THE DEVELOPMENT OF BOCCIA BALL THROWING TEST INSTRUMENTS ON *PALSY CEREBRAL* ATHLETES

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Abstract: Boccia is a accuracy game for cerebral palsy athletes. In the boccia game, the player will throw a red or blue leather ball with a target of the white ball (jack) target. The score of game is the closest colored ball to the white ball (jack) which counts points. Athletes experience throwing problems in approaching the white ball (jack), so it is necessary to develop instruments to measure throwing skills. This development research purpose was determined the boccia ball throwing test instrument in cerebral palsy athletes. The research subjects were 10 athletes. The research uses a development method through 4 stages such as data collection, product planning, model testing and validation. Research Analysis was used corrected item-total correlation analysis in SPSS through validity and reliability testing. The results showed tht the instrument validity by 6 throws testing, that is in the first throwing the validity value is 0.754; second throwing the validity value is 0.828; third throwing the validity value is 0.859; forth throwing the validity value is 0.742; fifth throwing the validity value is 0.789; and on sixth throwing the validity value is 0.779. The instruments reliability value is 0.918. The research conclusion is the development of boccia ball throwing tests instrument are valid and reliable so that it can be used to measure the accuracy of athletes' skills in balls throwing of boccia.

Keywords: Boccia, Development, Throwing

1. INTRODUCTION

Boccia is a simple ball (precision) sport that resembles a pétanque (Calado, Leite, Soares, Novais, & Are-, 2019). Boccia is a accuracy game for cerebral palsy athletes. In the boccia game, the player will throw a red or blue leather ball to the target of the white ball (jack) target. This game can be played with singles, pairs and teams. Score this game is the closest colored ball to the white ball (jack) which counts points. Athletes have a problem with the throwing accuracy in approaching the white ball *(jack),* so it is need for the development of instruments to measure the throwing accuracy. In this case what needs to be developed is the existence of target related to the distance of the colored balls that determine points if close to the target. This development will help athletes in throwing exercises and can find out the accuracy of the athlete's throwing skills. The skill of the throwing accuracy in boccia was measured using an instrument. In preparing the instrument, it is necessary to test the validity and reliability. Validity is a measurement of instrument valid to measure what should be measured (Ha, Kim, Yoon, & Wang, 2019). Test and retest, inter and intra-rater, and internal consistency of test reliability, which is described as the degree of independence from measurement error (Wen, Robertson, Hu, & Song, 2018). Reliability is an instrument that, if used several times to measure the same object, will produce the same data. The instrument is

a tool that meets academic requirements as a tool for measuring an object or collecting data about a variable. The instrument is divided into two types such as test and non- test. The group of tests instrument such as learning achievement tests, intelligence tests, aptitude tests and skills tests; while non-tests such as interview guidelines, questionnaires, suitable lists, observation guidelines and rating scales.

2. LITERATURE REVIEW

Boccia is a sport with disabilities designed for athletes who experience severe disturbances in training capacity, such as cerebral palsy (Paulo et al., 2016). Boccia is a Paralympic sport for athletes with cerebral palsy and certain other conditions, such as muscular dystrophy which causes disorders similar to cerebral palsy. The game purpose is to get the game ball closer to the white target ball (jack) than the opponent. Points or scoring are calculated by throwing a different colored ball as close as possible to the target of a white ball (jack) (Fong, 2012). Boccia is a modified form of indoor bowls, a team game that involves throwing colored balls to the target ball (jack) from a sitting position (Ovenden, I., Dening, T., & Beer, 2019). This game requires coordination, accuracy, concentration, courage to strategize, emotional control, interaction with others. Development of this ability can contribute to physical and mental development among children with cerebral palsy. Specifically Boccia was adapted from boules, the Boccia International Sports Federation - BISFED manual functional classification ensures that athletes meet physical criteria in sports and evaluate effects of diffable functional on sports performance (Figueira et al., 2017a). Some disability performance measurements during the Boccia game are measured using a pandlet by calculating the angle of rotation of the wrist and the force exerted during throwing a ball, using Kinect can recognize facial expressions and from the Mio Fuse band can find out the heart rate(Figueira et al., 2017a). Boccia is a game that can be done individually, in pairs or in groups with three players. Boccia match can be played with mixed gender. Main purposes of game is to score points by placing a red or blue balls as close as possible to the white target ball, also called jack (Paula, Alves, Castro, Miceli, & Barbosa, 2018). Each player has six balls in one round and each throw has a time count. Jack is first thrown, followed by the two regular balls being first thrown (at the beginning, the player throws the jack and then the other). The distance of the ball farthest from the next jack will try throwing back to approach the jack. Each throw is continuous until one session throws six balls. After that the opponent is pleased to throw the remaining ball. If all the tosses have been taken, the referee determines the color ball (blue or red) closest to the jack, and scores according to the points obtained for each ball that approaches the jack rather than the closest enemy ball. The group or player who has the highest total points in the final is the champion. If both groups hold a balanced number of points, all rounds are completed, there will be one extra round to determine the winner. The individual competition consists of four rounds and each player has six balls per round, while the pairing competition consists of four rounds and six balls per pair per round (three per player). The team competition consists of six rounds, and six balls per team each round (two per player). In partner and team numbers, reserve players are allowed. Reserve players can be replaced for players during the match, but only one substitution per game is permitted.

3. METHODOLOGY/MATERIALS

3.1   Research Time and Place

The research was conducted at Sport Center, Sebelas Maret University, for 4 months

3.2   Research Type

The research method was used research and development approach (R and D). Development research is a research activity for identifying and investigating ideas worthy of being used as a solution that can be applied or used as a product.

3.3 Research Stage

According to Haroz, (2014) development research consists stages of (1) preparation of instruments including trials, (2) reliability and validity testing. Reliability and validity coefficients with a range of values from 0 to 1 are quantities that indicate the quality or consistency of test measurement results. The higher the reliability and validity coefficients, the higher the test quality, (3) revision based on the results of stage 2, and (4) retesting the revised stage (Haroz et al., 2014).
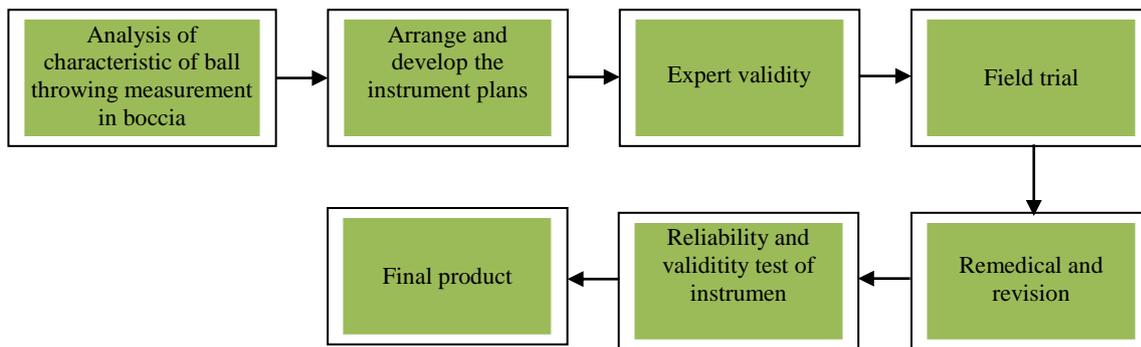

Figure 2. Research Stage Illustration

3.4 Data Collection

Data collection techniques were used observation, questionnaires and tests. Observation was used to collect initial condition data. Questionnaires were used to collect product eligibility assessment data from experts and athletes' opinions. The test was used to determine the validity and reliability of the instruments developed.

3.5 Data Analysis

Data analysis were used corrected item-total correlation analysis in SPSS to test the validity and reliability of the instrument.

4. RESULTS AND FINDINGS

4.1   Research Results

4.1.1 Need Analysis

a)   The previous test instrument had limitations in having the same distance so that it did not reflect the actual situation and conditions of the match; the accuracy of the throwing test instrument used the shape of a square box that has not been equipped with an assessment; Previous test instruments had not yet classified the athlete's skill category.

b)   It is necessary to develop the accuracy of the Boccia throw test instrument which is equipped with an assessment, classification of skill categories, and be able to describe the needs of the Boccia throwing skill in the actual match

4.1.2 Expert Evaluation

In the expert evaluation, the instrument was assessed through a questionnaire, in addition to that there was also a discussion related to the development of the accuracy of the Boccia ball throwing test instrument. The results of the discussion resulted in the development of a precision test instrument with varying values for each distance, this is so that the value varies; the player's throw was declared right on target if the ball is in the middle lane, this assumption arises with hope if it is not in the middle lane as well as not approaching the

target ball jack if in the match; implementation of the developed throw test is limited in time, this means that the player has the pressure to do the throw test correctly. The following results of the instruments assessment through a questionnaire are explained in table 1.

Table 1. Expert Evaluation

Aspect	Average
Clarity of judgment	4.50
Conformity with the concept of the Boccia game	5.00
Clarity of implementation instructions	4.50
Accuracy of measurement	4.50
Appropriate equipment and facilities	5.00
Ease of application	5.00
Can be applied	4.50
Able to measure the accuracy of the throw	5.00
Total	38.00
Overall average	4.75
Criteria	Very good

Table 1 shows the results of expert evaluations with a sample of 1 boccia trainer and 1 academic. According to the table the average ratings obtained 4.75 which means the instrument in the category of very good to use.

4.1.3 Group Trial
The number of subjects used in the group trials was 10 boccia athletes. In the group trial conducted an assessment through a questionnaire. The assessment results are explained in table 2.

Table 2. Group Trial

Aspect	Average
Clarity of judgment	5.00
Conformity with the concept of the Boccia game	5.00
Clarity of implementation instructions	4.80
Accuracy of measurement	4.50
Appropriate equipment and facilities	5.00
Ease of application	4.20
Can be applied	4.50
Able to measure the accuracy of the throw	33.00
Total	4.71
Overall average	5.00
Criteria	Very good

Table 2 shown the results of a group trial with a sample of 10 boccia athletes. According to the table the average ratings obtained 4.71, which means the instrument in the category of very good to use.

4.1.4 Validity and Reliability Test

In the validity and reliability test will be in the degree or significance level of validity or reliability. The validity and reliability coefficient criteria used to select the test instrument are explained in the following table:

Table 3. Classification of Validity and Reliability Degrees

Klasifikasi	Validity	Reliability
Perfect	0.80-1.00	0.90-1.00
High	0.70-0.79	0.80-0.89
Medium	0.50-0.69	0.60-0.79
Low	0.00-0.49	0.00-0.59

Table 4 . Instrument Validity Test Results

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
Throwing 1	15.10	22,767	.754	.907
Throwing 2	15.20	17,956	.828	.903
Throwing 3	3:30 p.m.	21,567	859	.893
Throwing 4	14.90	24,767	.742	.914
Throwing 5	16.50	20,500	.789	.901
Throwing 6	3:00 p.m.	21,556	.779	.902

Table 4 shown the results of the instrument validity test with 6 attempts of throwing used developed instrument. Based on the table the instrument validity values are shown in the corrected item-total correlation table. Throwing 1 the validity value is 0.754; throwing 2 the validity value is 0.828; throwing 3 the validity value is 0.859; throwing 4 the validity value is 0.742; on throwing 5 the validity value is 0.789; and throwing 6 the validity value is 0.779.

Table 5. Instrument Reliability Test Results

Cronbach's Alpha	N of Items
.918	6

Table 5 shown the results of the instrument reliability test with 6 attempts of throwing used the developed instrument. Based on the table, the instrument reliability value is 0.918 which means the instrument developed is reliable

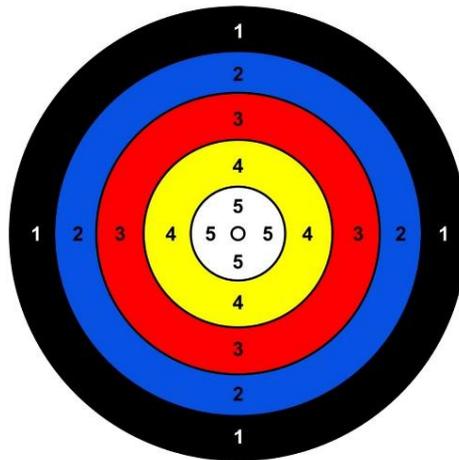*4.1.5 Boccia Ball Throwing Test Instrument*

Figure 1. Boccia Ball Throwing Accuracy Test Instrument

This instrument explains the points achieved by players in the boccia sport. A circle target will be placed 5 meters from the player.

a) Purpose: This test purpose to measure the accuracy of the boccia throwing
b) Boccia throwing test kit:
(1) boccia field is 12.5 meters x 6 meters
(2) Target with a circle shape
(3) Red leather ball 6 ball and blue ball 6 ball
(4) Gauge
(5) Chalk for lines
(6) Stopwatch
c) Implementing officer
(1) Turner and concurrent starter
(2) 1 person as target supervisor
(3) Results recorder
d) Implementation :
(1) Testi is in the box prepared and ready to throw the ball.
(2) On the "yes" signal, the testi throws a red or blue leather ball towards the target in the middle.
(3) Throw is made 6 times
e) Implementation time: 7 minutes
f) Rating:
(1) The highest score with a white track is point 5 if the red or blue ball is on that track.
(2) The score of the yellow track is point 4 if the red or blue ball is on that track.
(3) The score of the red track is point 3 if the red or blue ball is on that track.
(4) The score of the blue track is point 2 if the red or blue ball is on that track.
(5) Black track score is point 1 if the red or blue ball is on the track.
g) Value Criteria

Table 6. Value Criteria

Kategori	Batas Nilai
Very less	<8
Less	8-15
Enough	15-22
Well	22-28
Very good	> 28

4.2   Discussion

This development research was resulted an instrument product in which implementation and assessment were explained. Before producing the product, the instrument development was evaluated by experts and tested through groups. The expert evaluation in this study used 1 boccia trainer and 1 academic person, then obtained qualitative and quantitative data. The results of the expert judgment average is 4.75, which means the instrument in the category is very good to be used with the input of the development of the test instrument of the throwing accuracy with values varying each distance, this is so that the values vary; the player's throw is declared right on target if the ball is in the middle lane, this assumption arises with hope if it is not in the middle lane as well as not approaching the target ball jack if in a match. Implementation of the developed throwing test is limited in time, this means that the player has the pressure to do the throw test correctly. Implementation of a group trial using 10 athletes, then obtained an average rating of 4.71 which means that the instruments in the very good category to use. The results of this study support previous research that observed that desain of *interface* Boccia robotic, for this time the *interface* prototipe is able analysis and manipulated *UX* (*User Experience*) and *UI* (*User Interface*) on disability used *3D printers*, and used result of *CAD* (*Computer Aided Design*) *production* and *3D printers Proof* and modification of *actual prototype outputted*. Through four stages, can create *interface* of Boccia robotic by repeat the proces *CAD data production*, *3D printing*, verification from the investigation evidence throught sketch of ideas, provide a healthier life and reduce the risk of major illnesses and injuries (Sato, Ainoya, Motegi, & Kasamatsu, 2019). Previous studies have shown that the Boccia simulator game, application for training cerebal palsy patients produces positive assessments, which means that the Boccia simulator is efficient, as expected, convincing, in accordance with the main objectives, and practical (De & Do, 2017). The instruments of boccia's throwing accuracy were developed to overcome the problem of the throwing accuracy skills associated with the accuracy of the distance of the jack to the ball the athlete throws. The previous test instrument had the same distance so it did not reflect the actual situation and conditions of the match; the accuracy of the throwing test instrument used the shape of a square box that has not been equipped with an assessment; previous test instruments had not classified the athlete's skill category. Previous research has developed an interface that supports the boccia throw using a laser pointer to present intuitive estimates of the lobbing and rolling distances to the operator. In the end, verify the usefulness of the device robotic of boccia throwing which has been developed by conducting experiments in the field (B, Onishi, Kasamatsu, & Shimomura, 2019). The development of this instrument is in the form of a target with points for each distance. This instrument will hone the athlete's throwing accuracy skills, because the athlete will try to approach the target with the highest points (Ichiba, Okuda, Miyagawa, Kataoka, & Yahagi, 2020). This will benefit the athlete if in a match where the athlete will easily throw the ball to close to the jack ball. The use of specific sports equipment is facilitated to understand the function of the tool during the dexterity manual assessment. With regard to intralimb coordination, motoric form

(continuous and intermittent) is more relevant to the classification than the direction of movement (vertical and horizontal) or the arrival of the ball in the Boccia game (Roldan, A., Sabido, R., Barbado, D., Caballero, C., & Reina, 2017). The study presents a hybrid approach that used wearable devices, Mio Fuse bands and pandlets, and non - wearable devices, Kinect cameras to monitor the elderly while playing Boccia. Initial tests were carried out in the laboratory. The results include data collected about the main movements used during the Boccia game.

5. CONCLUSIONS

5.1   Based on validity and reliability tests that the development of the boccia throwing instrument is valid and reliable so that it can be used to measure the accuracy of the athlete's throwing skill in the boccia.

5.2 On throwing 1 the validity value is 0.754; throwing 2 the validity value is 0.828; throwing 3 the validity value is 0.859; throwing 4 the validity value is 0.742; throwing 5 the validity value is 0.789; and throwing 6 the validity value is 0.779.

5.3 The instrument reliability value is 0.918 which means the instrument developed is reliable.

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