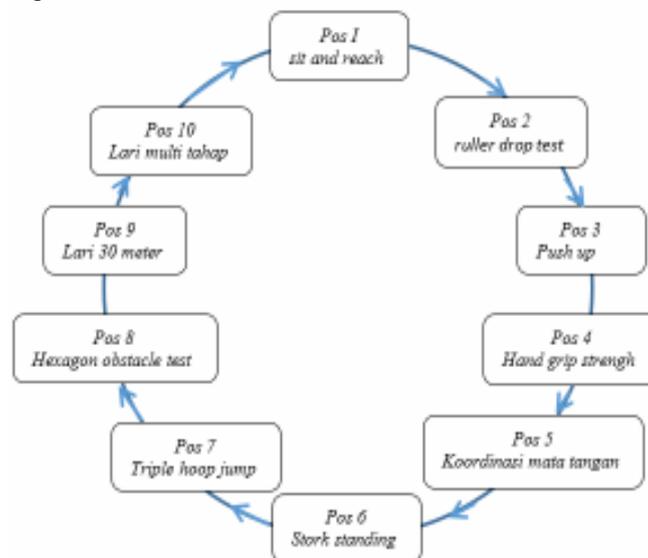


Figure 1. Test Flow

The research method is complemented by a flowchart that illustrates what research has been done and achieved before the appropriate college roadmap research. It would be better if the presentation can be attributed to the researcher's achievement that can be used as a reference to continue the research activities to be proposed and will be undertaken during the study period (Kusumandari & Istyarini, 2015). The method should describe fully clear research stages, outcomes, measurable achievement indicators at each stage. To produce Taekwondo Physical Instrument Test. Therefore, as is usual in the step of scientific research conducted by researchers is to explore (exploration) of the object under investigation. Data is collected from an experienced background (natural setting) as a data source directly. The meaning of data can only be done if the depth is obtained from the facts obtained. This approach is determined by observing the phenomena observed by the subject of the conceptual world through actions and thoughts to understand the meanings compiled by the subject around everyday events (Kusumandari & Sukirman, 2017).

#### *Data collection and analysis / Statistical analysis*

Instruments physical tests taekwondo athletes taekwondo Relevant physical conditions must be owned by every sporting achievement performer, especially the taekwondo atalet. In pencak silat required physical factors such as flexibility, agility, speed, endurance, power, strength, and coordination.

### **1. Ability (Sit and Reach)**



Figure 2. Sit and Reach Test

Objective: To know the ability of togok and hip joint formation.

Equipment: The bench centimeter or tape meter

Implementation Procedure: The athlete sits on the floor with the knee position both straight in front of the assistive device, both hands with straight fingers pushed forward parallel to the floor slowly as far as possible. Conducted 2 times in a row.

Rating: Taken the best score by how many centimeters.

### 2) Speed Reaction (Ruller Drop Test)

Objective: To measure the speed of the athlete's reaction.

Equipment: a one-meter long ruler and an assistant.

Implementation Procedure: The ruler is held by an assistant system between the index finger and thumb of the athlete's hand on the dominant hand, then the athlete's thumb will be aligned with the 0 cm line on the ruler. The assistant will instruct the athlete to catch the ruler as soon as possible after the ruler is released.

Calculation: The formula used to calculate the speed of the reaction is

$$d = vt + \frac{1}{2} at^2$$

Information

d = distance in cm

v = initial speed = 0

a = acceleration based on gravity (9.81 constant numbers)

t = time in milli-seconds (ms)

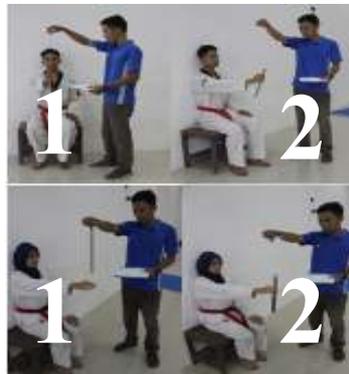


Figure 3. Ruller Drop Test

### 3) Coordination of the Hands of the Feet

Purpose: Measures coordination between the eyes, hands and feet

Equipment: 1 Handball Ball, 1 Stopwatch and recording device

Implementation Procedure: Testee is ready to carry the handball behind the boundary line with a distance of 4 meters from the wall (target / target) and infinite sideways. After the "Yes" command, Testee quickly performs throwing, grasping and kicking the ball towards the target (wall) of 4, 3, 2 and 1 scales continuously for 30 seconds. The ball that bounces off the throw or kick must cross the predetermined line. Each Testee provided 2 (two) pieces of ball. If the first ball is thrown or kicked in its reflection does not cross the line or out of line, Testee is allowed to take the second ball (backup) and then back behind the line to continue the next movement until the time specified is up. If a second ball thrown or kicked off its reflection does not cross the line or out of line, the testee can quickly pick up the ball without help from anyone, then back behind the line to make the next move until the specified time runs out.

Rating: The calculated score is, the number of targets that the ball has successfully touched the result of a throw. When a ball is thrown or kicked about the target line, then the highest score is calculated. If the result of a throw or a kick is not on the target is scored "0". The test is done as much as 2 (two) times and the best score is taken.

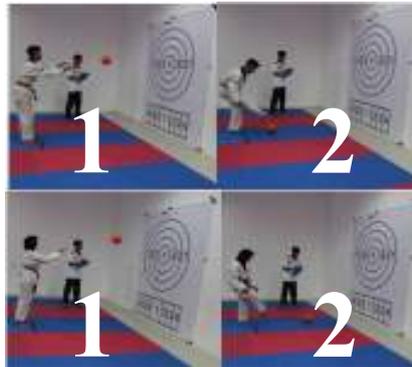


Figure 4. Hand and Foot Coordination Test

**4) Stork Standing Balance Test**

Objective: Measure the static equilibrium level equipment: field, stopwatch, and whistle

Implementation: Stand tall with one foot dominant foot the other pasted on the knee of the foot of the pivot.

Calculated duration of holding stand in seconds.

Assessment: Scores obtained with the longest standing time standing one foot on tiptoe, and eyes opened, each candidate is given a chance 3 times and taken the best time.



Figure 5.. Stork Standing Balance Test

**5) Power Tes Muscle Limb Power (Test 3 Hop Jump)**

Objective: This test aims to determine the ability of leg muscle power.

Equipment: trajectory with flat and non-slip surface, long meter stretched straight 10-15 m, and 1 m wood meter, to project distance traveled by size (meter length).

Procedure: Testee standing (standing start) without prefix by putting the foot of the pivot behind the "start" line, at position  $\pm 30-50$  cm to the right or left of the measuring meter that stretched. Once there is a "ready ... yes!" Signal from the tester, the testee makes a leap with one leg (hop) 3 times toward the front straight as much as possible. Hop jump is done with 3 right limb hop and 3 hop left limbs. Break time between right hop and hop left at least 5 minutes. Testee does 1 repetition, unless there is a failure in execution.

Assessment: For the measurement method is done with the following conditions: (1) The measured result is the 3 hop distance achieved from the right hop and the left hop (there are two results); (2) The result of distance is measured in units of m (with a precision of 0.01 m); (3) the final distance is measured right on the heel of a hop.



Figure 6. Triple Hoop Jump

**6) Hexagonal Obstacle Test**

Objective: To measure or know the agility level of an athlete.

Equipment: 66 cm hexagon, stopwatch and assistant

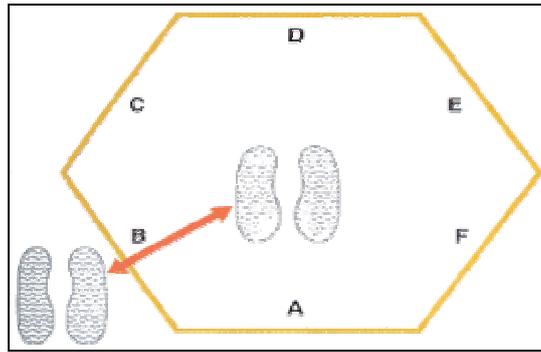


Figure 7. Hexagonal Obstacle Test

Implementation Procedure: The athlete stands in the middle of the hexagon, facing line A. to maintain this position during testing, ie facing line A. on GO stopwatch command is executed and the athlete jumps with both legs over line B and back to center, then passes the C line then back to center and so on until all (6 lines jumped). When the athlete jumps through the A line and returns to the middle until it can perform all the lines skipped, then the test is considered to have performed a series of tests. Athletes carry it out three times. After completion the three stopwatch sequences are stopped and time is recorded. After performing the test series the athlete breaks, then performs the second test loop.

Assessment: In the recording of scoring record the highest value that can be achieved by the athlete. If the athlete performs a test that passes the line not according to the rule then the test is repeated.



Figure 8. Hexagonal Obstacle Test

### 7) Maximum Running Speed (30m Run)

Objective: To know the ability of maximal running speed taekwondo athlete candidates.

Equipment: 30 meter running track, stopwatch, and whistle / flag

Implementation Procedure: The athlete stands behind the starting line, with a starting stance, when the 'yes' command is running as fast as possible until it passes the finish line.

Assessment: Score is obtained with the fastest time record starting from 'yes' command to finish, each candidate is given 3 times chance is taken the best time



Figure 9. Run 30 m

### 8) Strength (Hand Grip Strength)

Purpose: To measure the strength of the right and left hand grip

Equipment: Handgrip Dynamometer

Procedure Implementation: Participant stands upright, legs spread apart shoulder width, right and left hand is located beside the body in straight position holding handgrip dynamometer tool. Participants squeeze the device with all the strength. at the time of squeezing the tool, the arm makes a 20-30 degree angle with the body (armpits do not close). This test is performed alternately between the right and left hands respectively twice

Rating: The best grip strength score of two trials, recorded as a score in Kg units. with a precision of 0.5 kg



Figure 10. Hand Grip Strength

### 9) Muscle Resistance (Push Up)

Purpose: measure the strength of the upper body resistance, especially the arm muscle.

Equipment: matras

Procedure Implementation: Testee stands face to face, so one of them can be a movement counter. Testee lie face down and place the palms on the floor below the testee's chest. Both hands of the testee are located under both shoulders, elbows maintained or locked in a straightened arm state. The whole body is straight, no part of the body touches the floor except both hands and heels. Both feet are stretched shoulder width apart. The test participant bends his arm, the body is lowered until his chest can touch the counter hand and push back to the starting position. The body must be maintained straight along the motion. Testee performs as many tests as possible without having to stop.

Assessment: the value given is based on the number of repetitions performed correctly.



Figure 11. Push Up

### 10) Endurance Kardiorespiratori (Dashboard)

Objective: Aerobic freshness is an important component of various endurance-based sports, taekwondo also requires aerobic freshness because the players must constantly move for long periods of time. Multistage Fitness Test is used to assess aerobic freshness.

Equipment: cadence band for running back, flat, flat and non-slip surface run, cassette player (Tape recorder), stopwatch, cone cone or stack 4 and form

Procedure Implementation: Check the speed of the cassette player using a one minute calibration period and adjust the running distance when necessary (described in the tape and in the tape manual). "Turning on the tape

recorder, at the beginning of the tape, the distance between the tut signals" marks an accurately measured 1 minute interval. Use this start-up to ensure that the tape in the tape is not yet "tapering" and also the speed of the tape recorder machine is working properly. Accuracy of 0.5 seconds in the direction of the manapun. If the time span is greater than 0.5 seconds, the distance between places should be changed. Using a stopwatch, check the duration of the cyclical rotation period. If the duration is shorter or longer than 60 seconds, correct the distance of the track as far (see table: meter) according to the following table:

Table 1. Table Multi Stage Fitness Test

Standard Time Period (Seconds)	Running Distance (meters)
55	18,333
55,5	18,5
56	18,666
56,5	18,833
57	19
57,5	19,166
58	19,333
58,5	19,5
59	19,666
59,5	19,833
60	20
60,5	20,166
61	20,333
61,5	20,5
62	20,666
62,5	20,833
63	21
63,5	21,166
64	21,333
64,5	21,5

Measure the distance according to the table and mark it with tape and distance barrier. Run the cadencenya band. Instruct the testi to run toward the opposite end / end and touch one foot behind the border at the sound of "tuut". When the testi has arrived before the "tuut", the testi should rest on the rotary point, wait for the sound sign, then run toward the opposite line in order to reach just as the next sign goes off. At the end of each minute the time interval between the two "tuut" sounds shortens, therefore, the speed of the run is accelerating. Testi should be able to reach the end line at the specified time and not too late. Emphasize to the testi to spin and run back, instead of running a curved turn, as it will take more time. Each testi keeps running for as long as possible so that the testi can no longer pursue the "tuut" of the tape. The criterion for stopping the test is when the testi lags behind the "tuut" sound twice over two steps behind the end line. Assessment: Record the last level and shuttle that the testis can complete or complete.



Figure 12. Multi-track running

## RESULT

### Need analysis

This research is a research and development where each item is the result of discussion which have been done by researcher, trainer and instrument development expert, measurement test and taekwondo. The physical test form in this study took some of the existing physical tests and incorporated some physical fit tests on taekwondo sport and then developed a test model to obtain valid and reliable norms. This product is expected to be used as a reference coach in searching for candidates taekwondo athletes aged 14-17 years.

### Small Group Trials

Before being tested on a small scale, the test instrument to be used for small-scale data collection is requested by the experts, then after obtaining expert approval, the instrument feasibility test is performed, then the test is tested in the category of 14-17 year age taekwondo athletes (kyorugi) of 111 sons and 136 daughters. The results of the data from the experiment are carried out accordingly and can be continued with large group trials.

### Data Research Results

Large group test results were used to determine test norms for athletes of age category taekwondo (kyorugi) 14-17 years. This research was conducted in 4 regions in Central Java. Furthermore, physical testing of the age category of taekwondo athletes (kyorugi) 14 - 17 years in large groups with the number of athletes 150 sons and 150 daughters with age categories 14-17 years of men and girls are grouped into norms. The results of validity and reliability of taekwondo physical test instrument are: 1) Sit test and achieve the value obtained by 0,719 for children and 0,609 for girls, 2) Test of ruller decrease obtained value equal to 0,674 for children and 0,540 for girls, 3) eye, hand and foot coordination obtained values of 0.809 for children and 0.712 for girls; 4) stand up standing balancing test obtained values of 0.640 for children and 0.731 for girls; 5) Triple hoop jump test obtained values of 0.801 for men and 0.749 for girls 6 ) Obstacle hexagon test obtained values 0.608 for children and 0.608 for daughter, 7) Running 30 meters obtained value of 0.817 for children and 0.740 for girls, 8) Handheld strength obtained value of 0.771 for children and 0.737 for girls 9) Push 1 minute value of 0.871 for his son and 0.737 for girls and 10) The multistage run obtained values of 0.799 for children and 0.814 for children. To find out the results of data obtained on each test component then created table classification per item. Here are the results of large-scale tables for prospective male and female taekwondo athletes presented in the table below. The results of sit and range test scores can be seen in table 1 below:

Table 1. Sit and Reach Male and Female Test Scores

Scores	Sit and Reach Male	Sit and Reach Female
5	≥ 41,99	≥ 38,27
4	34,49 – 41,98	32,24 – 38,26
3	26,98 – 34,48	26,21 – 32,23
2	18,86 – 26,97	17,67 – 26,20
1	≤ 18,85	≤ 17,66

The results of the ruller drop test can be seen in table 2 below:

Table 2. Ruller value of the Male and Female drop test

Score	Ruller Drop Test Male	Ruller Drop Test Female
5	≤ 2,24	≤ 2,68
4	2,25 – 7,52	2,26 – 7,70
3	7,53 – 12,38	7,71 – 12,34
2	12,39 – 17,25	12,35 – 16,98
1	≥ 12,39	≥ 12,34

The results of hand and foot eye coordination values can be seen in table 3 below:

Table 3. Eye and foot hand eye coordination value of Male and Female

Score	Eye and Hand Coordination Male	Eye and Hand Coordination Female
5	≥ 45	≥ 31
4	32 – 44	23 – 30
3	20 – 31	16 – 22
2	7 – 20	6 – 15
1	≤ 7	≤ 6

The result score of *standing stork balance* can be seen in table 4 below:

Table 4. Score *standing stork balance* Male and Female

Score	Standing Stork Balance Male	Standing Stork Balance Female
5	≥ 23,74	≥ 23,64
4	17,37 – 23,73	17,49 – 23,63
3	11 – 17,36	11,34 – 17,48
2	4,10 – 10,99	4,67 – 11,33
1	≤ 4,09	≤ 4,66

The result of standing stork balance can be seen in table 4 below:

Table 4. The Score of stork balance of Male and Female

Score	<i>Triple Hoop Jump Test Male</i>	<i>Triple Hoop Jump Test Female</i>
5	≥ 13,26	≥ 9,83
4	10,30 – 13,12	8,03 – 9,82
3	7,35 – 10,29	6,23 – 8,02
2	4,27 – 7,34	4,15 – 6,22
1	≤ 4,24	≤ 4,14

The result of the hexagon obstacle test can be seen in table 6 below:

Table 6. The hexagon obstacle test of Male and Female

Score	<i>Hexagon Obstacle Test Male</i>	<i>Hexagon Obstacle Test Female</i>
5	≥ 7,23	≥ 7,08
4	5,85 – 7,22	5,86 – 7,07
3	4,62 – 5,84	4,64 – 5,85
2	3,32 – 4,63	2,32 – 4,63
1	≤ 3,31	≤ 2,31

The result of 30 meter sprint value can be seen in table 7 below:

Table 7. The 30 meter Sprint Male and Female

Score	<i>Sprint 30 Meter Male</i>	<i>Sprint 30 Meter Female</i>
5	≤ 4,67	≤ 5,59
4	5,40 – 4,68	5,58 – 6,17
3	6,13 – 5,41	6,18 – 6,77
2	6,93 – 6,14	6,78 – 7,42
1	≥ 6,13	≥ 7,43

The results of hand grip strength can be seen in table 8 below:

Table 8. Hand grip strength Score of Male and Female

Score	<i>Hand Grip Strength Male</i>	<i>Hand Grip Strength Female</i>
5	≥ 76,18	≥ 49,70
4	56,67 – 76,17	39,11 – 49,69
3	37,15 – 56,66	28,51 – 39,10
2	16,02 – 37,14	17,03 – 28,50
1	≤ 16,01	≤ 17,02

The result of push up Score can be seen in table 9 below:

Table 9. Score *push up* Male and Female

Score	<i>Push Up Male</i>	<i>Push Up Female</i>
5	≥ 30	≥ 26
4	22 – 29	19 – 25
3	16 -21	13 – 18
2	9 – 15	7 – 12
1	≤ 9	≤ 7

The results of multi-stage running can be seen in table 10 below:

Table 10. Score Multiple Step Run Male and Female

Score	<i>Multiple Step Run Male</i>	<i>Multiple Step Run Female</i>
5	≥ 39,06	≥ 30,49
4	31,83 – 39,05	25,98 – 30,48
3	24,59 – 31,82	21,46 – 25,97
2	16,75 – 24,58	16,57 – 21,45
1	≤ 16,74	≤ 16,56

Furthermore, the norm of testing for prospective athlete taekwondo age 14-17 years to find out test results that have been tested. Unit tests are equated with  $T_{score}$ . The results of the overall norms of male physical tests can be seen in table 11 below.

Table 11. Men's Physical Test Norm

Score	<i>Amount of Score</i>	<i>Classification</i>
5	≥ 38	Very Good
4	35 – 37	Good
3	32 – 34	Enough
2	29 – 31	Less
1	≤ 28	Less Once

The results of the overall norm of the female physical test can be seen in the following table 12.

Table 12. Men's Physical Test Norm

Score	Amount of Score	Classification
5	≥ 37	Very Good
4	33 – 36	Good
3	30 – 32	Enough
2	27 – 29	Less
1	< 26	Less Once

Development activities can be undertaken if there is a need for data analysis based on field conditions. Development of physical tests for taekwondo athletes aged 14-17 using a procedural descriptive model in which tests for athletes age 14-17 outline the research and development steps that must be followed to produce the product. The basic steps that must be taken to create a test model is the conceptualization of problems, product creation, and product testing. Furthermore, if the decision is accepted then product creation can begin and if it has not been accepted then the process must be repeated. This step is used to build and develop tests in the hope of obtaining valid and reliable instruments involving sports experts, especially badminton sports specialists, sports evaluations, test and measurement experts, and experts in research methodologies.

### Discussion

From the data analysis using confirmatory factor analysis, there were 10 indicators of physical condition of Taekwondo athlete category of match (kyorugie) both son and daughter. The dominant factors of the physical condition of Taekwondo athlete in the category of match (kyorugie) in both sons and daughters are 10 indicators consisting of set and reach test, ruller drop test, hand and foot eye coordination, standing stork balance, triple hop jump, hexagon obstacle test, meter, hand grip strength, push up and run multi-stage.

Having known the dominant factor of physical condition of Taekwondo athlete category of macthes (kyorugie) sons and daughters continued with correlation analysis of produck moment, which aims to strengthen the research findings. Basically, these components need to be followed up with a continuous training process and should pay attention to technological developments. In order to find the results of this study useful for athletes and sons and daughters to achieve better performance.

The development of sports science that is the theoretical basis for the development of sports will certainly provide a valuable contribution to the achievement of the sport itself, especially Taekwondo macthes category (kyorugie). As a sport that develops into the realm of sporting achievements of course Taekwondo requires various studies of sports science as a foundation of achievement development. Physical condition as a fundamental element in any sporting activity is an absolute necessity for sports actors, especially sports achievements. Relevant physical conditions must be owned by each sporting achievement performer, especially the Taekwondoin tension category. Taekwondo sport as a full body contact martial arts demands the Taekwondoin to keep spurring its ability to the highest threshold according to the demands of the sport Taekwondo macthes category (kyorugie).

Physical condition is a very important element in determining the achievement of sports, because the element of physical condition should be considered in the forefront when training Taekwondo athletes, to further provide technical training, tactics, mental and maturity match to achieve achievement. According to Suharno HP (in saiful Anwar, 2013: 598) that physical coaching, technique, tactics, mental and match maturity are overall training goals where one aspect can not be left in a continuous training program throughout the year. Fiscal conditions in the Taekwondo sport is a condition where Taekwondo athletes have excellent physicality and are ready to face the opponent. Where Taekwondo athletes sometimes face punches and kicks from the opponent, or when performing attacks. Physical factors in each category in Taekwondo have several different needs. Physical condition is a unity that can not be separated from each other, but in practice there are some dominant physical conditions that have greater contribution and influence to a certain sport, in Taekwondo physical factors needed such as flexibility, agility, speed, balance, endurance, power, strength, and coordination.

Flexibility is the basic foundation that Taekwondoin must have, with good flexibility Taekwondoin will be able to perform a perfect engineering demonstration, both technical and targeted, because Taekwondo is a sport that relies on flexibility in motion, without flexibility it is difficult to achieve high technical feats.

Agility one element of physical conditions that play a role in the Taekwondo sport when the attack, then agility should be owned by a Taekwondoin athlete in improving and developing an optimal achievement. According Rudiyanto, et al (2012: 27) agility important function to improve achievements in sports. Direct agility is used to coordinate multiple movements simultaneously, facilitating the mastery of high techniques, facilitating the orientation of opponents and the environment. Agility is one aspect of many physical conditions required in the sport Taekwondo. Speed is a person's ability to perform activities in continuity in the form of the same movement in the shortest time. That is, the speed in Taekwondo is the movement of the step length of the step frequency, is a determinant of the speed of doing good movement at the time of the punch and kick and avoid the opponent's attack.

Balance is the ability of a person or Taekwondoin athlete to maintain the equilibrium of movement either at the time of attack, dodge or while defending his body. According to Koirul Huda, et al (2012: 29) balance is the ability to maintain body equilibrium when placed in various positions. Irfan (2012: 1) in Koirul

Huda, et al (2012: 28) balance is the ability to maintain the center of gravity in the fulcrum, especially when the position is upright.

The endurance required in the Taekwondo sport of competing category (kyorugie) is anaerobic endurance. Taekwondo match conditions that took place in a high tempo and fast Taekwondoin demanding to exert all of his physical abilities in doing attack-defense. The duel technique is performed repeatedly to earn points, with a relatively short break time every breakthrough and round. Therefore Taekwondoin with good endurance will be able to survive until the end of the game and able to control the situation of the game to be profitable for him, and will be able to maintain the quality of the technique and facilitate the conduct of attack-defense.

The value of the counted attack or count is if the attack or defenses of the target area are precise, fast, steady, and powerful, then for this power is indispensable in every technique demonstrated. The intended power is the power associated with the defense-fighting tool in Taekwondo, namely the arms and legs. According to Yekti Linga Dinata, et al (2013: 25) to increase the explosive power the need for pliometric exercises. Pliometrics is a training method for developing muscular explosive power, a pwnting component of most sports achievements or performance. For that pliometric movement dirncang to improve the performance of Taekwondoin muscles that have good arm muscle and leg power will be easy to punch, kick or other attacks that use the arms and legs with good and strong, supported by good coordination will produce the expected points. Likewise with leg muscle power, Taekwondoin with high limb power value will result in a hard kick, and quickly so it will not be easily anticipated by the opponent.

The strength of this is the strength of the Taekwondoin athlete's muscles to move the full force of both the attack and the maximum resistance. According Kusworo 2010 (in Samsul Hadi, et al 2013: 57) Physiological muscle strength is the ability of muscles or a group of muscles to perform a maximum contraction against resistance or load. While the mechanical strength of the muscle is as a force that can be produced by a muscle or a group of muscles in a maximum contraction. To be able to perform the attack and defensive techniques quickly, on target, coordination is required. The coordination intended in this study is the coordination of the hands and feet. Referring to relevant research on Taekwondo, foot attack is the highest in every game, or it can be said that the average Taekwondoins compete by using a foot attack technique, so eye and foot coordination is absolutely required, so that it can be deduced that all components anthropometry and physiology described above are interrelated, and have a role to Taekwondo skill categories (kyorugie). Thus expected in this research is there is correlation between indicator variable with dependent variable, so can know the value of its role to dependent variable.

## Conclusions

Based on the results of the research described in the discussion chapter, it can be concluded that: (a) A valid and reliable physical test model to train a taekwondo athlete candidate consists of 10 physical tests. The contents of the test model are: (1) sitting and reaching, (2) ruller fall test, (3) eye coordination, hands and feet, (4) standing stork balance (5) triple hop leap, (6) , (7) runs 30 meters, (8) hand grip strength, (9) push ups, and (10) multi-stage run.

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