

# The Development of Ball Throwing Machine Zpd 01 For Futsal Goalkeeper Training

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## ABSTRACT

The purpose of this study is to facilitate the futsal coach in providing some various goalkeeper training through the modern machine-based device. The developed device is designed as simple as possible so that the cost can be minimized and easier in the application. The ball thrower machine ZPD 01 for a goalkeeper has an upper and lower thrower, each thrower is equipped with a storage basket for storing the balls. This study is a research and development design with the techniques of data collection such as observation, interview, and administering a questionnaire. The validity testing is conducted which involved 3 experts consist of an engineer, electrical, and futsal. The purpose of the validity testing is to gather as much information as possible as input to develop a machine that can function optimally. The machine trial involved a limited sample which consists of 6 athletes with the result valid and useable. Next, the machine trial involved a larger subject of 12 athletes with the same results are valid and useable.

## Keywords

Thrower machine, futsal, goalkeeper

Article Received: 10 August 2020, Revised: 25 October 2020, Accepted: 18 November 2020

## Introduction

Futsal is a popular sport which is known by the most of the people around the country. This sport is very flexible which can be played indoor or outdoor, or just as an after-work recreation activity. Another reason this sport is very popular because it doesn't need a wide field like a football field so there are lots of indoor futsal fields provided for people to play anytime and anywhere. Manuel, Hermoso and Granda, (2008) describe that futsal is a dynamic sport which is played in 40x20 m field length and 3x3 m goal post. The small number of players makes it possible for people to play with their close friends. As Daryanto, (2013) explains that futsal is a team game which consists of 5 players in each team. Moreover Oppici et al., (2018) also stated that futsal is an indoor sport with 5 players in each team. The other reason that futsal is a popular sport because the duration of the game is not long which does not consume too much energy. The duration of a futsal game is 20 minutes for each round and played in two round (Manuel, Hermoso and Granda, 2008).

One of the important components in a futsal team is a goalkeeper. Luxbacher, (2016:125) explains a goalkeeper is a player in a futsal or football team which is allowed to use his hands to receive or control the ball. Ulfiansyah, B and Kriswantoro, (2015) added that a goalkeeper is a player who is entrusted to guard or escort a goal post by the management or the coach from the conceding or opponent's attack. Then, it can be concluded that a goal keeper is a player in a team who responsible to catch the ball before entering the goal post to prevent the opponent to create scores.

Basically, a goalkeeper is an influential component of the team and expected to have qualifications in his part. There are nine positioning techniques that a goalkeeper should master, such as (a) steady position on the goal post; (b) straight rolling ball to the post; (c) low direct shoot to the

post; (d) side rolling ball; (e) receive the ball with chest height; (f) receive the ball with chest and head height; (g) receive a high ball; (h) reach out towards the ball; (i) rolling the ball; (j) throwing the ball; and (k) kicking the ball (Luxbacher, 2016:126-139).

In order to support the rest of the team to have outstanding performance in a futsal match, a goalkeeper needs to be trained exclusively to have an outstanding performance during the match. In this modern era, technology give a huge advantage in every aspect of life, one of them is in the sports field. Technology in sport can be very beneficial for the coach to train their athletes. The technology facilitates the easiness of a coach to give good and consistent training quality. The technology referred to in this study is a throwing ball machine for a goalkeeper. From the researcher observation, the availability of a throwing ball machine for futsal in Pontianak can be said to be non-existent. The researcher did an interview with some active futsal clubs in Pontianak related to the use of machines in helping the coach to train the player. As a result the researcher found that there is not one of the coaches ever trains their player with the assistance of machine-based devices. As the result of rationalization is the coach expected or desired the assistance of technology during their training activity.

There are numerous product produced by some researchers related to machine-based device to help the coach in training the athletes.. They are Amni, Ruhayati, and Sultoni, (2017) who develop a microcontroller-based tennis ball throwing machine., Kovács and Hosszú, (2015) ho develop a very accurate throw intelligent controller., and Ponnusamy, Yong, and Ahmad, (2015) who develop an automatic table tennis ball thrower which is integrated with a microcontroller.

The development study of other throwing ball devices are conducted by Kumar et al., (2015) who study about bowling ball thrower; and Roy et al., (2006) who develop cricket ball thrower. Meanwhile, a researcher who develops a futsal ball

thrower in Indonesia are Mohamad Abdul Syakur, Badruzaman, and Paramitha, (2017) with their microcontroller-based futsal ball thrower, and Jaenudin, Rusdiana, and Kusmaedi, (2018) who develop training media of passing training which integrated with Arduino Uno. From those studies conducted by previous researchers who take advantage of technology, the researcher adopted the way of the programming as the consideration to develop more modern and affordable machine for the futsal coach. Based on the explanation above, the researcher develops a simple model design of a futsal ball thrower machine which is simpler and affordable. It is called ZPD 01 as the name of the model with some new features from the previous study. ZPD 01 is developed in order to help the futsal coach in training the goalkeeper in some active Futsal club in Pontianak. The machine itself is equipped with two throwers which helps the goalkeeper to train their upper and lower ball, two baskets to store some balls, and the speed control to give variation on the ball speed.

The Development of Ball Thrower Machine ZPD 01 for Futsal Goalkeeper Training

The developed ball thrower machine is a machine for futsal goalkeeper training. This machine is developed based on the existing machine developed by Mohamad Abdul Syakur, Badruzaman and Paramitha, (2017). From the existing machine, the researcher adds more features that make the machine in this study different from the previous one. The features that the researcher adds to the machine are the storage basket, lower thrower, and speed control. The previous devices do not have basket storage, and there is only one thrower, so the ball need to push manually and the thrower only for the upper ball

The function of the basket installed in this machine is to store 6 to 7 balls at a time. It is time-efficient because the player does not waste their time by recollecting the ball during the training. The height degree of the thrower can be set according to the training need so the goalkeeper can practice catching the ball from different angles. Moreover, the two thrower holes add another variety of incoming balls for the goalkeeper to catch.

The Design of ZPD 01 ball thrower for the goalkeeper training

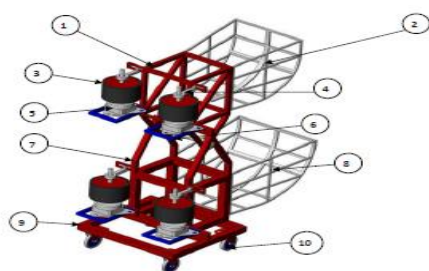


Figure 1.

The Design of ZPD 01 ball thrower for the goal keeper

No	Parts	Number
1	Upper body	1
2	Upper ball storage	1

3	Throwing wheels	4
4	Upper body frame	4
5	Motor	4
6	Motor holder	4
7	Lower body	1
8	lower ball storage	1
9	Lower frame base	1
10	Moving wheels	4

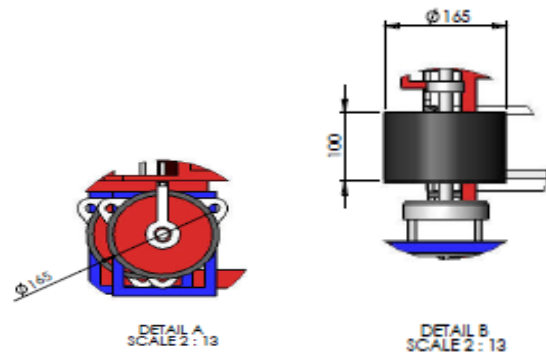


Figure 2. The assemble of throwing wheels

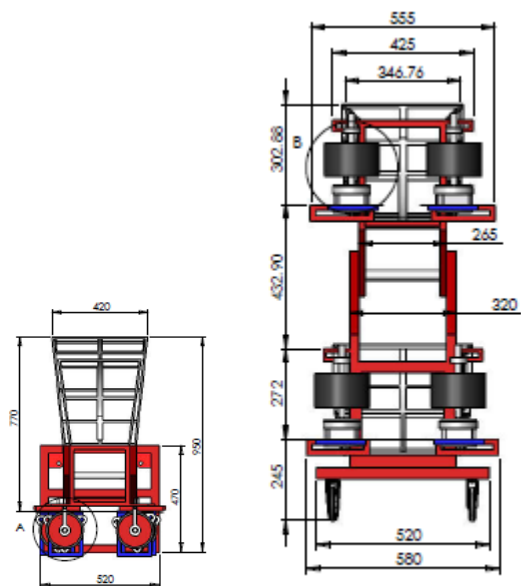


Figure 3. The assemble of ZPD 01 ball throwing from the top and front view

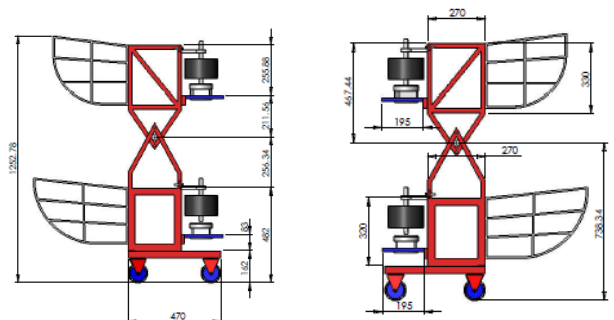


Figure 4. The assemble of ZPD 01 from side view

Methods

This study uses a research and development design. Sugiyono, (2018:297) explain that research and development design is a research design which is conducted to create a certain product, and to test the effectiveness of the product. The steps in conducting this study is described as follow:

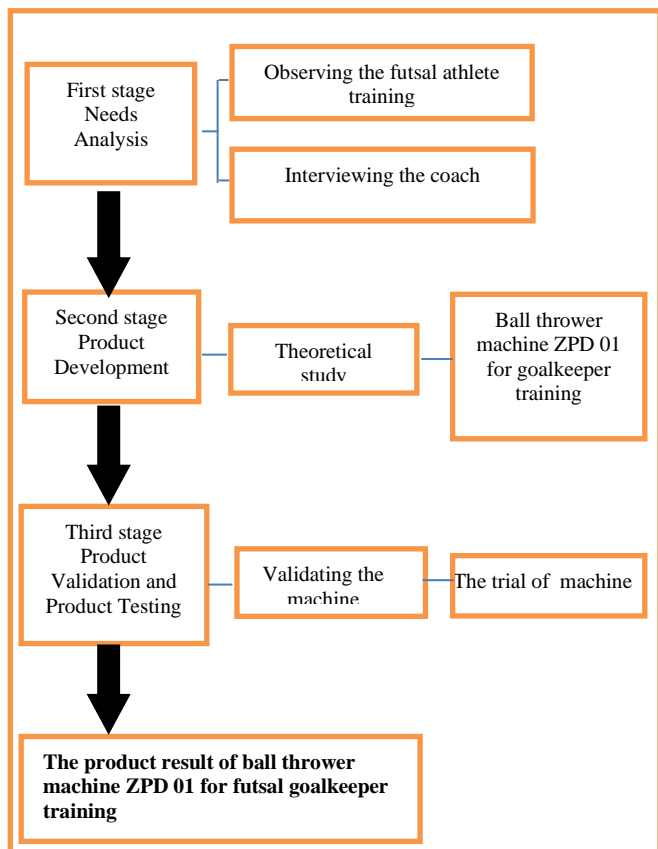


Figure 5. Chart of the procedure ZPD 01 development for futsal goalkeeper training

The technique of data analysis used in this study is the percentage of descriptive analysis. This technique used only to know the percentage of product effectiveness (Sudjana, 1990:45).

The formula of percentage is as follow:

$$P = \frac{X}{Xi} \times 100\%$$

Notes:

- P = the percentage of the experiment result
- x = the score
- xi = the maximum score

The criteria to set the conclusion achieved are as follow:

**Percentage table of subject evaluation result**

Percentage	Criteria
80% - 100 %	Valid/useable
60% - 79%	Quite Valid/useable
50% - 59 %	Less valid/replaced
<50%	Not valid/replaced

**Evaluation Discussion Context**

The result of this study is a ball thrower machine named ZPD 01 that was developed for the futsal goalkeeper training. The result can be described as follow:

No	Component	Findings
1.	<b>First stage (preliminary study).</b> A preliminary study through field observation and interviews of two coaches was conducted to know the need analysis of the study	1. Needs Analysis a. The researcher set Pontianak regency in West Kalimantan as the setting of the study and the futsal athletes as the subject. b. Interviewing the coaches to gather additional information about goalkeeper training in Pontianak, West Kalimantan
		2. Analyzing the data of needs analysis results a. From the need analysis result, it is formulated to study the need of futsal goalkeeper on a ball thrower machine to assist them in the training. b. The subject of the study is futsal goalkeeper athletes in Pontianak regency, West Kalimantan. c. The place of the study is in IKIP-PGRI Pontianak and laboratory workshop of Polytechnic Pontianak in West Kalimantan. The training process conducted in IKIP-PGRI and the machine production is in state Polytechnic workshop. d. The observation and interview of the coaches resulting in information that there is no machine-based ball thrower for goalkeeper training. e. The need for a machine-based ball thrower with more efficient and effective features such as balls storage, 2 throw holes, and the adjustable speed and heights of throwing to increase the goalkeeper skill.
2	<b>Stage two (product development)</b> The product development stage consists of a review of supporting theories and arrange the initial draft of the product.	1. Theoretical studies This is the stage to study scientifically of the used material based on empirical theories. The underlying theories are: a. Futsal b. Goalkeeper c. The development of ball throwing machine ZPD 01 for the goalkeeper training.
		2. The development of the initial product The design of the initial product is based on a theoretical study so that it is formulated in the following order:

No	Component	Findings
		a. Low pitching practice b. Chest height pitching practice c. Head height pitching practice. d. Passing over head pitching practice e. Goalkeeper reaction/agility practice
3	<b>Stage three (product validation and product trial)</b> The validation stage involved three experts to judge the product validity.	1. Testing with experts' judgment. <ol style="list-style-type: none"> <li>The testing was conducted to gather suggestions and responses from the expert for the perfection of the machine.</li> <li>The instrument used is an open-ended and closed-ended questionnaire.</li> <li>The quantitative data of the expert are:               <ol style="list-style-type: none"> <li>1) Electronics experts with the result 84,37 %.</li> <li>2) Mechanical expert with the result 82,60 %</li> <li>3) Futsal expert with the result 80,20 %</li> </ol> </li> <li>From the expert judgment validation testing it can be concluded that the product is worth testing with average percentage is 82.39%.</li> </ol> 2. The finite testing <ol style="list-style-type: none"> <li>This stage is the follow-up of the experts validating testing.</li> <li>The purpose of finite testing is to investigate product acceptability to the limited number of research subjects.</li> <li>The number of the subject used in the study is 6 athletes</li> <li>The Instrument is a close-ended questionnaire.</li> </ol> 3. Product revision of finite testing result. <ol style="list-style-type: none"> <li>The result of finite testing is 69,44%.</li> <li>It can be concluded that the product is valid enough and useable.</li> </ol> 4. Wider testing <ol style="list-style-type: none"> <li>This stage is as the follow-up from the finite testing.</li> <li>The purpose is to investigate the acceptance of the product in a wider subject number</li> <li>The number of subjects are 12 athletes.</li> <li>The instrument used is a close-ended questionnaire.</li> </ol> 5. Product revision II <ol style="list-style-type: none"> <li>The wider testing</li> <li>The result is 81,94%</li> <li>The conclusion is that the product is valid and useable.</li> </ol>

No	Component	Findings
4	The result and the report of final product.	A product in form of throwing ball machine ZPD 01 for the futsal goalkeeper.

### Conclusion

The result of the study is the developed ball throwing machine ZPD 01 for the futsal goalkeeper in assisting (a) intercept the lower ball training; (b) intercept chest-height ball training; (c) intercept head-height ball training; (d) intercept upper head-height ball training, and (f) reflect training.

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