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Throwing Technique Training Model for Blind Goalball Athletes

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Abstract Throwing is the main form of attack for scoring a goal in a goalball game. This research aims to design and apply throw technique training models to goalball games for blind athletes. The research uses a development study as its method. There were three forms of training models designed in this research whether experts then reviewers. Subsequently, twenty men goalball athletes, divided into two groups of ten each for experiment and control, respectively, participated in evaluating the designs in an eight-week training treatment. In the evaluation process, Aiken V was used to assess the validity of designs. The goalball throw velocity test was used to evaluate both groups' throw velocity, and an independent t-test was used to test differences in both groups' throw velocity. The research shows that the three training models designed are valid (Aiken V value > 0.69). Independent t-test shows that t_{count} (4.97) > table (2.10) with sig 0.00. It was further demonstrated that the experimental group achieved better throw velocity improvement than its control counterpart. It is assumed that the three throwing technique training models designed were pronounced valid and effective in improving goalball throw velocity.

Keywords Training Model, Throwing Techniques, Goalball, Blindness

1. Introduction

Sports are activities that aim at maintaining and improving human health and can be utilized in the form of sports competitions as a means of talent scouting. One participating in sports is valued by his/her achievements [1]. When an athlete has achievements, it means that s/he can achieve optimum results in the forms of abilities and skills in finalizing tasks, either in group or individual competitions. However, this statement by Hague et al. marginalizes people with disability since they are hindered enough to be actively involved in normal sports by their limited physical abilities. This marginalization occurs due to the assumption that people with disability do not possess abilities and are not able to achieve the normal level of aspiration. This condition, however, does not happen anymore, due to the invention of specialized sports for athletes with a disability, such as a goalball. Goalball offers other perspectives to people with disability, since it is a game designed for their use, especially those with blindness or vision impairment.

In order to assist a goalball game, the court is marked out with string held in place by 5 cm wide adhesive tape, which should be easily detectable by the player's hands and feet so that they can determine their position which can help them in defending or attacking the opposition [2]. In goalball, each player requires blindfold use to ensure their closed vision. Besides, in a goalball team, there are three players with their respective roles based on position (two wingers and the center) [3]. The aim of this game is to throw a goalball ball into the opposing team's goalpost [4]. The ball itself contains a bell which enables the players to determine its velocity and direction. In a defending position, players can perform blocking by using their body,

and then after controlling the ball, they can initiate an attack to their opponent by throwing [5].

Muñoz-Jiménez et al. [6] explained that throwing is an important technical-tactical act and able to be performed anywhere in the court before the six-meter line starting from a standing position. Therefore, a goalball coach should know his/her players' performance when they are placed in the three playing positions and also know their opponent's playing style to encourage throws from different positions. The researchers' observation in the Goalball National Training Center for ASEAN Para Games 2022 showed the coaches' limitations in coaching their athletes in throwing the goalball, and thus the development of throwing technique training model in goalball is necessary. The necessity happens due to the fact that throws are the main line of attack performed for shooting to the goalpost. Molik et al [7] showed in their game performance evaluation that the offensive phase was found to be more effective for B2 and B3 athletes. On the other hand, preparations were needed to determine the way the attack should be designed. Attack preparation was done by identification of players' position and role in the court to clarify the players' throw frequency, which in turn would give relevant information for the specifications of throw training [8].

Indeed, in training blind athletes, full attention and a hands-on approach need to be given due to their unique characteristics. One of them is their reliance to hearing in order to learn something [9]. Hence, special treatment in training is given by means of audio training materials, with one of the materials given is the throwing technique, in order to ease the athletes and coaches to repeat previous training programs. Floyd & Mowling [10] stated that in order to fulfill needs, modifications are optional apart from the players' abilities. In essence, the idea to design a training model for goalball throwing techniques was born out of the fact that in order to prepare offensive strategy, players need to be skilled enough to throw the ball as fast as possible to put them into their opponent's goalpost. Analysis of Morato et al [11] of the highest-level goalball game gave information on elite players' performance, in which it significantly indicated that goals were scored when the ball traveled in higher velocity. Based on the phenomenon, an in-depth scientific study is needed through scientific research to design and apply throwing technique training models for blind goalball athletes. Therefore, this research was conducted with the aim to design and apply a model of throwing technique training on goalball for blind athletes.

2. Method

2.1. Subject

Twenty blind men's goalball athletes training in Goalball National Training Center for ASEAN Para games participated in this research to evaluate the training models. The athletes were between 21 and 24 years old, had at least 2 years experience in goalball, and had participated in national and international competitions. Before undergoing training and testing, the athletes or their accompanying coaches signed a form of informed consent. This study had been approved by the Human Research Ethics Committee of Sebelas Maret University, with its experimental procedure was conducted in accordance with Ethics in Human Research procedure.

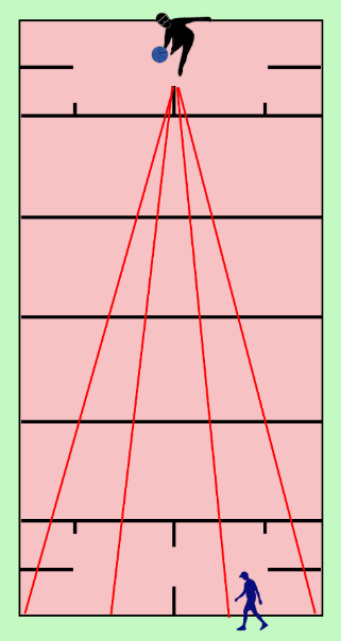


Figure 1. Training by audio aids

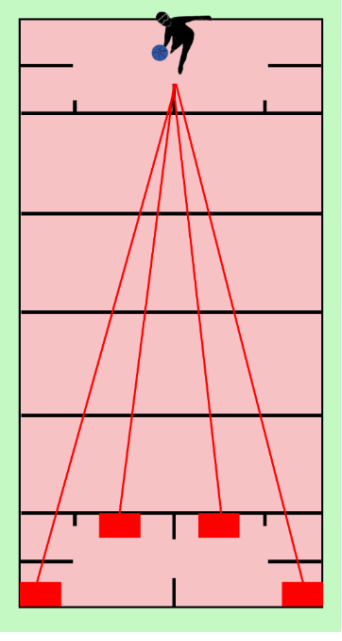


Figure 2. Training by using sound-producing targets

2.2. Throwing Technique Training Model Designs

1. Training by audio aids

In this training model, the athlete in training should have a partner responsible for sounding the audio aids used as the athlete's throw target point. Varying instruments of audio aids can be utilized, such as bells, whistles, and hand claps. For this research, hand claps cues were used. The companion clapped his/her hands twice for three successive periods to clarify and ease the athlete to determine target (Figure 1).

Implementation:

a. Partner is positioned in the predetermined target.
b. Throw targets consist of straight target, cross target, and gaps between wingers and the center.
c. Partner gives predetermined cues.
d. Athlete listens to source of sound as targets.
e. Athlete throws according to the sound direction.

2. Training by using sound-producing targets

This training model employs targets which can produce sound if hit by the ball. For this research, wooden boxes were used as target which can produce sound when hit by the ball, which signals that the throw accurately hits the target (Figure 2).

Implementation:

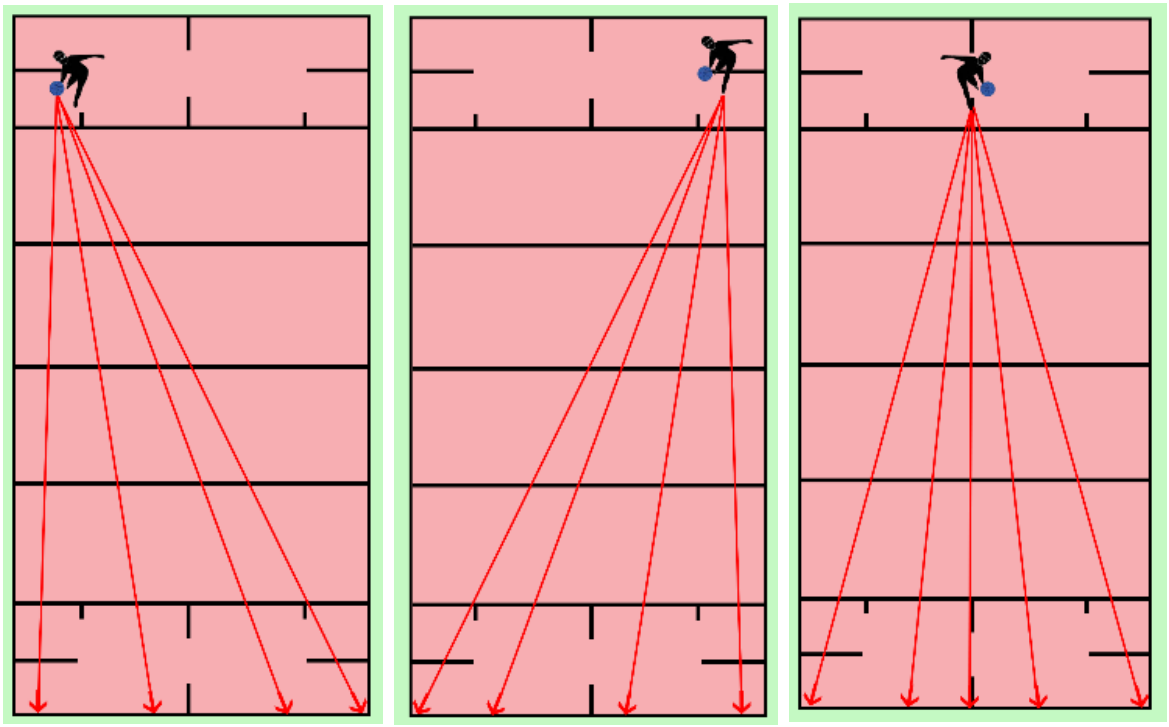
a. Wooden boxes were placed on predetermined target places.
b. Throw targets consist of straight target, cross target, and gaps between wingers and the center.
c. Then, the athlete was instructed to hit the wooden box targets by throwing the ball. The wooden boxes would produce sound when hit accurately.
d. Before throwing, the athlete was given opportunities to sense the targets by touch accompanied by partner in order to know the target direction.

3. Training based on athletes' position

In this training model, the athletes will be placed in their respective best positions to throw according to predetermined targets of straight target, cross target, and gaps between wingers and the center (Figure 3).

Implementation:

a. Athletes are positioned in their respective best positions to throw according to the predetermined target.
b. Before conducting throws, athletes are guided by their partners to sense and feel the targets by touch.



(a) (b) (c)

Figure 3. Training based on athletes' position; (a) right winger position; (b) left winger position; (c) center

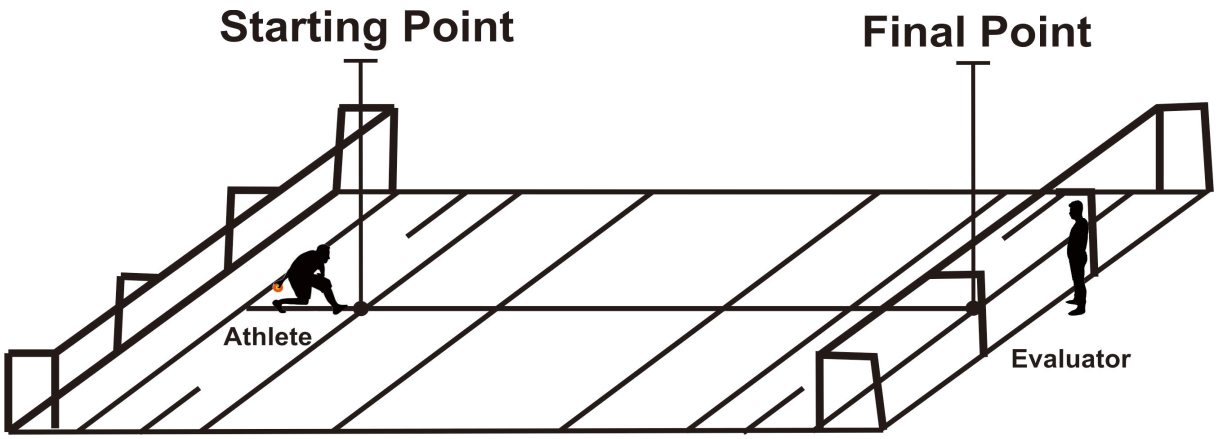


Figure 4. Ball throwing velocity test

2.3. Validity and Effectiveness Assessments

The design of the goalball throwing technique training model was validated by three experts. Questionnaires were given to experts to review the training model design (Table 1). Each expert was asked to give their assessment to the three training model designs. The assessment used a five-scaled Likert scale, with "5" indicating "Extremely Agree" assessment and "1" indicating "Extremely Disagree" assessment. After pronounced valid by experts, then the testing of effectiveness was conducted by employing two groups of athletes functioning as experiment and control groups. The experimental group underwent treatment of throwing technique training by using the training models designed, for three training sessions per week in an eight-week schedule. The reason for eight-week treatment is that based on previous research, eight-week training has a positive effect on athletes with blindness [12]. In order to understand the designs' effectiveness, the two groups underwent initial and final tests of goalball throw velocity.

Goalball ball throw velocity test instrument was used to evaluate throw velocity on 12 meters distance (Figure 4). Ball velocity was measured by using sports radar and expressed in m/s. The tests were conducted, in which players were handed the ball and tried to throw it into opponent's goalpost. The players were encouraged to achieve their highest velocity possible with throwing techniques most suitable for them. Each player was given three times of opportunity to do the test. The highest ball velocity was taken as the analyzed score [13].

2.4. Data Analysis

In assessing the validity of the training models designed, the experts used Aiken V coefficient. An Aiken V value of 0.69 is needed to achieve critical value with 95% confidence level [14]. Thus, if each model attains Aiken V value of > 0.69, they are pronounced valid and can proceed to effectiveness testing on goalball athletes. In testing the training models' effectiveness, a comparison of goalball throw velocity between experiment and control groups was conducted by using an independent t-test with 0.05 significance.

Table 1. Expert assessment questionnaire

No	Statement
1	Suitability to goalball game concept
2	Accuracy of training model to goalball throwing skills
3	Suitability of instruments and facilities
4	Ease of model application
5	Suitability to age
6	Ability to encourage development in throwing technique
7	Safety of application
8	Clarity of instruction of model implementation

Table 2. Experts' assessment results

Training model	Aiken V score
Training Model 1: Training by audio aids	0.84
Training Model 2: Training by sound-producing targets	0.76
Training Model 3: Training by virtue of playing position	0.85

Table 3. Results of training model effectiveness test on group

Group	Test	N	Mean	SD	Improvement	Differences Between Groups	
						t-count	p-value
Experiment	Pre-test	10	11.49	0.67	21.29%	4.97	0.00*
	Post-test	10	13.94	0.60			
Control	Pre-test	10	11.53	0.58	10.49%		
	Post-test	10	12.74	0.57			

*Statistically-significant difference between experiment group and control group with p-value < 0.05

3. Findings

Table 2 shows the Aiken V score of each model. It shows that the three models were found to be valid (Aiken V > 0.69) which enabled the models to be tested for its effectiveness in group testing.

Table 3 shows the results of training model effectiveness test on groups. It was found that both groups experienced goalball throw improvement. However, the experiment group in which training the three models tested were applied showed a significantly higher throw velocity improvement of 21.29% compared to that of the control group amounting to 10.49%.

4. Discussion

This research aims to design and apply throwing technique training models for blind goalball athletes. The three training models designed underwent validity assessment from experts with the results showing that the models assessed to be valid, thus allowing their effectiveness to be tested on goalball athletes. Results of effectiveness testing show that through the use of different training models, the two groups all showed improvement in their goalball throw velocity. However, the group using the three training models designed improved better than its counterpart using conventional model. This shows that the models designed are efficient in improving goalball throw velocity. It is suitable to goalball athletes' needs, in which the ability to vary throwing types to score goals – obtainable through training – are extremely important in male elite goalball [15]. One of the training models designed is based on the athletes' playing position, which will greatly help them when playing as wings or centers in improving their throw techniques which in turn will contribute to their success in scoring goals. Monezi et al [3] in their analysis of attacks in goalball games showed that in terms of playing position, wing players cover greater distances and higher velocity in throw techniques than their teammate in the center. Although the throws made are between the wingers and the center in the same team, both positions require throwing techniques. Wingers use throws to initiate attacks while center uses them to distribute the ball in order to conduct next attack. In line with this, the research provides information on the regular structure of performance and influences of target sector and ball velocity by using several methods of computer vision to detect the ball. The results show that a significant correlation was found between assessment level and ball velocity in the throws to goalpost [16]. On the other hand, by using a different concept of training model, Miura et al [17] developed *GoalBaural* app designed to improve ability to identify ball throw direction and distance without requiring athletes to play goalball live. The app has been evaluated, with the evaluation results showing it to be efficient in indicating throw accuracy and velocity. However, the *GoalBaural* app was shown to be effective only amongst women players with limited number of players in a team.

5. Conclusions

The research produced three throwing techniques training models that can be utilized for goalball athlete training, namely: 1) training by audio aids, 2) training by sound-producing target, and 3) training by virtue of playing position. Assessment and testing to the training models confirmed that they are valid and effective in improving goalball throwing technique.

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