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# Play Activity: To Increase Fundamental Movement Skill for Children with Mild Mental Retardation

M. Haris Satria<sup>1,\*</sup>, Bangkit Seandi Taroreh<sup>1</sup>, MargarettaIneke Melynda<sup>2</sup>, Novri Asri<sup>3</sup>

<sup>1</sup>Department of Sport Education, Universitas Bina Darma, Palembang, Indonesia

<sup>2</sup>Nursing Pavilion, RSUD dr. H. Moh. Rabain, MuaraEnim, Indonesia

<sup>3</sup>Department of Sport Education, Universitas Islam Kalimantan Muhammad Arsyad Al Banjari, Banjarmasin, Indonesia

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**Abstract** This research aims to, 1) develop a draft of play activity: to increase fundamental movement skill for children with mild mental retardation and 2) obtain empirical data on the effectiveness of the results of play activity: to increase fundamental movement skill for children with mild mental retardation. This research is the development of (research and development). The sample in this study is retarded children in SD SLB C Karyalbu, SD SLB C YPAC and SD SLB B Pembina. The result of research and development as well as the procedures, the resulting product is a model of instruction play activity: to increase fundamental movement skill for children with mild mental retardation currently consists of 46 model variations. From the results, small group test showed that model of play activity: to increase fundamental movement skill for children with mild mental retardation, this good and can be used by students and teachers in SD SLB C in Palembang. From the results field try group test stated that the products developed can be used by children with mild mental retardation however still needing guidance. The effectiveness test product development showed a significant improvement to the fundamental movement skills (locomotor, non-locomotor and manipulative) children with mild mental retardation, and the results large-scale trial stated that the products developed can be used without guidance. Suggestions on this research are that this product can be used as one way to increase fundamental movement skills for children with mild

mental retardation and specific to the teacher that this product can be used as material to instruct the basic motion of matter.

**Keywords** Play Activity, Fundamental Movement Skill, Mild Mental Retardation

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## 1. Introduction

Mental retardation is a child who has a level of intelligence below the average normal child. This is in line with the opinions of Armatas saying that "Mental retardation (MR) is a genetic disorder manifested in significantly below average overall intellectual functioning and deficits in adaptive behaviour. Mental retardation is a particular state of functioning that begins in childhood and is characterized by decreased intelligence and adaptive skills and also is the most common developmental disorder [1]. Furthermore, according to Kemis and Ati saying that a child of mental retardation is an individual who significantly has intelligence under normal intelligence with an equal or lower IQ score of 70[4]. According to Genewa in Widati and Murtadlo argues that mental retardation is a state of stalled or incomplete mental development characterized by skill constraints during developmental period so that it

affects all levels of intelligence, such as cognitive, language, motor, and social skills [7]. According to Kemis and Ati, there are some classifications of children with mental retardation including (1) Classification based on learning needs consists of (a) the level of borders in education called slow learner with IQ 70-85, (b) educable mentally retarded with IQ 50-75 or 75, (c) trainable mentally retarded IQ 30-50 or 35-55, (d) dependent or profoundly mentally retarded with IQ in the 25 or 35, (2) The medical-biological classification consists of (a) the degree of the border (IQ: 68-85), (b) mild disabled (IQ: 36-51), (c) moderate mental retardation (IQ: 35-20), and (d) disabled is very heavy with an IQ level below from 20. (3) Psychological classifications based on psychometric criteria consisting of (a) mild mental retardation) with IQ = 55-69, (b) moderate mental retardation) with IQ = 40-54, (c) severe mental retardation with IQ = 20-39, and (d) profound mental retardation) with IQ 20 and below.(4) A clinical classification which is classified on the basis of the following physical characteristics (a) down syndrome/mongoloid, (b) hydrocephalus is the size of a large head containing fluid, (c) microcephalus is too small head size and macrocephalus that is too large head size [4]. Based on the results of observation as a preliminary study conducted by researchers to children with mild mental retardation, it is obtained that its motoring ability is impaired and not as normal children in general especially the ability of fundamental movement skill. This is evident when they carry out the learning activities of physical education that the movements look awkward, lack the body balance so that they are difficult to control the position and have a less coordination of motion. After the initial observation turned out in addition to the motor capability of children disabled mild, there are disorders apparently their social activities are also impaired, this is evident from the less capable they interact among fellow, unstable emotions that require more mentoring. Therefore, adaptive physical education teachers are required to be more active and creative to modify the learning to be

useful and meaningful for the child who is light. Looking at the characteristics of a child's mental retardation then in adaptive penjas? learning there must be elements of fun. Therefore, a play approach can be applied to the learning of adaptive Physical education. The form of games provided do not origin-asaln? or haphazardly, the games given must have a therapeutic element so as to improve their basic mobility skills. According to Prasedio in Efendi(2006) .[3] said that the game that can be given to the child of disabled at least has a charge, among others, has different therapeutic values as well as a given game figure and not too difficult to digest the child disabled. Departing from the problems, researchers are interested in doing a research on the child's mental retardation.. The title of research raised is "Play Activity: to Increase Fundamental movement skill For Children With Mild Mental Retardation.

## 2. Methodology

This study was conducted in three schools, namely Elementary School of Extraordinary School C Karyaibu, Elementary School of Extraordinary School C Yayasan Pembina AnakCacat (YPAC) and Elementary School of Extraordinary School B Pembina in the city of Palembang. The goal in this study is that students with child characteristics are mild mental retardation /capable of training/imbecilic that have an age between 7-12 years. The plan for the research of the play activity: to increase fundamental movement skill for mild mental retardation used the research & development of Borg and Gall with ten steps/stages. The stages are as follows (1) research and information collecting, (2) planning, (3) develop primary form of product, (4) preliminary field, (5) main product revision, (6) main field testing, (7) operational product revision, (8) operational field testing, (9) final product revision, (10) dissemination and implementation [2]. For more details can be seen figure 1.

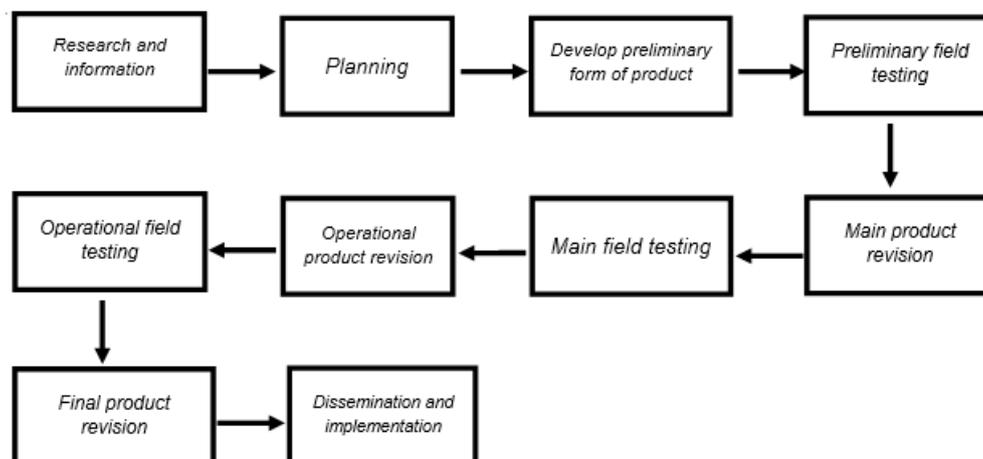


Figure 1. Instructional Design Research and Development

### 3. Result & Discussion

#### 3.1. Expert Judgment

The expert evaluation consisted of 6 people with details for the adaptive physical education expert as many as 3 people and motorists as much as 3 people. The Draft product that has been made by researchers comprises 50 variations of fundamental movement skill. After being evaluated by experts turned out to be continued, namely 46 models and 4 variations are declared unworthy to continue.

**Table 1.** Result of Expert Evaluation

No	Model	Approved of Model		(Feasible/No Feasible)	Suggestion
		Expert PE and Expert Motoric			
		Yes	No		
<b>LOCOMOTOR SKILL</b>					
<b>Walking</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	Yes	Yes	Feasible	Can be implemented
3.	Variation 3	Yes	Yes	Feasible	Can be implemented
4.	Variation 4	Yes	Yes	Feasible	Can be implemented
5.	Variation 5	Yes	Yes	Feasible	Can be implemented
<b>Running</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	Yes	Yes	Feasible	Can be implemented
3.	Variation 3	Yes	Yes	Feasible	Can be implemented
4.	Variation 4	Yes	Yes	Feasible	Can be implemented
5.	Variation 5	Yes	Yes	Feasible	Can be implemented
<b>Leaping</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	Yes	Yes	Feasible	Can be implemented
3.	Variation 3	Yes	Yes	Feasible	Can be implemented
4.	Variation 4	No	No	No Feasible	Difficult to do
5.	Variation 5	Yes	Yes	Feasible	Can be implemented
<b>Dodging</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	Yes	Yes	Feasible	Can be implemented
3.	Variation 3	Yes	Yes	Feasible	Can be implemented
4.	Variation 4	No	No	No Feasible	Difficult to do
<b>NON-LOCOMOTOR SKILL</b>					
<b>Jumping</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	Yes	Yes	Feasible	Can be implemented
<b>Foot Balances</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	Yes	Yes	Feasible	Can be implemented
<b>Bottom Balances</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	Yes	Yes	Feasible	Can be implemented

Table 1 Continued

<b>MANIPULATIVE SKILL</b>					
<b>Small Ball Catch</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	Yes	Yes	Feasible	Can be implemented
3.	Variation 3	Yes	Yes	Feasible	Can be implemented
4.	Variation 4	Yes	Yes	Feasible	Can be implemented
5.	Variation 5	Yes	Yes	Feasible	Can be implemented
<b>Distance Throw</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	No	No	No Feasible	Difficult to do
3.	Variation 3	Yes	Yes	Feasible	Can be implemented
4.	Variation 4	Yes	Yes	Feasible	Can be implemented
5.	Variation 5	Yes	Yes	Feasible	Can be implemented
<b>Racquet Strike</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	Yes	Yes	Feasible	Can be implemented
3.	Variation 3	Yes	Yes	Feasible	Can be implemented
<b>Ball Strike</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	Yes	Yes	Feasible	Can be implemented
3.	Variation 3	Yes	Yes	Feasible	Can be implemented
4.	Variation 4	Yes	Yes	Feasible	Can be implemented
5.	Variation 5	Yes	Yes	Feasible	Can be implemented
<b>Large Ball Kick</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	No	No	No Feasible	Difficult to do
3.	Variation 3	Yes	Yes	Feasible	Can be implemented
4.	Variation 4	Yes	Yes	Feasible	Can be implemented
5.	Variation 5	Yes	Yes	Feasible	Can be implemented
<b>Hula Hoops</b>					
1.	Variation 1	Yes	Yes	Feasible	Can be implemented
2.	Variation 2	Yes	Yes	Feasible	Can be implemented

### 3.2. Product Revision I

Once the product is validated by the expert then the product is repaired according to expert input/advice. The input from experts is to give input to equipment and supplies that are suitable for children with mild mental retardation, material content and implementation of the model.

### 3.3. Small Group Test

Small group trials were conducted at Elementary School SLB C Karyaibu with the number of research samples of 12 students with a mild mental retardation. The results of small group trials can be concluded that the product "can be used by children with mild mental retardation but still must be given instruction from the teacher/companion".

**Table 2.** Result of Small Group Test

No	Model	Suggestion/Recommendation	Explanation
<b>LOKOMOTOR SKILL</b>			
<b>Walking</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric
3.	Variation 3	Can be application with instruction	assessment rubric
4.	Variation 4	Can be application with instruction	assessment rubric
5.	Variation 5	Can be application with instruction	assessment rubric
<b>Running</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric
3.	Variation 3	Can be application with instruction	assessment rubric
4.	Variation 4	Can be application with instruction	assessment rubric
5.	Variation 5	Can be application with instruction	assessment rubric
<b>Leaping</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric
3.	Variation 3	Can be application with instruction	assessment rubric
4.	Variation 4	Can be application with instruction	assessment rubric
<b>Dodging</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric
3.	Variation 3	Can be application with instruction	assessment rubric
<b>NON-LOCOMOTOR SKILL</b>			
<b>Jumping</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric
<b>Foot Balances</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric
<b>Bottom Balances</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric
<b>MANIPULATIVE SKILL</b>			
<b>Small Ball Catch</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric
3.	Variation 3	Can be application with instruction	assessment rubric
4.	Variation 4	Can be application with instruction	assessment rubric
5.	Variation 5	Can be application with instruction	assessment rubric
<b>Distance Throw</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric
3.	Variation 3	Can be application with instruction	assessment rubric
4.	Variation 4	Can be application with instruction	assessment rubric

Table 2 Continued

<b>Racquet Strike</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric
3.	Variation 3	Can be application with instruction	assessment rubric
<b>Ball Strike</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric
3.	Variation 3	Can be application with instruction	assessment rubric
4.	Variation 4	Can be application with instruction	assessment rubric
5.	Variation 5	Can be application with instruction	assessment rubric
<b>Large Ball Kick</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric
3.	Variation 3	Can be application with instruction	assessment rubric
4.	Variation 4	Can be application with instruction	assessment rubric
<b>Hula Hoops</b>			
1.	Variation 1	Can be application with instruction	assessment rubric
2.	Variation 2	Can be application with instruction	assessment rubric

### 3.4. Product Revision II

The second revision was carried out after a small-scale trial. The inputs for revision are: (1) teacher and student assignments at the time of implementation, (2) a companion to assist the teacher's role, and (3) the companion may involve the student's parents.

### 3.5. Large Group Test

The large group trials were conducted in three elementary schools, namely the Elementary School of SLB C Karyalbu, Elementary School of SLB C YPAC and Elementary School SLB B Pembina in Palembang with a number of research samples of 60 students are light. The results of large group trials can be concluded that the product "can be used by all the children with mild mental retardation without guidance.

Table 3. Result of Large Group Test

No	Model	Suggestion/Recommendation	Explanation
<b>LOKOMOTOR SKILL</b>			
<b>Walking</b>			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric
3.	Variation 3	Can be application	assessment rubric
4.	Variation 4	Can be application	assessment rubric
5.	Variation 5	Can be application	assessment rubric
<b>Running</b>			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric
3.	Variation 3	Can be application	assessment rubric
4.	Variation 4	Can be application	assessment rubric
5.	Variation 5	Can be application	assessment rubric

Table 3. Continued

<b>Leaping</b>			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric
3.	Variation 3	Can be application	assessment rubric
4.	Variation 4	Can be application	assessment rubric
<b>Dodging</b>			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric
3.	Variation 3	Can be application	assessment rubric
<b>NON-LOCOMOTOR SKILL</b>			
<b>Jumping</b>			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric
<b>Foot Balances</b>			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric
Bottom Balances			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric
<b>MANIPULATIVE SKILL</b>			
Small Ball Catch			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric
3.	Variation 3	Can be application	assessment rubric
4.	Variation 4	Can be application	assessment rubric
5.	Variation 5	Can be application	assessment rubric
Distance Throw			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric
3.	Variation 3	Can be application	assessment rubric
4.	Variation 4	Can be application	assessment rubric
Racquet Strike			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric
3.	Variation 3	Can be application	assessment rubric
<b>Ball Strike</b>			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric
3.	Variation 3	Can be application	assessment rubric
4.	Variation 4	Can be application	assessment rubric
5.	Variation 5	Can be application	assessment rubric
<b>Large Ball Kick</b>			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric
3.	Variation 3	Can be application	assessment rubric
4.	Variation 4	Can be application	assessment rubric
<b>Hula Hoops</b>			
1.	Variation 1	Can be application	assessment rubric
2.	Variation 2	Can be application	assessment rubric

### 3.6. Final Product

Field trials show that the model of play activity: to increase fundamental movement skill can be applied and can be done by students with mild mental retardation. Therefore, nothing else should be revised because it has fulfilled the required aspect of the standard so that the product is worth using.

### 3.7. Model Effectiveness

Effective test was carried out in three schools, namely Elementary School of SLB C Karyaibu, Elementary School of SLB YPAC and Elementary School of SLB B Pembina Kota Palembang, amounting to 60 students by giving the treatment of basic motion-based models for children with mild mental retardation. For more details can be found below:

- Locomotor test, the test results show that there is a significant difference between before and after the treatment is given. Judging from the result Mean = 2.35517 where  $t_{\text{count}} > t_{\text{table}}$  is  $14.357 > 2.000$ .
- Non locomotor test, the test results show that there is a significant difference between before and after the treatment is given. Judging from the result Mean = -1.72500 where  $t_{\text{count}} > t_{\text{table}}$  is  $-24.175 > 2.000$ .
- Manipulative test/object control test, the test results show that there is a significant difference between before and after the treatment is given. Judging from the result Mean = -4.533 where  $t_{\text{count}} > t_{\text{table}}$  is  $-23.754 > 2,000$ .

The test results showed that there was a significant increase. So, it can be concluded that model play activity: to increase fundamental movement skill for children with mild mental retardation effective and feasible, so that it can be used by children with mild mental retardation.

**Table 4.** Locomotor Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Paired	Pretest - Posttest	2.35517	1.27072	.16405	2.02691	2.68343	14.357	59	.000

**Table 5.** Non-Locomotor Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Paired	Pretest - Posttest	-1.72500	.55270	.07135	-1.86778	-1.58222	-24.175	59	.000

**Table 6.** Manipulative Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Paired	Pretest - Posttest	-4.533	1.478	.191	-4.915	-4.151	-23.754	59	.000

### 3.7. Discussions

Play activity: to increase fundamental movement skill for children with mild mental retardation in this research was declared feasibly and effectively used by children with mental retardation. It is feasibly worthy because it has been tested (small group test and large group test) and evaluated by experts judgment (physical education, motor and mental retardation), hereinafter stated to be effectively used based on effective tests. This research also shows that the results through a play approach will make it easier for children to follow the activity of motion taught because in playing there is a feeling of delight and a sense of contentment that is unconscious and also by it they can develop other aspects of development besides physical development. Looking at the results of the above research stating that activities/play activities are one of the right ways to provide of material fundamental movement skills then it is in line with some opinions of which are according to Astuti in Mumpuniarti that said that the game is as an effort to help children to make the physical, intellectual, emotional and social aspects optimally [6]. Furthermore, according to Cratty in Mulyono that motion games in helping children with learning problems and movement activities can provide a sensory experience that can show the performance of learning in a common way in class [5]. According to Tedjasaputra, the play is "a useful experience for development that is beneficial to: (1) The development of physical aspects; (2) Development of motor aspect; (3) Social aspect development; (4) Development of aspect of emotional/personality; (5) Developmental aspects of cognition; (6) Sharpen sensing sharpness; (7) Develop sports and dancing skills " [8]. Actually playing is a means of natural actualisation that exists in every human being. In addition to the means of an indirect actualization play, it can make one get the freshness and fitness both physically and spiritually. For the child, especially mental retardation in this research of the playing activity should be more optimized. Elements of fun feeling and the form of an easy game are possible to achieve the ultimate goal of a learning that is beneficial to the child mild mental retardation. The research fundamental movement skill-based games conducted by researchers were strengthened by the research from Yuniar Indah Utari and Nanik Indahwati who said that through traditional games can increase the fundamental movement skill of the locomotor child with mild mental retardation. The research indirectly replied that the approach to play can be used as a means to enhance the fundamental movement skill for child with mild mental retardation [9]. What distinguishes is the research conducted by researchers focuses more on the overall fundamental movement skill of locomotor, non-locomotor and manipulative. To be able to implement a learning model well and to be the defining success of learning, then you are the leader of the forefront of implementing it.

In the context of learning for a child, in this research, the child has a mild mental retardation that learning should be prepared with the principles of specificity or individual principles. So a teacher should be able to develop a curriculum that exists according to the needs of the child's own mild mental retardation. In this research, it is related to motor especially fundamental movement skill of the child mild mental retardation. The condition is in line with the opinion of Kemis and Ati that the teacher has a strategic position and determines the success of learning, because the function of the teacher is the designer, organizer and evaluator of the entire learning process so that eventually the real will determine the depth and breadth of the material to be taught to each participant, because the teacher can be able to select and choose the material that is as good as the obstacles, problems and learning needs of each individual to be educated. More clearly according to Kemis and Ati that there are two principles in conveying learning for the child, namely (1) General principles consist of: Principles of motivation, background/context, direction, social relations, study while working, individualization, finding and Problem solving, (2) Special Principles for children with mental retardation namely principles of love, compassion, habilitation (habituations) and rehabilitation (improvement) [4]. From the results of the research and theory that by playing can be used as an approach in providing learning or training in this case related to the fundamental movement skill. Playing in addition to the stimulus of psychomotor to stimulate children, can also stimulate cognitive and attitude/affective for the child with mental retardation. In addition, in order to convey the material well, it should be understood the character of disabled children because the child has a slow understanding and a diverse ego that requires being given more attention and supervision to. Therefore, for further study the model is expected based on difficulty level to facilitate for teachers, trainers, elders and students.

### 4. Conclusions

The conclusion in this research is to produce a product in the form of a play activity: to increase fundamental movement skill for children with mild mental retardation. This Model can be applied during learning and training fundamental movement skill because it is through a play approach. Can be applied to this has been tested for effectiveness, where the test-t results indicate a significant increase.

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# Development of Tennis Serve Learning Models Based on Multiple Training

Surya Rezeki Sitompul<sup>1,\*</sup>, Firmansyah Dlis<sup>1</sup>, Hernawan<sup>1</sup>, Anisa Sholihamia<sup>1</sup>,  
Galang Pakarti Mahardika<sup>2</sup>

<sup>1</sup>Department of Sport Education, State University of Jakarta, Jakarta, 13220, East Jakarta, Indonesia

<sup>2</sup>Department of Sport Education, University Muhammadiyah Jakarta, Banten, 15419, South Tangerang, Indonesia

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**Abstract** This study aims at developing multiple-training-based learning model to improve technical capabilities of tennis serve of the students of the Faculty of Sports, Medan State University. This study used research and development method propounded by Borg and Gall. Based on the test result that was taken and applied to small and big samples, it is revealed that the multiple-training-based learning model can be implemented to improve the skills of tennis serve technique of the students of the Faculty of Sports Science, Medan State University. The subjects of this research and development study were 38 students of Physical Education, Sports, Health, and Recreation Department, Faculty of Sports, Medan State University, North Sumatera, Indonesia. The study found that the effectiveness level of the old teaching model is 66% out of the expected level criteria, while that of the new learning model reaches 96%. It means that the effectiveness level improves for 30%. Accordingly, it can be concluded that: (1) the multiple-training-based learning models can improve the serve technique and the serve result, and (2) the learning model is more effective and efficient in increasing students' participation in the instructional process.

**Keywords** Learning Models, Tennis Court, Serve, Multiple Training

## 1. Introduction

Tennis is one of the sport branches of small ball game which can be played single or double. The game is applied by hitting the ball using a racket to the opponent (s)' court bounded by a net. Like other sports, tennis demands some basic skills every tennis player must have. In the lawn tennis game, technique and physical condition are the determining factors for success. The basic techniques in the tennis game are the forehand, backhand, drive, service, slice, spin, dropshot, smash, lob, passing shot and volley [1]. In modern tennis game, world-class players have standardized-serve and return as they may have significant impact on the outcome of the game.

There are five basic techniques that must be mastered by a tennis player. They are serve, groundstroke, volley, smash and lob. Groundstroke shots include drive, slice, dropshot and half volley. There are three types of strokes; they are groundstroke, volley, and overhead stroke. Groundstroke is where the player hits after the ball bounces once on the court. Techniques that are classified as a type of groundstrokes are forehand drive, drop shot, and half-volley. Volley technique is where the player hits the ball before it bounces on the court. Here, the racket is not swung over the head. Volley shots consist of volley, drives and lob. On the other hand, overhead strokes are serving and smash.

Serve is defined as the opening shot of a point.

According to the rules, player has the right to do a second trial if it fails in the first, To avoid the failure, in the first serve, the ball is usually thrown into the air to reach the maximum strength and spin, and almost always toward the weaker side or toward the opponent's body [2]. One of the most important aspects in the lawn tennis game is the service. Factors affecting service, besides the body's physical condition and position, are angle of movement and force. Good body position, right angle of movement and strong force will result in a good service [1].

There are three types of serves that can be used. They are (1) flat serve: the shot in which the ball is hit almost without spin (minimal spin). (2) slice serve: the shot in which the ball is hit with a sidespin, transmitted by brushing the ball from right to left (for right-handed player) [3]. Topspin serve is hit with combination of double spin, side and forward, transmitted by brushing the ball from the back to the top and right (3) twist serve: originally known as the "American twist", a special kind of slices serve where the ball reacts differently after bouncing on the field because it has more topspin than sidespin rotation [4].

When twist serve is executed properly, the ball bounces in the opposite direction of the slice serve. In all types of serves, especially in specific cases, the most commonly used grips are continental and eastern backhand [5]. As explained by the references above, it can be concluded that there are few types of serves based on its application and used in tennis game.

Based on the authors' observation supported by statements from the lecturer of the tennis course at Physical Education, Sports, Health, and Recreation Department, Faculty of Sports, Medan State University, there are some shortcomings in the process of learning tennis serve that negatively affect the achievement of the desired results. The results showed that: (1) the students tend to get bored and less active in following the learning activities, (2) the students do not understand the purpose of learning, (3) the students lack mastery of correct movements techniques, (4) students do not enjoy the process of learning (5) the students feel bored and cannot make sense of the benefits from the learning activities.

These evidences are in line with the students' average scores in tennis technique skills in which many students obtained score C or even E. Accordingly, motivation and repetition in training and learning must be possessed by the students. Motivation is booster that changes the energy within a person into real activity to achieve certain goals in the target. Motivation is an aspect that is needed to achieve the goal(s) in learning. Motivation has been defined as the process whereby goal-directed activities are initiated and sustained. In expectancy-value theory, motivation is a function of the expectation of success and perceived value. As the quote says, the use of literature on teaching and learning also determine the effectiveness of

students' motivation and interest. On the other hand, certain patterns can improve fitness training elements and also increase muscle development [6]

Therefore, to improve muscle fitness and development, special exercise and repetition are required. It has to be said that an increase in creativity and innovation in the educational processes in sports education and health especially in field tennis items. Success in the application of training models in increased success does much to have a close effect on solving the learning difficulties [7].

Development research is a pragmatic form of research that provides a way to test theories and legalize habits that have been perpetuated through academic traditions. In addition, development research is also a way to generate procedures, techniques, and tools based on analysis, methodists of a problem [8].

All in all, the research and development is a study which focuses on the creation of an effective product in which the process includes the needs analysis, product development, and product testing. The research that is developed in this study is tennis serve learning models for students of Physical Education, Sports, Health, and Recreation Department, Faculty of Sports, Medan State University.

### 1.1. Learning Model

Learning model is one of important components in supporting learning process [9]. Therefore, it is needed to conduct a development in its empowering and organizing, to achieve desired goals. Models are description of a reality reflection which will be done as stated "models by definition and a reflection of reality-temporary stand-ins for something more specific and real; model are helpful in explaining that may be difficult to describe; a model may illustrate a process; a model may be a representation of something". Learning models can also be linked to the whole course of good learning starting from the beginning of learning to the end of learning that involves aspects of the facilities used directly and indirectly. Curriculum materials, materials design and petfor learning that teachers use become learning tools [10].

Model can also be interpreted as a plan or pattern that is used to compile the curriculum, organize teaching materials and give instructions to the teachers in the implementation of teaching and learning activities in the classroom. The classroom activities are implemented in two types of schools; private and public institutions which are parts of the public education system as Slater and Ravid reveal that schools and universities, both private and public are parts of the public education system.

The development of learning model is one form of applying a system approach in learning activities which in fact is a systematic process that generates a learning system that is ready to be used appropriately. Learning

model is a series of components of an integrated learning strategy. The strategy consists of several components such as: (1) the phasing and sequence of contents of the material; (2) the use of examples; (3) the use of practice; and (4) the use of different strategies.

Stating a model-based approach for physical education uses the application of various pedagogical models, each with unique and distinctive learning model results and aligning learning outcomes with teaching strategies and learning materials where the use of each is non-negotiable in terms of what is done by teachers and students for carrying out the model with full confidence. Advances in educational program evaluation contribute significantly to curriculum thought, as qualitative approaches were added to the standard of quantitative styles. As the quotation says, then advances in the evaluation of learning have important contribution to the development of the students themselves saying that the logic behind the model-based approach is that the use of different work modules, each with different features and special learning outcomes, can meet various objectives [11].

It also reveals that the model operates on two levels; curricular level and instructional level. At the curricular level, the model approach provides the program with mission, main content, identity and infrastructure all for the purpose of allowing more students to achieve learning outcomes of long-term priorities [12]. While at the instructional level, the model approach is used to promote the study in a short duration that aims to align the learning outcomes. Finally, from the explanation in a wide range of experts above, it can be concluded that the learning model is a pattern or step that includes analysis, development, and evaluation of learning outcomes in which the purpose is to make it easier for the students be able to achieve optimal learning outcomes and master tennis serve techniques.

### 1.2. Flat Serve Technique

Serve is the first shot made to start a game to obtain points. Serve is executed by hitting the ball to the opposite court over the net by crossing and falling on the opponent's service box [13]. The flat serve is the basic service motion. The setup for this serve is the foundation for the more advanced serves. When placed accurately, the flat serve often results in a service winner, a weak return, or an ace! The tradeoff is that it offers less control.

A flat service is the most effective of the four services, and the effect or characteristic of these services' blows does not create a rotary effect, in order to prevent the opponent from recapping the ball in order to create a distraction, if the technical treatment is done properly and the time, speed and locating of the ball, then the service is highly effective [14].

Flat serve is the hardest and most powerful serve shot compared to other serves. Accordingly, it is commonly

called cannon ball serve. The ball produced from this serve shot has almost no spin. The ball course on flat serve is in a straight line and the produced ball bounce is normal. For tall tennis players, flat serve becomes the first choice in serving. Suggesting that there are four steps in the executing flat serve, they ate racket grip, toss Ball, impact on the ball, and advanced Movement. Above all, the grip is a key success factor. In addition, it is generally mentioned that the cause for the absence of the optimal impact on the ball on the racket strings is the wrong grip [3].

Based on the elaboration of the explanations of these theories, it can be concluded that the flat serve tends to produce strong and powerful shot without making the ball spinning that the ball course movement is straight without any changes. [3]

## 2. Materials and Methods

This study used Research and Development (R & D), in development research, there are two fundamental differences, but these terms guided at the same value, and the purpose of the development research process makes both in increase of theoretical contributions and increase of practical contributions [15]. In the contribution of educational development research for example, to quote 2008 puslitjaknov research there were 3 components of (1) development research in the education consisting of (1) development model, (2) development procedures and (3) development model or product testing.

Suggesting that the study is conducted through these following steps: (1) conducting research and gathering information; (2) planning that includes defining skills, formulating objectives, determining the order of teaching, and testing on small scale; (3) developing initial product forms such as preparing teaching materials, preparing handbooks and evaluating equipment or media; (4) carrying out initial field test. This test was given to 6-12 subjects; (5) revising the main products in accordance with the advice from the results of the initial field test; (6) carrying out the main field test involving 30-100 subjects; (7) revising the product based on the suggestions and the results from the main field test; (8) conducting field trials to 30-200 subjects; (9) revising the final product; (10) writing a report about the product in the journal in collaboration with publisher (s) who can distribute commercially.

In this study the method of research analysis refers to qualitative approaches as used to supplement the goal of the first, while the quantitative approach is used to unblock the second goal, with a design for experimental research pre-test and posttest design). Researchers observe a pre-test (o1), which is treated by maintenance techniques (x), followed by observation or post-test (o2). find an average score of pre-test and post-test results, and

then compare them through statistical methods (uji-t) to see if there was a significant impact on the use of the learning model. Other data in the form of field records and documentaries should be present in the main test so that feedback (feedback) can be used for the improvements and improvements of the learning model in the next development up to the optimization that is the ultimate form for use.

### 3. Conclusions

Based on the data obtained, the results of small group trials, field tests and discussion of research results can be concluded that:

- a). Development of these tennis serve learning models helps the lecturer in implementing or carrying out effective and efficient learning process.
- b). Through the learning models provided, learning outcomes of tennis serve on student of Physical Education, Sports, Health, and Recreation Department, Faculty of Sports, Medan State University improves and it helps the lecturer in implementing or carrying out the learning process.

The implementation of the learning models that have been developed is considered to make a significant contribution both to the learning process and to the learning outcomes effectively and efficiently and to motivate children to play an active role in the learning process with the steps that are students to understand. The final result of this study would be in the form of a product (video) completed with learning specifications as well as facilities and infrastructure.

The results of tennis serve learning models development for students of Physical Education, Sports, Health, and Recreation Department, Faculty of Sports, Medan State University were written in the form of a script (storyboard script) that provides various forms of tennis serve learning models, packaged in modified form of learning models with customized approach from the steps in tennis serve techniques that will make it easy to apply in the field. Table 1 shows the learning success achieved through the learning models development.

Table 1 shows that the amount of data obtained are 520. Thus the effectiveness of the old learning model as a whole is  $520 : 760 = 0.68$  or 68% of the expected criteria. Test results of the old learning models are 68% or only 24 students passed the learning target, while 32% of it, or 14 students, did not pass the target. Furthermore, it also reveals that the amount of data obtained is 760 which means the effectiveness of the overall new learning model development is  $600 : 760 = 0.78$  or 78% of the expected criteria. The test results of learning using new learning models development of tennis serve are 92% or 35 students passed the learning target. While 8% of them, or

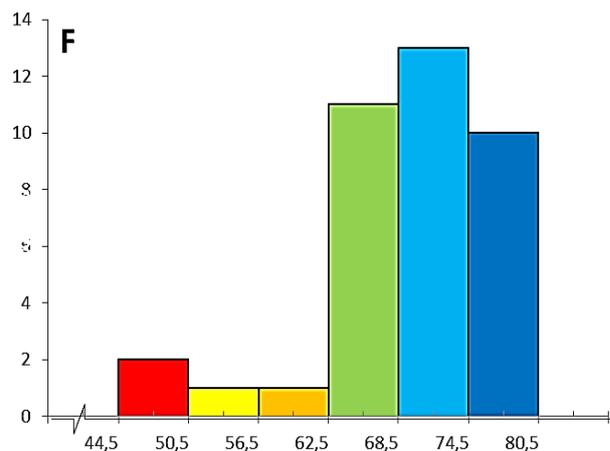
3 students, did not pass the target. The next step is to calculate the psychomotor t-test, to decide whether the difference is significant or not. Then the value of the t-count needs to be compared to the value of t-table at  $dk\ n - 2 = 36$ .

**Table 1.** Comparison Table of Assessment Results of Old Learning Model (s) and New Learning Models

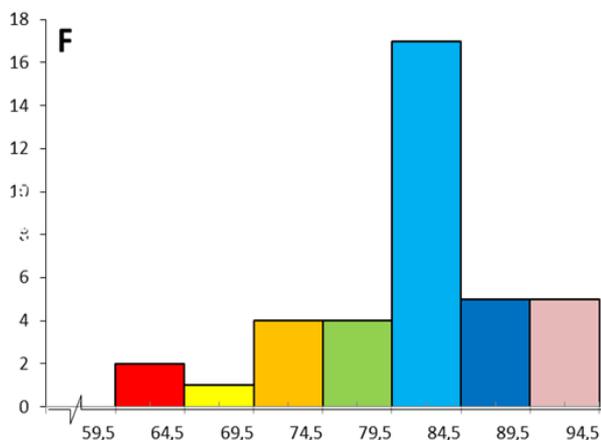
Conventional Method	Rated Aspect	New Learning Method
122	Ready position	148
104	Ball toss	116
95	Racket pull	102
109	Impact ball	135
90	Continued movement	99
520	Amount	600
0.68	Average	0.78

Based on the attachment, the value in the t distribution is that, if  $dk\ 36$ , for one-tail test with a standard error of 5%, then the value of t table = 1.685. If the value of t count falls to the reception area of  $H_a$ , then  $H_a$  stating that the new learning methods are better than the old learning methods is accepted. Based on the calculation, it turned out that t count is -17.29 and falls on the acceptance of  $H_a$  or rejection of  $H_o$ . Accordingly, it can be concluded that there is significant differences on the effectiveness between the old and new teaching approaches.

Comparison between the results of tests on serve ability using the conventional methods and learning model development methods obtained results of Precision/Accuracy 458: 586 and Power 324: 443, with a total score of 769: 1029. The techniques used to determine and make a decision, whether the difference is significant or not, comparing the value of t count with the value of t table at  $dk\ n - 2 = 36$ .



**Figure 1.** Histogram image of learning outcomes of conventional learning methods



**Figure 2.** Histogram image of learning outcomes of new learning methods

Based on the attachment, the values in the t distribution is that, if dk 36, for one-tail test with a standard error of 5%, then the value of t table = 1.685. If the value of t count falls to the reception area  $H_a$ ,  $H_a$  stating that the new teaching approach is better than the old teaching approach is accepted.

Based on the calculation, it turned out that t count is 19.72 and falls on the acceptance of  $H_0$  or rejection of  $H_a$ . Thus it can be concluded that there is no significant difference between the new learning methods and the old learning methods.

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# Locomotor Basic Movement Levels in Improving the Health of Elementary School Students

Eka Fitri Novita Sari<sup>1,\*</sup>, Rekha Ratri Julianti<sup>2</sup>, Nofi Marlina Siregar<sup>1</sup>, Sukiri<sup>1</sup>

<sup>1</sup>Department of Physical Education, Universitas Negeri Jakarta, Jln Pemuda 10 Rawamangun Jakarta Timur, Indonesia

<sup>2</sup>Department of Physical Education, Universitas Singaperbangsa Karawang, Jl. H.S. Ronggowaluyo Telukjambe Timur Karawang Barat Jawa Barat, Indonesia

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**Abstract** Children's health could be monitored through basic motion skills, for example, running, walking, jumping, sliding, galloping, skipping, hopping, and leaping. Children could be determined as healthy if they can perform those movements properly aligning with their development phase. This study is a part of research development in order to develop test instruments of basic locomotor skills through puzzle-based activity. This study aims to describe elementary school students' health levels through 8 basic locomotor skills measured by the test instruments. The data were collected through a descriptive approach. The participants consisted of 60 students in a class, Ciracas, East Jakarta. The study shows that 35 students (58,33%) received a good score in walking, 29 students (48,33%) received a good score in running, while 38 students received a good score in jumping, hopping, leaping, galloping, skipping, and sliding. According to the results, students' health levels in this study varied as 25 students (42%) received overall good scores, 20 students (33%) received overall average scores, while 15 students (25%) received an overall bad score.

**Keywords** Locomotor Movement, Elementary Students, Physical Activity

perspective of 7 to 8 years old first-grade elementary school students. Carson et al., Johnstone, Hughes, Martin, & Reilly (2018) described that children who are involved in frequent physical activities could be benefited from their health. To be precise, frequent physical activities may reduce the risk of cancer, depression, diabetes, and prevent obesity. It also enhances students' cognitive development, develops healthy bones, psychosocial, and cardiometabolic [1, 2]. Healthy and active lifestyles during the early stages of childhood will help improve their motor development throughout the growing process [3]. Physical activities that could be conducted by children are various, for example, active play.

Johnstone, Hughes, Bonnar, Booth, & Reilly described that the approach of active play could address the low rate of physical activity and enhance students' basic motion skills [4]. Westlund Stewart, Divine, O, & Law also described that Task Force on Community Preventive Services is recommended to schools that incorporate it has managed to enhance students' physical activity through modification of social circle and behaviour [5]. Increasing the number of physical activity areas in playgrounds in school and after school play an important role in children's physical activity habits [6] Thus, the approach of active playing should be considered and incorporated by physical education teachers in schools.

The basic locomotor motion is the movement of the body from one place to another where it becomes the teaching material for physical education teachers in grade

## 1. Introduction

Physical activities are more favourable from the

one elementary school. Through basic locomotor movements, students will explore their ability to move. This activity is one of the structured physical activities that students can do at school.

M Dipa, Sari & M. Mashur (2018), Pratiwi et al (2019), Sari Sujarwo & Sukiri (2020) described their study results that active play could be incorporated through games which enhance students' basic motion skills. Also, the teachers could modify the medium of learning in schools during active play [7]–[9]. Active play motivates the students to actively participate during physical education class through designing a fun learning activity with appropriate assessment instruments to measure students' development in the elementary school level that could provide meaningful learning activity for the students.

Basic locomotor skills in the education context are supplementary activity incorporated by PE teachers in order to reach goals based on the elementary school curriculum. It consists of students' movement which moves from one spot to another spot, for example, walking, jumping, sliding, hopping, galloping, skipping, and leaping. These movements are also determined as part of active physical play that enhances students' body function in order to achieve proficiency in conducting various basic motion skills which contribute to enhanced body health.

The problem that exists is how to achieve the basic locomotor motion of first-grade elementary school students. Whether the teacher has maximized the process of teaching activities to reach the achievement of learning outcomes for locomotor basic motion is well illustrated. This portrait is needed in which through the data obtained, the quality of the physical activity can be described.

Wibowo, Nugroho, & Sultoni (2018) described their study results in examining the correlation between fundamental movement skills (FMS) and games performance of elementary students in modified invasion game activities, the results show that there are significant correlations between the two variables [10]. Capio, Sit, Eguai, Abernethy, & Masters (2015) described that FMS is able to influence children's physical activity (PA) and children who are influenced showed a tendency to be more active in learning [11]. Ng & Button (2018) conducted a meta-analysis study which described positive correlations between PA, FMS, MVPA, and TPA during childhood [12]. D. Jones, A. Innerd, E. Giles et al (2020) also shared similar results with the previous studies which described the positive correlation between PA and FMS during childhood [13].

The previous studies have shown that generally, proficiency in basic motion skills have a positive influence on physical activities through active play activities which could be structured or flexible play, and teachers could also modify tools and medium of learning to enhance students' happiness during learning through social circle intervention. The efforts will make students

more active in learning in the long-term, thus developing students' fundamental movement skills.

This research was conducted to capture the achievement of basic locomotor movements of first grade elementary school students where through these activities it is expected that the achievement of physical activity of first grade primary school students can also be illustrated.

## 2. Materials and Methods

Research development has been studying basic locomotor motions level in improving the health of elementary school students through developing instruments to measure students' basic locomotor skills which incorporate puzzle-based activity. The aim of this study is to describe elementary school students' health achievement through measurement instruments.

This study incorporated descriptive quantitative as its methodology design through tests in which a series of data were collected. The participants of this study consist of 60 elementary school students in one class. The samples were about 8-9 years old with an average weight of 26-29 kg and an average height of 128-134 cm. The school is located in Ciracas, East Jakarta. The test instrument of basic locomotor skills is based on a puzzle game that was incorporated to observe 8 basic locomotor skills which consist of walking, running, jumping, sliding, leaping, galloping, skipping, and hopping [5, 12, 13].

### Operational Definition

Students' health level was determined through physical activity achievement by conducting the basic pattern of locomotor skills which consist of running, walking, jumping, galloping, sliding, hopping, leaping, and skipping with puzzle-based activity approach.

### Conceptual Definition

Students' health level is overall physical activity in the form of 8 basic locomotor skills which are conducted through puzzle-based activity. The students were measured based on their maximum and minimum score. The dimension of basic locomotor skills consists of 4 indicators which are head, body, arms, and limbs. If all 4 indicators are conducted successfully, the students will receive an overall score of 4. To be precise, the formula of measuring students' score is described as below:

$$\text{Overall Score} = \frac{\text{Score Received} \times 100\%}{\text{Total Score}}$$

The following table 1 is a locomotor basic movement research instrument for first grade students which were developed with eight locomotor basics.

**Table 1.** Locomotor Basic Movement Skills Instruments for First Grade Students

Skills	Indicators	Description
Walk	Head Body Arms Legs	The eyes view are straight forward, the hands are swinging back and forth, the body position is upright, and the foots move forward alternately
Run		Straight forward view, relaxed body position and leaning forward, hands swing back and forth alternately, knee position raised with both feet moved quickly and flying towards to the front
Slide		The body moves sideways, the eyes look horizontally, the arms move following the movement of the body, and the legs are not crossed.
Leap		Both legs are raised, moving forward alternately for several steps and then jumping and preceded landing on one leg, swinging hands following body movements, straight eyesight.
Gallop		A straight forward view, the position of the foot is lifted alternately and moves forward, relaxing body, the position of the hand follows body movements.
Skip		The feet jump alternately (up and down), the position of the body upright moves to float, a straight forward view, the hand swings following the body movements.
Hop		One of the legs is lifted up alternately and moves forward, one hand straight up opposite the leg raised up, body position is upright, and when landing begins with one leg as a pedestal
Jump		The position of the body is lifted and moves from one place to another place, hands are swinging forward following body movements, feet are raised forward (down and up) quickly, knees are bent when landing.

**Table 2.** Number of Students Based on Locomotor Basic Motion Tests per Item

No	Items	Student Total		
		Good	Medium	Less
1.	Walking	35	24	1
2.	Running	29	27	4
3.	Jumping	14	38	8
4.	Sliding			
5.	Hopping			
6.	Galloping			
7.	Skipping			
8.	Leaping			

**Table 3.** Percentage Obtained from the Locomotor Basic Motion Test per Item

No	Items	Percentage (%)		
		Good	Medium	Less
1.	Walking	58,33	40	1,67
2.	Running	48,33	45	6,67
3.	Jumping	23,33	63,33	13,33
4.	Sliding			
5.	Hopping			
6.	Galloping			
7.	Skipping			
8.	Leaping			

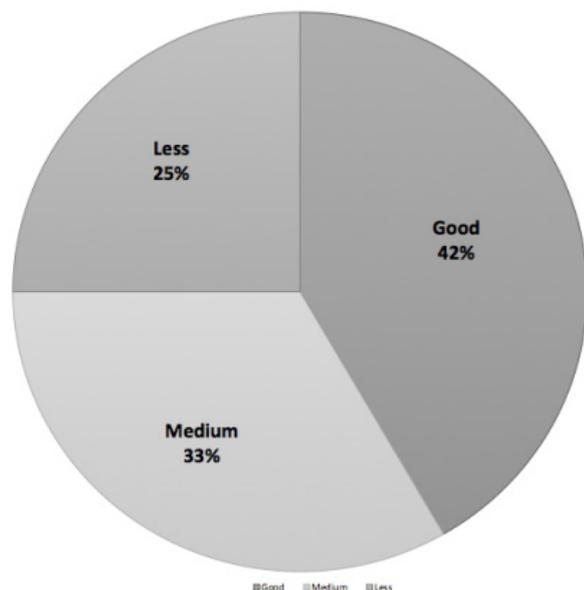
### 3. Results and Discussion

The Data on test results in this study are presented in two parts. These are the average scores for each locomotor base motion item and the average score for the whole basic motion item. The distribution result data is presented to determine the level of student ability in each test item and also the overall motion variable in first-grade students in elementary school.

The data is obtained from the basic motion test on 60 students of the first-grade elementary school in the Ciracas area of East Jakarta which the site was possible for the researchers in conducting this data collection. Following are the data obtained on each basic motion item.

From the data table 2 and table 3, it was found that the eight basic locomotor motions of the students on each test item showed varying gains. From the eight basic movements, six items namely jumping, sliding, hopping, galloping, skipping, and leaping, illustrate the acquisition of the medium category, an average of 60 students there are 38 in the moderate category or around 63.33% and the acquisition of good categories only 14 students or around 23.33% and fewer categories as many as 8 students with a percentage of around 13.33% (see table 2 & 3). While the two locomotor basic motion items, namely walking and jumping, illustrate better gains because the number of students in the good category reached more than the six other items. Walking based on good categories illustrated as many as 35 students (58.33%) and running 29 students (48.33%) while based on the medium categories being drawn walking 24 students (40%) and running 27 students (45%), and based on the less categories with a very small number were walking 1 student (1.67%) and running 4 students (6.67%) (see table 2 and 3).

Distribution of further research data is presented in the form of an average of all locomotor basic motion variables, through which this data will illustrate eight overall levels of student ability. The following picture 1 is the presented data.



**Picture 1.** Number of Students and Percentage Level of Locomotor Basic Motion Abilities Based on Overall Locomotor Basic Motion Items

Yusamawati et. al., 2019 states that learning outcomes obtained by students in locomotor basic motion material are influenced by many factors including student input, teacher quality, school support [16]. Ivan Serbetar states that for optimal perceptual-motor development, stimulating home environment should be accompanied by enjoyable play and exercise facilities and surroundings, which should be accessible, well structured, and should increase children's opportunity to be physical active and to develop motor skills [17]. Eka Sari, 2014 explained the results of her research that parenting for children in active play activities at primary school age affects the basic ability of children at that age [18]. According to Logan and Hardy in Wesley O'brien, it is important to note that these basic movement patterns are not naturally acquired during the process of maturation, movement practitioners need to structure and implement developmentally appropriate activities, specific teaching and learning (with feedback) during physical education with continuous provision for opportunities of practice available [19].

Based on the statement above and the data obtained in the study, many factors and elements underlie a child's basic mobility. When the ability is good or even lacking, we can evaluate some of the factors behind it. The role of the teacher in the school is a role that is no less important than the role of family and parents in terms of laying the foundation and developing basic mobility. Physical education teachers in primary schools are an important element in the implementation of formal activities.

Caint C. T. Clark et. al., 2016 states that fundamental movement skills are considered as the basic building blocks for movement and provide the basis for special movement and sports skills needed to participate in various physical activities [20]. J Lee, T. Zhang, T. Chu et al., conducted a study to examine the effects of an 8-week

FMS-based afterschool program on physical and cognitive health outcomes among children. This finding suggests that structured FMS-Focused strategies (e.g., fun games and goal settings) can be a critical component when implementing a physical activity program to enhance children's motor skills and physical activity behaviour [21].

Through a variety of fun activities both in formal and informal activities, the child will do basic movement activities without feeling bored and unmotivated. Moving for a long time though is not a fundamental problem for them. Sebire Simon, R. Jago, K. Fox et al., 2013, in their research results stated that children's motivation to consciously move in physical activity is based on their satisfaction and pleasure while doing the activity [22]. Based on these psychological factors, students take pleasure in physical activity which provides the positive motivation that can be a potential target of physical education teachers in the framework of designing, implementing and even evaluating student learning activities in elementary school. Active student involvement in physical activity through locomotor basic motion was done with a condition of awareness that these activities can motivate them to carry out with sufficient time setting and a set of appropriate strategies; the problems related to health are things that might not happen.

Based on data from research on several existing samples, it is illustrated that the results of the locomotor basic motion of first grade elementary school students in the Ciracas area are in the good category (picture 1) where the number of samples shows a higher number with 42% students. Through these results it can also be described in general that students have good physical activity. Gralla, McDonald, et. al., 2019 wrote that physical activity in youth can produce greater health benefits than average or low activity as evidenced by the results of research he has done [23]. L. Bolger, Linda A., et. al., 2019 in his research to investigate the correlation between fundamental movement skills and signs of health of elementary school children in Ireland resulted in the conclusion that various types of FMS are important for the cardiorespiratory fitness of physical activity (PA) children [24].

The results obtained from this study related to the locomotor basic motion of 60 first-grade elementary school students in the Ciracas area of East Jakarta illustrates how the achievement of locomotor basic motion skills and expectations also on their health level. Students who move actively with good locomotor basic motion results give a temporary picture that they are healthy because they can move actively by displaying their abilities through these activities. To measure more deeply the level of health caused by locomotor basic motion activities, in terms of the capacity of bodily functions, whether it is proven that good results are also needed, a deeper study and collaboration with researchers who have

the capacity in diagnosing and measure their health levels in depth.

## 4. Conclusions

Based on the results of the study it was concluded that the level of locomotor basic mobility ability of 60 first-grade elementary school students in the Ciracas area of East Jakarta was in a good category as seen from the number of students who were in the three categories compiled showing a greater number with 25 students (42%), and students who are in the medium category with a total of 20 (33%) and only 15 students (25%) are in the poor category. Based on these results a special study needs to be undertaken in collaboration with pediatric sports researchers whether with the level of physical activity through locomotor basic motion the student's health function and capacity are validly proven in the study.

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# The Effectiveness of Core Stability Exercises on Increasing Core Muscle Strength for Junior Swimming Athletes

Ika Novitaria Marani, Ari subarkah, Vian Octrialin

Faculty of Sport Science, Universitas Negeri Jakarta, Jakarta, 13220, Jakarta Timur, Indonesia

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**Abstract** Swimming is a way to maintain a streamlined body position, which requires core muscle strength; the core muscles must be strong to carry out their function in maintaining body position during swimming. Core muscle strength correlates with swimmers' buoyancy and performance. Thus, training such as core stability exercises is needed to increase the strength of the core muscles. Therefore, this study aims to determine the effectiveness of core stability exercises using a Swiss ball to increase core muscle strength in junior swimmers. An experimental method was employed with one group only pretest and posttest design. The research instrument utilized to measure the core muscle strength of junior swimmers was the sit-up test. 50 members of the Taksaka Swimming Club were determined as the population of the study while only 30 of them were involved as the sample of this study. Out of the 30 people, 15 of them were given treatment and the rest 15 people were grouped in the control group. They were divided using a purposive sampling technique. The results showed that core stability exercise using a Swiss ball was effective in increasing core muscle strength in junior swimmers as indicated by a t-score of 7.5 at the significance level of  $\alpha = 0.05$ . Therefore, it can be concluded that core stability exercises using a Swiss ball can be used to increase the strength of the core muscles to enable the stability around the lumbar spine and abdominal muscles might bring about biomechanical changes that allow swimmers to swim faster

in a more efficient way.

**Keywords** Core Stability Exercises, Swiss Ball, Core Muscle Strength, Junior Swimmers

## 1. Introduction

Swimming performance benchmarks are seen from one's ability to cover a certain distance in the water in the shortest possible time. Improving swimming performance depends on the propulsion generated and minimizing resistance to movement in the water. The speed variation in each stroke cycle in swimming is caused by variations in the arm, leg, and body movements that might move the swimmer forward [1], [2]. Hence, to improve swimming performance, it is necessary to increase technique (stroke, coordination, starts, and turns techniques), biomechanical standards, the good physical condition of swimmers (flexibility, strength, aerobic, and anaerobic conditioning), and body composition of swimmers [3].

To improve the efficiency of swimmer performance and maintain the body position, streamlined and hydrodynamic need to be considered. Moreover, maintaining this posture depends on the strength of the core muscles [4]. The reason is that swimming does not have a foundation that can be used for the body to move

forward and adjust the center of gravity to maintain the body. Thus, a swimmer is required to have a strong core muscle strength to be able to carry out the function of maintaining balance and efficient movement in water [5]. Studies have also proven that there is a strong positive correlation between core muscle strength, buoyancy, and swimming performance since the strength of the core muscles of a swimming athlete acts as a foundation to produce movement and power which leads to increased performance [6] [7].

Having strong core muscle strength enables a swimmer to perform body movements more efficiently and quickly, as it can better distribute the strength of the developing core muscles throughout the upper and lower body [8]. Panjabi [9] defined core stability as “the capacity of the stabilizing system to maintain the intervertebral neutral zones within physiological limits”. The extremities connected to the spine are responsible for propelling the body into the water in swimming. Thus, having strong core muscle strength will allow more energy to be transferred to attract and maintain the one-round component of the stroke [10] [11]. Therefore, efficiency in swimming requires the involvement of the contractile qualities of the core muscles and the upper body, whereas the lower body participates little as the driving force in swimming [12].

To maximize the efficient function of motion, an important component, core stability, is needed. Core stability is the ability of the muscles around the lumbopelvic region, the center of the body during static and dynamic positions that has a function to control postural stability [13]. Therefore, to produce the desired optimal performance in sports both at speed and time, the function that must often be generated is the kinetic chain, the activation of body segments in the distal segment coordinated and sequential. The core muscles which include the spine, hips and pelvis, lower limb, and proximal are very important to give local strength and balance to reduce back injuries [8]. The core muscle is the center of almost all kinetic chains in sports activities. Hence, if it can control the strength of the core muscles, balance will be able to maximize all the kinetics chain of upper and lower body functions [14].

It is recommended for a competitive person as well as junior swimmers to do ground training to improve performance [15]. It is necessary to do exercises to train the core muscles as an integral part of a physical conditioning program to achieve greater force production in the upper and lower extremities. The core exercises program includes processes that target muscle strengthening and motor control of the core muscles to sustain movements in the same direction [16] [17]. An exercise that might be used to increase core muscle strength is core stabilization exercises, exercises that involve various muscle systems that give lumbopelvic stability to stabilize the kinetic chain. Core stability

exercises are shaped by body posture, the intensity of loading, and the direction of movement [18]. Core stability allows the individual to remain balanced. It also allows a simultaneous increase in arm and leg strength. [19]. Moreover, the greater the stability of the core, the more power is expended on the arms and legs in sports performance. This is a dynamic concept that is constantly changing to suit posture or meets external loads. The presence of a strong and stable lumbopelvic region plays a role in the transfer of energy needed to create in both the upper and lower extremities [20].

Herrington L, Davies R said that core stability exercises are exercises that involve activation of the multifidus, transversus abdominis, and pelvic floor muscles that stabilize the lumbar region [21]. Core stability exercises in a static and dynamic environment as well as lumbopelvic stability can increase the strength of the large and small muscle groups, increase the control and balance of the body, and reduce the risk of injury [22]. Many training tools can be used to improve movement performance in a variety of conditions such as sudden changes in body direction that might lead to instability. The use of an unstable tool for core muscles is to be more active to maintain movement technique [23].

The use of an unstable tool causes the muscle groups to participate in the movement at different rates. An unstable tool that might be used in core stability exercises is the Swiss ball. A motor control system is needed in core stability exercises using a Swiss ball to stabilize the muscles around the spine [24]. Core stability exercises using the Swiss ball require a good balance to maintain the same posture on the softball, making it possible to relax or tighten the lumbar muscles from low back pain and to increase the range of motion of the spinal joints [25]. Although several studies have been conducted to look at the effects of core stability exercises on various athletic measures, not all studies have proven it to be effective. Moreover, very few studies have been conducted on swimmers relate to core stability and most of the studies include isolated strength training. Thus, this study focuses on investigating the effectiveness of core stability exercises using a Swiss ball to increase core muscle strength of junior swimmers.

## 2. Materials and Methods

### Research Design and Subjects

This study employed a quasi-experimental design in the form of a nonequivalent control group design for the researchers cannot fully control external variables in the experiment. In this design, the subjects were randomly divided into two groups with different treatments. The design chart is illustrated as follows.

**Table 1.** Quasi-Experimental Research Design

Research Design	R	X	O
Control group	R	C	O

The population of this study was 50 athletes of the TAKSAKA Bekasi Swimming Club. Then, 30 people were chosen as the sample of this study using a purposive sampling technique with the criteria of athletes with an age range of 10-13 years old who have mastered 4 swimming styles. Out of the 30 people, 16 were boys and 14 were girls.

### Research Procedure

This study was conducted from January to March 2020. The study was carried out in 3 steps. First, a pretest was conducted to measure core muscle strength in all samples. Second, after having the pretest of core muscle strength and getting the result of swimming performance, the sample group was divided into 2 groups (experimental group and control group) randomly. After that, the initial test (pretest) and the final test (posttest) were carried out in both groups. The treatment that was only given to the experimental group consisted of 10 forms of core stability exercise using a Swiss ball. The treatment was adjusted to the characteristics of the swimming sport and the form of core stability exercise using a Swiss ball given differs each time.

The treatment was given for 16 meetings or 6 weeks with 16 meetings for the treatment frequency of three times per week. The increased intensity was given after every 3 times exercise. The intensity and duration of the core exercise given during 6 weeks treatment was continued to be increased. In the first week, the participants were performed 3 sets of 15 repetitions of each exercise. The second week, the training continued consisting of 3 sets of 20 repetitions. The third and fourth week, the training continued consisted of 4 sets of 20 repetitions of each exercise. And for the fifth and sixth week, the training continued consisted of 4 sets of 25 repetitions of each exercise.

Third, a posttest was conducted to measure core muscle strength in both experimental and control groups. The instrument used to measure core muscle strength at the pretest and posttest was the sit-up test for 1 minutes and for swimming performances, used proceeds time record of 50 m butterfly,

### Data Analysis

The obtained data were analyzed using SPSS Statistics 25.0 for Windows. Thus,  $\pm$  SD was calculated for each group, both the experimental group and the control group, from the results of the pretest and posttest. The results were obtained from the pretest results (before the treatment for 16 meetings ( $\pm$  6 weeks)) and were then compared with the posttest results. Analysis of the

difference in the basic group between the experimental group and the control group was carried out using the unpaired t-test and using the paired t-test whether core muscle strength in swimming athletes. Statistical significance at  $p \leq 0.05$  has been set for post-hoc research Bonferroni's correction was used for multiple comparisons. All data provided in this analysis are presented as Mean  $\pm$  SD.

## 3. Result and Discussion

### Result

After the research data were obtained, the data then were presented in the form of data description which included the highest score, lowest score, mean, standard deviation, median, mode, frequency distribution, and histogram of the pretest and posttest results of each group (experimental group and control group). The data description from each group is presented in Table 1.

**Table 2.** Data Description of Pretest and Posttest from the Experimental Group and Control Group

Description	Pretest Experimental Group	Posttest Experimental Group	Pretest Control Group	Posttest Control Group
Mean	27.93	43.46	27.64	34.71
Standard Error	1.00	1.40	0.76	0.79
Median	28.5	42	28	35
Mode	25	40	25	33
Standard Deviation	3.75	5.04	2.84	2.95
Range	13	17	9	9
Minimum	21	38	23	30
Maximum	34	55	32	39
Sum	391	565	387	486

Table 2 shows the comparison between the before and after the 6 weeks treatment in the form of core stability exercises in the experimental group. There were significant differences in the experimental group with the following results:  $t = 36.24$ ;  $p = 0.00$ ). It shows an increase in core muscle strength after core stability exercises using a swiss ball was conducted for 6 weeks in the experimental group.

**Table 3.** Comparison between the Results of Pretest and Posttest in the Experimental Group

Test	Mean	SD	t-value	p
Pre	27.93	17.26	36.24	0.00 (HS)
Post	43.46	41.8		

Table 3 presents the comparison between the control group before and after given ground exercises for six weeks. There were significant differences in the core group with the following results:  $t = 18.41$ ;  $p = 0.00$ ). This

indicates an increase in core muscle strength after doing ground exercises for six weeks in the control group.

**Table 4.** Comparison between the Results of Pretest and Posttest in the Control Group (N = 15).

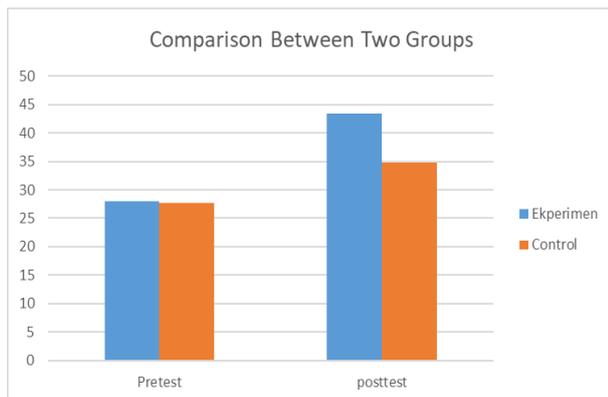
Test	Mean	SD	t-value	p
Pre	27.64	10.46	9.62	0.00 (HS)
Post	34.71	12		

Table 4 shows the comparison between the experimental group ( $43.9 \pm 41.8$ ) and the control group ( $34.71 \pm 12$ ) after six weeks of core stability exercise programs using the Swiss ball and floor respectively. The results indicate that  $t\text{-value} = 9.62$  with  $p < 0$ . Thus, the core stability exercises using a Swiss ball is deemed to be effective in increasing core muscle strength.

**Table 5.** Comparison between the Results of the Experimental Group and Control Group (N = 15)

Group	Mean	SD	t-value	p
Experimental	43.9	41.8	9.62	0.00 (HS)
Control	34.2	12		

The following graph 1 showing the comparison between the pretest and posttest mean scores of the experimental group and the control group that clearly shows an increase in core muscle strength in both groups.



**Graph 1.** Comparison between mean values of pre and post-test scores of the experimental and control group

**Table 6.** Data Description of Pretest and Posttest from the Experimental Group and Control Group

Description	Experiment		Control	
	Pretest	Post test	Pretest	Post test
Minimum	38.56	36.92	39.56	36.98
Maximum	54.53	52.41	58.54	58.03
Median	45.54	42.39	46.42	47.06
Modus	45.31	0	49.36	0
Average	45.76	42.88	47.11	46.73
Standard deviation	4.72	4.50	5.61	5.95

Here is a description of data from a record time of 50 meters butterfly style of pretest and posttest experimental group and the control group.

## Discussion

This study investigated whether core stability exercises using a Swiss ball is effective in increasing core muscle strength in junior swimmers. The results show that the hypothesis proposed that core stability exercises using a Swiss ball is effective in increasing core muscle strength for junior swimmers is accepted. This can be seen based on the t-count value obtained by comparing the posttest of the experimental group with the control group of 7.5, greater than t-table of 2.24 with a significance level of  $\rho < 0.05$ . It means that core stability exercises can be carried out using a Swiss ball to increase the core muscle strength of junior swimmers. High level of core muscle stability during sports activities, is required by athletes especially swimming athletes [26].

Core muscle strength exercises using the Swiss ball aims to provide core muscle activation globally and locally. The global and local muscle groups are activating muscle subsystems that play a major role in stabilizing the core muscles. The global group consists of large and superficial muscles that transfer force between the thoracic cage and pelvis as well as act to increase intra-abdominal pressure (e.g. rectus abdominis, internal and external oblique abdominis, erector spinae, lateral quadratus lumborum). In contrast, the local group consists of small muscles that control intersegmental movements between adjacent vertebrates such as multifidus, rotatores, interspinal, and intertransverse [27]. The tension in the core muscles is controlled by the nervous subsystem. As tension increases within these muscles, the comprehensive force also increases between the lumbar vertebrae that might strengthen the lumbar spine for increased stability [28].

Stability can change instantaneously on the condition that there is a postural adjustment or an external load on the body. The nervous subsystems are required to work simultaneously to ensure sufficient stability and also allow the desired joint motion to occur [28]. The transverse abdominis is a key muscle that works with the nervous subsystem to ensure adequate stability. Crosswell and Thorstenson [29] demonstrated that the transverse abdominis muscle functions primarily to increase intra-abdominal pressure that reduces the stress load on the lumbar spine. Other studies showed that the transverses abdominis is the first muscle to activate itself during unexpected body loading [30] and movement of the upper and lower limbs regardless of the direction of movement [31] [32].

It showed that some swimmers have difficulty in achieving a proximal to distal order of muscle activation. In fact, Gordon's findings [33] showed that the activation sequence was important for swimmers and can help to improve swimmers' performance. Therefore, it was necessary to do exercises to increase the sequence of activation to strengthen the core muscles. One of the exercises to train core muscle strength is by using a Swiss

ball for studies that show that core muscle activity is higher during exercises using a Swiss ball compared to during exercises on a stable surface [34] [35]. Behm and partner [36] argue that exercises prescribed to strengthen or increase the endurance of core stabilizers for activities of daily life, sports performance, or rehabilitation should involve a destabilizing component. This study also proves that lack of stability can result from the base or platform on which the exercise is performed (in this case, it is the Swiss ball) or by placing the limb or resistance beyond the base of the body support (unilateral dumbbell holding motion). According to Charles etc. [37], the stability ball can increase hip motion and may alter muscular recruitment pattern during semi-recumbent exercise with little impact on cardiorespiratory.

The results of 6 weeks of core stability exercises using a Swiss ball showed a significant improvement in the strength of core muscles such as lower back and abs. Core stability exercises using a Swiss ball emphasizes the core muscles, namely the trunk extensors (lower back), flexors (stomach), lower limb extensors (quadriceps), and flexor muscle strength (hamstring), as well as abdomen, lower back, and lower leg endurance [38] [39] [40] where these core muscles are indispensable in swimming.

Science swimmers' performance is influenced by their ability to be able to generate thrust and drag experienced by swimmers while swimming, drag depends on various factors such as physical characteristics of swimmers in water [41]. Therefore, swimming training is focused on actions that might increase swimming speed and reduce movement resistance. Thus, a strong core muscle is needed to ensure strong kicks and hand pulls as well as to improve swimmers' performance. Besides, having strong core muscles can keep swimmers in a streamlined position during swimming [42]. This is what differs swimming from other sports. The core muscle is a reference for all movements in all swimming styles to improve swimmer performance.

Based on the above discussion, it can be said that it is important to have sufficient strength and stability for the body to function optimally both in the daily environment and in sports. Sports performance can be improved by training the core muscles with dynamic movements and with additional endurance by having sufficient strength and stability [43]. Moreover, one of the exercises that can be used to increase core muscle strength is to use a Swiss ball. Core stability exercises using a Swiss ball can be said to be an effective training device to increase core muscle strength as well as to improve spinal stability and flexibility [44] [45]. Thus, the significant results in this study indicate that the core stability exercises using the Swiss ball is recommended as a training method to improve the core muscle strength training of junior swimmers. For future study, a study of core stability training is possible to be carried out by comparing the involvement of the isometric and isokinetic muscles.

Furthermore, the use of appropriate tools for each of these muscle types can also be further studied.

## 4. Conclusions

Core muscles are important for stabilization and strength building in all sports activities. Judging from the efficient biomechanical function, core stability is considered important in maximizing force generation and minimizing joint loads in all types of sports activities as well as in swimming. One of the core stability exercises using a Swiss ball is considered suitable for training local and global muscle strength. The results showed that core stability exercises using a Swiss ball were effective in increasing the strength of the core muscles. Future research is expected to examine core stability exercises using other tools such as TRX to improve balance both dynamically and statically as well as its effect on swimming performance at various swimming numbers and distances.

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# The Effect of Concentration Training on Shooting Free Throw in Basketball Game

Oki Candra

Department of Physical Education Health and Recreation, Faculty of Teacher Training and Educational Science, Universitas Islam Riau, Pekanbaru, 28284. Riau, Indonesia

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**Abstract** This study aimed to determine whether there is an effect of concentration training on shooting free throws by female students in basketball extracurricular. This research was a quantitative research using experimental design. The research design used was a pre-test post-test system aimed to ensure the effectiveness of the treatment given. The population in this study was basketball extracurricular students at State Senior High School 10 Pekanbaru consisted of 15 students. Sampling was done by using total sampling technique which all of them were used as samples. The t value obtained based on the findings of research using the t test was 3.49. The results of this calculation were then consulted on the t table with 14 degrees of freedom, so that the t table obtained was 1.76. In other words, t count was greater than t table which indicated a significant difference between the pre-test and post-test results of 3.86 and 5.13, respectively. The increase in this value was found through the following steps: It was known that there has been an increase of 32.4% from the t table calculation as the difference between the results of the pre test and post test. Based on the research findings, the conclusion obtained is concentration training affects the shooting basketball free throws.

**Keywords** Concentration, Training, Shooting, Free Throw, Extracurricular Activities, Basketball

## **1. Introduction**

Basketball is an effective means of student physical

education. It is because basketball can facilitate the development of a harmonious, complex and comprehensive influence on organisms as well as strengthening health [1]. Basketball is one of the branches of big ball game which is very interesting to watch where this game has certain characteristics [2]. Basketball has gained its own popularity around the world as players and spectators are captivated by its dynamic characteristics of the team. There are several basic techniques that basketball players must master, such as dribbling, passing and shooting. Shooting is one of the three techniques that aim to enter the ball into the opponent's ring. Putting the ball into the opponent's ring is the main goal to win the game. It makes the shooting should be done using good techniques. This technique must be mastered properly and correctly by a basketball player. According to [3], it is explained that the game of basketball is played by 2 teams, each consisting of 5 players. The aim of this game is by putting the ball into rival team's ring and trying to prevent the rival team to put the ball into the ring [4]. Accuracy is needed to make the shooting technique to run well and get the ball into the ring. According to [5] winning in basketball is determined by how many balls are put in the ring. The more balls are put into the ring, the greater the chance for the team to win the game will be.

This effort should also be supported by shooting skills. This ability is a very important skill to play basketball. Shooting is defined as the basic basketball skill most familiar to and enjoyed by any players with their instinct to score goals. Shooting can be concluded as an attempt to get the last move that aims to get a point by putting the ball into the opponent's basketball ring [6]. If a player

cannot get the ball or shoot it into the ring, that player will not win the match. Shooting is a decisive element in winning a match. A win is determined by the advantage of the number of shots enter the ring compared to that received by the opponent. Each team that has control of the ball must always look for opportunities to shoot.

Shooting requires constant practice. It is the ultimate goal of every game. The success of a team in a game is always determined by its success in shooting. Good shooting is supported by mastery of the correct technique [7]. Therefore, this shooting is considered to be a basic technique that must be learned properly and correctly by practice. [8] This is like basketball's objective, to put the ball as many as possible into the opposing team's ring and prevents them from doing the same on its side.

The ability owned by a player of shooting skills affect the results achieved in a match. It is stated that the success of a team is always determined by the success of the players in shooting, especially in getting a shooting free throw. According to [9] shooting free throw is the basic technique of playing basketball that will determines whether a team can win the game. In accordance with the statement of [10], the characteristics of basketball (open skill) makes shooting the ball into the ring is one of the many shooting techniques which aims to put the ball into the ring. Athlete who has good concentration in doing shooting and is supported by his physical condition, will make him to get higher chances on better shooting results and on target.

A player must learn good mental skills to do shooting, including concentration. When a player performs a shooting free throw, he must focus on the target and ignore any distraction. For this reason, high concentration is needed since with good concentration, focus and good technique, the ball thrown by a player is likely on target. According to [11] concentration is attention to an object which is also the ability to think completely on a particular task or job. The role of concentration is very important so that the players' attention is focused on the game, on tactics or strategies to play their best. Meanwhile, [12] stated that concentration can be defined as a state in which a person's consciousness is fixated on a certain object within a certain time.

According to [13] the relationship between concentration level and shot accuracy decrease or even fail, if a player has a low concentration. [14] stated that the determinants of accuracy in this case are: (a) high coordination, means that it requires good accuracy, (b) target size, (c) distance to target distance, (d) mastery of techniques, (e) speed movement, (f) athlete's feeling and precision. According to [15] things may cause loss of concentration includes internal and external factors, such as anxiety, thinking too much about the results will be obtained, thinking about opponents too much and so on. Concentration is an important part of every life activities. A person can do activities well if he/she has high

concentration abilities. The need for high concentration is because there are various activities that must be done which are very complex, such as work, study and sports.

The opinions above explain that concentration is important in carrying out activities so that the results are as expected. If an athlete is unable to concentrate while he/she is in a match, it is likely that the result of the match will not be good as expected. This happen because good concentration can help to achieve maximum results. [16] suggested that distraction can result in decreased performance. Decreased performance in sports competition are such as the accuracy of throws, punches, kicks, or shots that are reduced, so that they are not on target.

On the other hand, there are factors affect the quality of a person's concentration. [10], divided these influences into internal and external, which is as follows. 1) Internal factors that affect concentration include: a) age, b) physicality, c) gender, d) knowledge and experience. 2) External factors may occur when: a) If there is a stimulus that is too strong, such as a very loud sound or shining light, such as a flash or camera flash, b) If the stimulus comes is something that is unusual or much different from the stimulus received, c) If the stimulus that comes is something extraordinary, 4) If the stimulus moves so that the attention of the player is not focused, is not monotonous and tends to see with the assumption and suspicion that there is a new stimulus.

Concentration is very much needed especially for sports that require players to always concentrate highly, include basketball. Accuracy is needed in basketball games. One of the most demanding techniques for high concentration in basketball is the shooting technique. A player is required to have high concentration when shooting into the basketball hoop. This is because concentration is related to the accuracy of the shot in basketball. [17] In previous studies on concentration, it was revealed that concentration is very influential in sports that require a high level of accuracy.

Based on some of the statements above, concentration is the ability to maintain full focus on a certain object within a certain time. In this case, a person is required not to be easily distracted by the surroundings. If a player is distracted by concentration, both internally and externally, it may result in a decrease in his performance as a player. This is the same for a student who cannot concentrate on shooting free throws which then makes the results he gets will not be optimal. In shooting, concentration is a very crucial to get the expected scores. Besides, it also requires excellent physical condition.

## 2. Material Methods

### 2.1. Research Methods

This research was a quantitative research using

experimental experimental design. [18] Randomized Control Group Pretest-Posttest Design was used as the research design. This design is close to perfect considering that there is a control group and a treatment group with randomly placed subjects. The pretest-posttest in this study aimed to ensure the effectiveness of the treatment given. The research data were obtained through pre-test and posttest by doing concentration exercises. Initial data collection was carried out by assessing the ability to shoot free throws. Treatment actions in this study were carried out for 4 weeks where the training program was carried out 3 times a week, on Monday, Wednesday, and Friday. Concentration training material was presented at each meeting. It consisted of point observation exercises, eliminating the number ten on the target, describing the numbers by writing, observing the second shown in hour hand [19]

The population in this study was all basketball extracurricular students at State Senior High School 10 Pekanbaru totaling 15 students. Sampling in this study was conducted using a total sampling technique. The analysis technique in this research began with the prerequisite test. Testing the measurement results data related to the research results aimed to help the analysis process to make it better. The normality of the data in this study was tested with the help of SPSS 22.

The instrument used for shooting a free throw according to [20] consists of: A basketball free throw test where the objective of the test was to determine the ability of an athlete to make a free throw in actual play. 1) basketball court with the hoop, 2) several baskets, 3) free shot instrument form, 4) stopwatch, 5) one person who tests the students, 6) one person who examines the results of free throws, 7) one person as caller participant, 8) free throw test form. The test started by instructing the participant who must be in a ready position on the half-circle line of the free throw. After being given the signal of "Start", the participant must run under the

basketball hoop and return to the semicircle in 24 seconds. After that, the participant can make 10 free throws. The basis for scoring is that every ball enters the ring will get one point.

**Table 1.** Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Pre-Test	15	1,00	6,00	3,8667	1,59762
Post-Test	15	2,00	8,00	5,1333	1,84649
Valid N (listwise)	15				

## 2.2. Mathematical Equations

According to [21] following is the formula used in this study, namely the pre-test formula and the post-test formula:

$$t = \frac{\sum D}{\sqrt{\frac{N \sum D^2 - (\sum D)^2}{N - 1}}}$$

$$\text{Enhancement} = \frac{M_D}{M_{pre}} \times 100 \%$$

## 3. Findings and Discussion

The findings obtained from this study were intended to describe the data, both data derived from pre-test and post-test. The pre-test data obtained from N 15 had the lowest (minimum) value of 1.0; the highest value (maximum) 0.6; average (mean) 3.86; and the standard deviation (SD) was 1.597. Meanwhile, in the posttest score, the lowest (minimum) score obtained was 2.0; highest value (maximum) 8.00; mean (mean) 5,133; mean and standard deviation (SD) 1.84. The details of the finding is presented below:

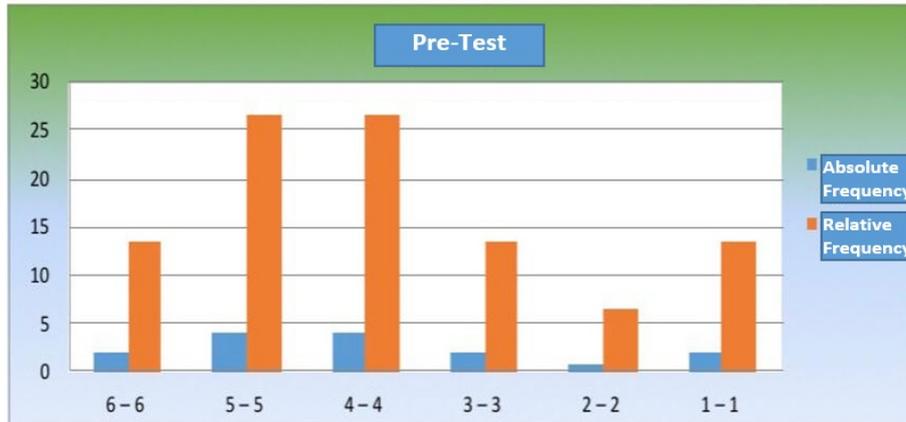
**Table 2.** Frequency Distribution of Pre-test: The Effect of Concentration Training on Shooting Free Throw in Basketball Game

	The Interval Class	The Absolute Frequency	The Relative Frequency (%)	The Cumulative Frequency	The Relative-Cumulative Frequency (%)
1	6-6	2	13.33	2	13.33
2	5-5	4	26.67	6	40
3	4-4	4	26.67	10	66.67
4	3-3	2	13.33	12	80
5	2-2	1	6.67	13	86.67
6	1-1	2	13.33	15	100
	Total	15	100		

The result obtained from the pretest exercises which examine the effect of concentration training on basketball free throw shooting is presented in the table 2 above. The first interval class 6 - 6 consists of 2 students (13.33%), the second interval class between 5 - 5 consists of 4 students (26.67%), the third interval class between 4 - 4 consists of 4 students (26.67 %), the fourth interval 3 - 3 amounts to 2 students (13.33%), the fifth interval between 2 - 2 amounts to 1 student (6.67%), and the sixth interval

between 1 - 1 amounts to 1 student (3.33%)..

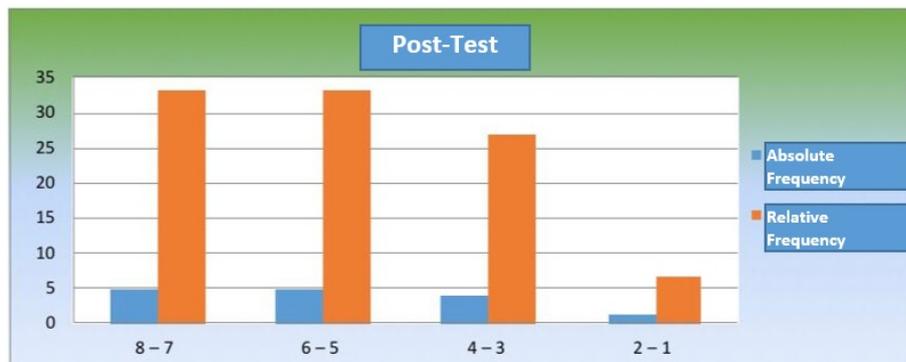
The table 3 presents that post test training is the results of concentration training's effect on free throw basketball shooting practice. There are several intervals obtained based on these data. The first interval class 8 - 7 consists of 5 students (33.33%), the second interval class between 6 - 5 is 5 students (33.33%), the third interval class between 4 - 3 is 4 students (26.67%), and the fourth interval class between 2 - 1 is 1 student (6.67%).



Graph 1. Bar Chart of Pre-test Exercises: The Effect of Concentration Training on Shooting Free Throw in Basketball Game

Table 3. Post-test Frequency Distribution: The Effect of Concentration Training on Shooting Free Throw in Basketball Game

The Interval Class	Absolute Frequency	Relative Frequency (%)	Cumulative Frequency	Relative-Cumulative Frequency (%)	
1	8 - 7	5	33.33	5	33.33
2	6 - 5	5	33.33	10	66.67
3	4 - 3	4	26.67	14	93.33
4	2 - 1	1	6.67	15	100
<b>Total</b>		<b>15</b>	<b>100</b>		



Graph 2. Post-test Exercise Bar Chart: The Effect of Concentration Training on Shooting Free Throw in Basketball Game

The data must be normalized before the hypothesis testing was carried out. The results of the normality test were obtained using the Kolmogorov Smirnov method, both before and after the test. The following are the results of the normality test obtained:

**Table 4.** The Normality Result of Kolmogrove Smirnov (Pre-Test)

Statistics	Pre-Test
N Sample	15
Mean	3,867
Standard Deviation	1,598
$D_n =$	0,133
KS Table	0,351
	Normal

**Table 5.** The Normality Result of Kolmogrove Smirnov (Post-Test)

Statistics	Post-Test
N Sample	15
Mean	5,133
Standard Deviation	1,846
$D_n =$	0,143
KS Table	0,351
	Normal

After the pre-test and post-test data on basketball free throw shooting skills were described, the research hypothesis was tested by analyzing the entire data. The test aimed to determine whether the concentration training affects free throws from basketball shooting.

**Table 6.** The Result of T-test

Mean		Df (n-1)	T- count	T- table	Enhancement
Pre-Test	Post- Test				
3.86	5.13	14	3.49	1.76	32,4 %

According to the results of the t test calculation shown in the table above, it shows that the t value obtained is 3.49. The results of this calculation were consulted on t table with 14 degrees of freedom so that the t table obtained was 1.76. This means that t-count was greater than t table. It implied that there was a significant difference between the pre-test results with an average value of 3.86 and the post-test results with an average value of 5.13. The increase in this value was obtained through the following steps: Based on the calculations made, the increase obtained was 32.4%. This value is the difference between the results of the pre test and post test. Therefore, it is concluded that concentration training has an effect on basketball free throws.

## 4. Discussion

Shooting free throws in basketball are the same as penalties in soccer. In the free throw technique, accuracy

of body movement, ball speed and shooting time is required. Concentration is important to obtain precise accuracy. Fouls in play and penalties for such offenses are very frequent, one of which is penalty shots. Shooting free throw is shooting that is taken in the opponent's penalty area. Players in this case must maximize shots in order to generate points that can benefit the team. [22] Players often fail to make a shot due to improper technique, poor physical condition, and sometimes the lose of concentration due to pressure from the crowd or from teammates. The results of this study indicate that the concentration factor has a considerable influence. This influence is quite reasonable considering that without high concentration, players will not be able to shoot the ball properly because of external forces may reduce their performance and cause the ball miss the ring. This means that the better the concentration level of a player, the better his free throw skills. [23] The results of previous studies also found that there was a significant relationship between the concentration level of students and the accuracy of free throws in basketball games. It was also found that the level of student concentration greatly contributed to the accuracy of free throws in basketball games.

Concentration is one of the most important abilities to focus attention on the game with its various aspects, including the best playing tactics or strategies. The beneficial role of positive emotions found in this study is in line with the results of many previous studies investigated the same topic [24]. Concentration seems to be a familiar term among athletes. However, it is not easy to describe the limitations associated with this definition. The level of attention ability of sportsmen is one of the factors that support the success of a sports activity. Concentration can be defined as a state in which one's consciousness is fixated on a certain object within a certain period of time. The better a person's concentration, the longer a person can concentrate. If a player's concentration decreases or is interrupted during training, especially when the match is in progress, various problems will arise and make the results will less optimal. Thus, it can be assumed that the player who has high concentration is better than the player with low concentration regarding the accuracy of the free throw. If a player has good (high) concentration, he can do good free throw technique to get scores and vice versa. This problem is certainly bad for the team since they will have less opportunity to get points. Based on the description above, players who have high concentration are clearly better than players who have low concentration on shooting free throw accuracy.

The results of this study found that the concentration factor had a significant effect. The reason is because without high concentration, players will not be able to shoot the ball properly considering external distraction may damage performance and cause the ball miss the ring.

This means that the better the concentration level of a player, the better his free throw ability. [25] Concentration is defined as the mental effort to put into the most important thing in any situation. Concentration is the ability to focus on relevant environmental cues. An athlete who is highly concentrated will do his job in the best possible way, make the learning process of new skills faster, increase self-confidence, able to control stress and anxiety by making good use of his experiences and focus on controlling factors. Internal factors that affect concentration are negative thoughts, fear, sadness, and worry.

[26] There are various things may affect the attention or concentration during a match. Experience teaches how a player can discern what is important to his performance and what should be ignored. However, this ability may take years. Athletes and their coaches can shorten this learning process by taking a little time to identify those areas that are indispensable for performance and those that are potential distractions. The trainer who is in charge of the young athletes needs to teach concentration training when the athlete is in a state of physical exhaustion and under the time limit. It is as a form of simulation training. Every sports skill has one kind of focus of concentration that aids performance and vice versa. For example, if a basketball player shooting a free throw is thinking about a previously failed attempt rather than focusing on the hoop where the ball should be put, he is likely to significantly increase his worry. This is because shooting the ball into the basket requires a narrow external focus rather than a wide internal focus.

Players are required to always focus on facing an obstacle in front of them, both physically and psychologically [27]. If a person has good concentration in carrying out activities, then the results of a movement he does will get good results too. In sport competition, if a player can focus and concentrate at the same time in doing something, then he can control the rhythm of the game and generate optimal points for the team. This happens considering that the player can make the opponent fooled or misstate in fighting for the ball from any situation. One example is when dribbling and unable to get past the enemy (opponent playing), then the shooting technique can be used to get points and win matches easily. Players must make sure that the shooting they do is precise and accurate to avoid the opponent grabbing the ball. In this case a good physical condition is needed.

A player with good physical condition will make him survive the pressure and physical disturbance of opposing players. [28] Explained that “*The free throw shot is a basic movement that has advantages over other techniques*”. The advantage in question is that the player will not be hindered by the opposing player when he makes a free throw, so that the player can think more calmly and freely in adjusting his position and movement. The freedom of movement granted in making free throws should assist the

player in scoring. However, this is not the case because the points generated are not comparable to the opportunities they have. It occurs because the player may make a movement that is less efficient. Some of the obstacles to movement may cause players to fail to get points include motion errors in the placement of the elbow position, throw position and balance. Referring to the quote above, it can be explained that at first glance the free throw shot looks easy to do, but in fact, many players cannot throw the ball right into the ring in this condition. Regardless the technical and physical perfection of the players, in fact, mental strength, concentration, peace of mind are also important. If all the supporting factors are owned by a player, the shooting free throw motion he makes will be more effective and efficient.

## 5. Conclusions

Based on the results of research using the t test, the t value obtained is 3.49. The results of this calculation are then consulted on the t table with 14 degrees of freedom, so that the t table obtained is 1.76. In other words, t count is greater than t table which indicates a significant difference between the average of pre-test and post-test, which is 3.86 and 5.13 respectively. The increase of this value is found through the following steps: It is known that there has been an increase of 32.4% from the t table calculation where this value is the difference between the results of the pre test and post test. Therefore, it can be concluded that concentration training affects the shooting basketball free throws.

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# Neuroscience-based Physical Education Learning Environment: An Analysis

Yusmawati\*, Eva Julianti, Ruliando Hasea Purba

Faculty of Sport Science, Universitas Negeri Jakarta, Jakarta, 13220, Jakarta Timur, Indonesia

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**Abstract** This research is part of the research and development phase conducted by researchers. The purpose of this study is to describe the physical education learning environment by integrating the neuroscience concept. The method used in this research is literature study and survey with the following steps, 1) conducting a theoretical study and related principles, 2) analyzing learning (including analysis of learning tools to its implementation), and 3) describing the findings. The subjects in this study were grade 3 elementary school physical education teachers in Jakarta. The instrument used was developed by the researcher according to the needs consisting of four indicators, namely, the teacher's teaching style, student learning styles, the integration of neuroscience in learning, and learning support facilities. Literature study data were analyzed using a normative approach while survey data were analyzed using descriptive analysis. The results obtained are that there are four main principles of neuroscience learning, namely 1) multi-tasking, 2) modeling, 3) fun, 4) sequential. Meanwhile, field findings show that teachers have unconsciously integrated neuroscience in learning, but have never seriously and specifically designed their learning according to the principles of neuroscience-based learning. Researchers suggest developing a neuroscience-based physical education learning model that is based on the found neuroscience learning principles.

**Keywords** Neuroscience, Learning Environment, Physical Education

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## 1. Introduction

The learning process is an important activity in the education system. Learning determines the success of achieving the goals or competencies expected by teachers, schools, and even the state, because education is one of the extraordinary tools that can be used by the state to improve the quality of its people.

Every learning process that is carried out must involve the performance of the brain. The purpose of brain performance is thought. Every healthy human brain, regardless of one's age, gender, nationality, or cultural background, is equipped with an extraordinary set of features: 1) the ability to detect patterns and make predictions, 2) phenomenal capacity for different types of memory, 3) ability to self-correct and learn from experience by analyzing external data and self-reflection, and 4) an inexhaustible capacity to create [1]. Even though the science of the brain has a lot of scope, many researchers have mapped the scope of people's performance in relation to the educational process. The direction of the learning approach, which is currently developing into student-centered learning, is one form of contribution to finding research on the brain related to learning. Students have the capacity to carry out learning independently with facilitation from various learning sources, especially by teachers. This shows that the human

mind has an important role in the learning process, not only at the level of memorization, understanding and even creation, but also in psychological aspects (motivation, emotions, meaning) and also socio-culture. Students are empowered to take responsibility for their own learning, with teachers and other professionals as facilitators [2].

The involvement of the mind in learning can help students understand the various information they receive so that it becomes more meaningful, especially for elementary school students. One is deliberately designed to actively engage young children's minds to help strengthen their neurological networks [3]. Neurons are single cells, with a cell body, or soma, which houses DNA and proteins that guide their function. Each neuron has one axon that sends messages and thousands of dendrites that receive messages. Dendrites appear like tree branches, with more branches representing more connections. This connection represents learning [4].

The strengthening of neurological networks that is expected to occur during the learning process will further improve the performance of nerves more thoroughly. This is because the central nervous system is experiencing good development. Considering how this nervous system changes during learning and development may prove beneficial for efforts to adapt educational approaches to the unique needs of children arriving at the doorsteps of formal education, making a significant difference in highly neural systems where educational practice must be established [5].

By being actively involved in learning, the teacher expects a growth process for the student's neurological network. The growing and developing the neurological network of students' thinking capacities. However, the stimulus provided by the teacher, does not necessarily have a positive impact. On the other hand, the stimulus that is given, if it exceeds the intensity that is in accordance with the characteristics of students, it will actually cause setbacks, in this case it can trigger stress and become unmotivated to learn. Inappropriate or excessive levels of stimulus can reach levels that cause stress and anxiety, caused by tasks that are beyond the individual's skills, abilities and / or comfort [4].

Brain Based Education is engagement strategy with goals that apply to the way our brains work in an educational context. Brain-based learning is called a combination of brain science and common sense. "Brain-based" learning activities engage both hemispheres of the brain simultaneously, resulting in stronger and more meaningful learning experiences and permanent brain connections [6].

Most of the stimulus is given by giving quizzes, assignments or even creating a project. It is not uncommon for this method to require students to study outside the classroom excessively which can take up time to play and rest that should be done during school hours. Of course, the form of assignments and projects is not

wrong, but the level of difficulty and assignments from other subjects need to be considered in order to provide a more appropriate dose of stimulus. With all this information, a teacher must be able to design an active, positive, fun and meaningful learning environment with an appropriate stress level. Through the guidance of neuro education, teacher awareness will be achieved to create a context that creates an emotional environment that facilitates effective and effective learning [7].

It is not certain whether the brain shapes the environment, or the environment that shapes the brain's performance. However, these two things are very closely related and especially in learning, it really depends on the age of one's development. For children who are at the elementary school level, the environment may have a bigger role in shaping their behavior, while for adults who already have various experiences, it may be possible to create their own environment based on their creativity. Thus, the learning environment for children in primary schools must be seriously designed in order to be able to achieve more precise and effective learning goals.

The learning environment designed by the teacher must be very diverse, according to the characteristics of the subject and material presented. One of the subjects that have a unique approach is the physical education subject. This subject carries out learning through various physical activities. Physical education is not only designed to create a learning environment to improve movement literacy, but also to improve cognitive, affective, and physical aspects.

Improved brain performance, not only can be developed through theoretical learning. But it can also be developed through various experiences of physical activity. A body of research has emerged showing that physical activity has a beneficial effect on brain structure and function. During the same period, concern has been increasing over high rates of childhood obesity. Considering that schools have been asked to increase academic achievement and childhood obesity rates, it is surprising that schools have not exploited research on the cognitive effects of physical activity [8]. In Indonesia, Physical education classes for final grade pupils at each level of education refers to learning activities for subjects that will be tested during the national exam. This certainly has an impact on the reduced physical activity of students and increases the children's thinking time and of course the children's sitting time while studying or listening. This then actually creates the potential for children who are sedentary which can systemically affect brain performance. On the other hand, disrupting academic teaching time to provide physical activity through physical education does not have a positive effect on achievement but is also not harmful [9].

Physical education learning for elementary schools must be designed to make students actively involved in learning. This aims to create learning that students enjoy. Things that are liked by children tend to be better

remembered until they are repeated by students. To be able to create an active learning environment must at least fulfill the important components in learning. An active learning environment requires many components that work independently of each other and also regulate overall conditions. As an example:

- a). The physical arrangement of tables, chairs, centers, libraries, lighting and other components attracts the child's interest;
- b). Spaces designed for individual work, small groups and large group meetings;
- c). Availability of manipulative materials and space for exploration that arouses children's natural curiosity; large blocks of time for children to explore, role play, and experiment; and
- d). Perhaps most importantly, a loving and caring educator who demonstrates a love for learning and modeling positive interactions.

Make efforts to create a learning environment in such a way that teachers need to do so that the maximum potential of students can be optimized. Physical education has a central role in developing all aspects of students' self when it is designed appropriately, especially in involving cognitive activities. Therefore, this study aims to analyze the learning environment of primary school physical education which is integrated with the basic concepts of neuroscience.

## 2. Material Methods

This research is part of the research and development phase conducted by researchers. The first method is used literature study to synthesize existing neuroscience-based learning theories and principles. The second is a survey to collect information on neuroscience-based physical education learning in elementary schools.

The subjects of this study were elementary school physical education teachers in DKI Jakarta.

The object of library research is in the form of literature works in the form of scientific journals, books, articles in mass media (either in print or in electronic form).

The instrument used for the survey was a questionnaire developed by researchers consisting of four neuroscience-based learning indicators 1) multi-tasking, 2) modeling, 3) fun, 4) sequences, which were modified based on the Creating a learning environment for all children. Source: Smith et al. (1995) with the Neuroscience Model Concept for learning developed by Lila Davachi, Associate Professor of Psychology at New York University.

Literature study data were analyzed using a normative approach, while survey data were analyzed using descriptive analysis.

Through the results of this study, we hope to get a theoretical and empirical basis in developing a

neuroscience-based physical education learning model. With some neuroscience-based learning findings, we tried to compile a neuroscience-based physical education algorithm. In addition, we hope that the data obtained from observations can be the basis for developing an appropriate neuroscience-based physical education learning curriculum.

## 3. Result and Discussion

In the first stage, the researcher conducted a literature review regarding the neuroscience-based learning. Physical activity through physical education does not directly affect academic achievement, but it is also not dangerous if it is done. It will provide more support for the brain's physiological performance [10][9][11].

Although it does not have a direct contribution to academic achievement, physical education through physical activity can be a support to optimize other potentials of children, for example cognitive, affective, and social. In the hierarchy of levels of explanation, the sciences of human movement play an important, but nonetheless a supporting or sub ordinate role, concerned with the investigation of the mechanisms, instruments or means which are relevant to the achievement of the normative or intentional ends with which we are essentially occupied [12]. One of the physical education learning methods that can improve theoretical understanding is the physical education learning model through discussion, discussion teaching method is very effective in the teaching and learning of PHE in theory, therefore, the subject should be structured towards active and participatory learning [13].

However, researchers believe that the right physical activity and in accordance with the dosage will actually contribute positively to physiological performance in general, especially brain performance. There is a significant positive relationship between physical activity and cognitive functioning in children [14]. One form of the development of this understanding is the concept of Brain breaks for elementary school children [15][16]. Children are given some time to do physical activity in between lessons to relax the left hemisphere and increase the supply of oxygen to the brain.

Through physical education learning, students are not only physically active, but also involve elements of themselves more complexly. Even through physical education it can stimulate social and ethical personal development, and address the holistic education of children in physical, cognitive, emotional and social aspects. Physical Education also relates directly to the perspective of neuroscience, through recreational activities and daily movement actions based on the basic concepts necessary for life [17].

Learning carried out by the teacher should be able to

support brain development. In this way, the teacher can better understand the child's learning needs according to the expected behavior. The development of the theory of neuroscience greatly influences the learning process to be more effective and meaningful.

Educational techniques that are brain friendly provide a biologically driven framework for creating effective instruction. This theory also helps explain recurring learning behaviors, and is a meta-concept that includes an eclectic mix of techniques [6].

One model encountered is the Neuroscience Model Concept for learning developed by Lila Davachi, Associate Professor of Psychology at New York University which consists of the following components:

- a). Attention. Concentration focus on a task or concept without distraction. Learning something new requires focused attention. To learn new information, it must be interesting or meaningful and there must be limited distraction. Multi-tasking requires that we pay attention to more than one thing at once. Multi-tasking is best suited for habitual behaviors that require little or no cognitive input.
- b). Generation. Students have direct interaction with the learning task to generate their own thoughts. Adult learning is very different from learning in childhood. Children absorb everything about their world in an uncensored way and place total trust in the adults around them. Modeling and demonstration play an important role in shaping the expected learning outcomes. The brain is a dynamic, plastic, experiential, social and affective organ
- c). Emotion. Emotional cues related to learning assignments. Emotions bind memory. Like adding fuel to a flame, emotional cues trigger more neural activity in more brain centers and, as a result, burn deeper pathways. Serve learning that provides motivation so that learning becomes more meaningful. We learn better when we are in a happy and positive mood and when we are having fun. Fun learning designs will be more meaningful for children.
- d). Distance. Adequate time gap to digest new learning, be consolidated, and trained. A relatively simple, but underused, way to improve learning outcomes is to reconsider how we 'empty' content. Biologically, each person's cognitive capacity will be different, the capacity is also often limited. The material presented will be more effectively presented in sequence and systematically using an attractive method.

Based on the literature study, four important points in Neuroscience-based Physical Education learning as a basic of algorithm include: 1) *Multi-tasking*, 2) *Modelling*, 3) *Fun*, 4) *Sequences*. After knowing the essential elements in neuroscience-based physical education

learning, the researchers conducted a field survey consisting of the four observation indicators.

### **Multi-tasking**

The questionnaire given to the teacher was designed to determine the application of multi-tasking in learning. This is none other than to train students' level of concentration while learning.

**Table 1.** Teacher Questionnaire Data on Multi-tasking in learning

This Is How I Think About My Classroom Related To Neuroscience Learning	Sample	Answer Percentage	
		Yes	No
<b>Multitasking</b>	<b>n</b>		
1. Students get motion assignments with graded difficulty levels	50	36	64
2. Students perform thematic motion tasks	50	32	68
3. In our classrooms we present small distractions to increase student concentration	50	8	92
4. Students get multiple motion assignments (doing several tasks at once, for example: jumping while counting, passing according to instructions)	50	6	94
5. Students carry out movement activities as instructed.	50	76	24
6. Many students do not focus on carrying out learning activities.	50	70	30
7. Most students focus on completing learning activities well.	50	12	88
8. Students have difficulty carrying out multiple learning activities.	50	10	90

The results of the questionnaire for the multi-tasking variable show that the teacher has actually designed the learning with multitasking activities, this is because in elementary level learning must use a thematic approach. But on the other hand, multi-tasking has not been implemented optimally, because multi-tasking instructions are still very minimal in learning (point 4). Meanwhile, most of the teachers have not trained students' concentration optimally as in point 3. This has an impact on point 7 which shows the incompleteness of learning assignments with the available time.

### **Fun**

Fun learning will be more meaningful for students. Fun learning can be seen from the general expression on students' faces, student participation during learning and student satisfaction after learning.

**Table 2.** Teacher Questionnaire Data on Fun Aspect in learning

This Is How I Think About My Classroom Related To Neurosaince Learning	Sample	Answer Percentage	
		n	Yes
9. Some students want to continue doing learning activities again	50	50	50
10. Many students compete with each other to be the best	50	86	14
11. Students feel happy when learning is carried out	50	86	14
12. Students show an indifferent attitude during learning	50	54	46
13. Some students don't want to study	50	14	86
14. Some students do not like class	50	32	68
15. All students feel that they are close friends with each other	50	82	18
16. Our classes are so much fun	50	84	16
17. Students mostly enthusiastic about performance, want to be the first to appear.	50	54	46

The interesting thing from this finding is that students feel very happy in learning physical education. However, the enthusiasm of students in carrying out physical education learning activities is still at the middle level. This means that there are still many students who do not want to repeat learning again. They may carry out learning activities only during school hours, but have not yet internalized it into a habit outside of school / class. It is necessary to trace the level of student enjoyment in an activity so that it becomes a habit he does without being ordered.

### Modelling

Modeling is an important element in physical education learning, especially in Indonesia. this is closely related to communication and actualization. In Indonesia, a teacher has a duty as a role model for students. especially at the basic level. Students in primary schools have excellent imitation abilities. So that whatever he sees, does and learns can shape it at a later date.

**Table 3.** Teacher Questionnaire Data on modelling in learning

This Is How I Think About My Classroom Related To Neurosaince Learning	Sample	Answer Percentage	
		n	Yes
18. The teacher provides a good example	50	82	18
19. Students idolize teachers	50	84	16
20. There are students who are respected in the class	50	90	10
21. Teachers provide examples of positive behavior to students	50	100	0

The modeling concept has been applied very well by teachers and even presents in the class itself. This may be a very potential strength for teachers in DKI Jakarta to create meaningful learning.

### Sequences

The ordering and mapping of material in the curriculum is common and is an obligation for every educator.

**Table 4.** Teacher Questionnaire Data on Curriculum Sequences in learning

This Is How I Think About My Classroom Related To Neurosaince Learning	Sample	Answer Percentage	
		n	Yes
22. The material is presented sequentially	50	10	90
23. The material starts from easy to difficult	50	36	64
24. Learning is carried out in stages	50	100	0
25. The teacher analyzes the learning before compiling the curriculum	50	80	20

By recognizing existing material, teachers can map the material more precisely. The continuous and gradual placement of the material will reduce the stress level of students while studying, thus learning becomes more effective. The positive side of the findings in this variable is that the teacher has conducted material analysis and the curriculum to be taught, but on the other hand, the teacher has not carried out the material arrangement continuously. This is an important note for neuroscience-based learning, that teachers not only analyze the curriculum but also have to organize the distribution of the material on an ongoing basis so that the material conveyed to children becomes more optimally accepted by children.

## 4. Conclusions

A search of related theories, shows that the concept of neuroscience can be compatible with physical education learning. Some evidence shows that physical education has a contribution to brain and cognitive development, besides that physical education has the potential to be a supporter in optimizing the overall aspects of a child. In fact, developments are now starting to include physical activity in between lessons to optimize brain performance and give the brain a break for relaxation.

Neuroscience-based physical education learning is something new in Indonesia. Not many teachers have applied this learning, although learning will not be separated from the role of neuroscience. Neuroscience-based learning is very possible in physical education learning, this will be very beneficial for students because both sides of both physical activity and cognitive development will influence each other.

Neuroscience-based learning has essential elements, including concentration (through multitasking), modeling, fun, and sequences. Neuroscience-based learning can be seen in the presence of these four variables.

Concentration indicators in learning through multiple assignment instructions have not yet appeared in the learning being carried out. Intrusion with multi-tasking patterns will increase student concentration, so that students really have an essential learning experience.

In terms of pleasure in learning, the teacher has created a pleasant atmosphere and almost half of the sample of teachers stated that the learning environment was pleasant. An important finding in this conception is that the level of student enjoyment must be reached at what level to make the learning experience a daily habit, because students who feel happy tend not to repeat related activities outside the classroom.

The modeling done by DKI Jararta physical education teachers has been very good. Even physical education teachers have become idols of many students. This is the strength of the teachers in the success of their learning in the future.

The curriculum analysis has been carried out by the teachers along with the curriculum documents. However, the continuous arrangement of the material has not been implemented optimally. The material needs to be reviewed and organized according to its relevance. Because new abilities will be more optimal when it comes to previous abilities.

Based on the existing model, the researcher offers a basic neuroscience based physical education learning model algorithm including 1) multi-tasking, 2) modeling, 3) fun, 4) sequences. This algorithm certainly needs to be investigated further through a series of subsequent research and development.

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# Model Development of Digital Based Volleyball Under Service Skills Instruments

Muslimin<sup>1,\*</sup>, Moch. Asmawi<sup>1</sup>, Samsudin<sup>1</sup>, Firmansyah Dlish<sup>1</sup>, James Tangkudung<sup>1</sup>,  
Aprizal Fikri<sup>1</sup>, Destriana<sup>2</sup>

<sup>1</sup>Sports Education Study Program (S3), State University Jakarta, Indonesia

<sup>2</sup>Physical Education and Health Study Program, Faculty of Teacher Training and Education, Universitas Sriwijaya, Palembang, Indonesia

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**Abstract** The purpose of this research is to develop a digital-based volleyball service skills test instrument. The research method used is research and development which adopts Borg and Gall theory which has 10 stages of development. The research subjects numbered 28 male. The results of this development research are the 12 subject small-scale trials getting an average value of 82% the category of "Good / feasible" to proceed to the large-scale trial phase volleyball players and daughter. Data collection uses observation, questionnaire, interview and test. The results of 16 subject large-scale group trials obtained an average value of 85.3% in the category of "Good / decent" which means that the digital-based volleyball under service skills test instrument was "feasible" to proceed to the stage of tool implementation. The conclusion from the results of the development of a digital-based volleyball under service skill game instrument "Eligible" is used as a tool to measure the technical ability of volleyball players.

**Keywords** Instrument Model, Under Service Skill, Volleyball, Digital

## 1. Introduction

Coaching sports in a planned, tiered, and sustainable manner through competition to achieve achievement with the support of science and technology (Science and

Technology), science and technology will continue to grow and be utilized for the world of sports, because current technological advances are very beneficial for improving sports achievements. According to research results, Sports video research is a popular topic that has been applied to many prominent sports for a large spectrum of applications [1]. Therefore, Sports video research is a popular topic that has been applied to many prominent sports for a large spectrum of applications [2]. In this paper, we introduce a technology platform which has been developed for the tennis context, able to extract action sequences and provide support to coaches for players' performance analysis during training and official matches

Meanwhile, according to the results of research "The purpose of player tracking technology is to find out the extent of the movements made by players, mark players, and find out how players look" [3]. In line with research according to research with the results of research that most sports can use sensors or other devices to monitor players while other equipment is not possible [4].

From the results of the research above, it shows that science and technology and sports today should go hand in hand, because the development of sports science and technology in developed countries is already very good and the results must also be very good for improving sports achievements. Because, in addition to being supported by good human resources, of course, to carry

out the development of sports development programs, it is necessary to have good facilities and infrastructure support, one of which is technology-based training and training infrastructure.

Sports coaching can be done either through sports club or at school or formal education. According, for junior high school students, students want new skills and develop a mind to learn fair play, good sportsmanship and want to use free time. One game that can be done in stages is a volleyball game. According to how many results of research and expert opinion, according said "The volleyball game contains a series of individual technical-tactical actions that interact during the course of the game" [5]. According Volleyball is a loving and exciting sport, but its poor promotion leads to a low number of consumers, especially in areas where this sport has no tradition [6]. There are several types of basic techniques in volleyball games: service, passing, smash and block. The basic technique of volleyball according to the results of the study states that "Volleyball is a complex sport where the results in the game depend on cooperation with each player who occupies a position in accordance with the rules of the game [7]. Performance in volleyball games really requires a good psychomotor aspect and is trained on every player. The ability to adapt in a team and physical and psychological abilities influence the outcome of the game " according states "in a process of learning sports teams specifically in volleyball, basically using a tutorial that has a theoretical basis in a cognitive approach that covers the development of strength and skills [8].

Based on the results of this research and several theories, volleyball is done by two opposing teams and tries to generate numbers by turning off the ball in the opponent's area, of course, supported by good physical conditions and good techniques to achieve achievements. However, based on the results of the field survey, volleyball players at the University of Bina Darma are still underperforming, which is caused by several problems among the evaluation tools that are still based on manuals, so that coaches are less objective and find difficult to evaluate the technical abilities of each player. Evaluation techniques that are still lacking in objective are the upper and lower serve volleyball service.

Previous research on the development of volleyball service test instruments conducted with the title Testing Protocol for Monitoring Spike and Serve Speed in Volleyball. The results of the research are two types of test instrument development namely an instrument to see the strength of a smash and an instrument for under service. According to the results of the development research that, to evaluate the results of service techniques can be done using radar-based test instruments [9]. According the model is an imitation, a simulation of a reality composed of specific elements of a number of phenomena that can be investigated by a person and this is an isomorphs of an image obtained abstractly that is a process mentality making generalizations from real

examples (the same as describing the atmosphere of the match) [10]. Widiastuti states that tests are tools or instruments used to obtain information about a person or object [11]. To get good measurement results, you should use a test tool or instrument that refers to the purpose of the test itself.

Based on these results there are still weaknesses in terms of components and objectives of the rules of service techniques that make instruments better and in accordance with the rules of volleyball games. Volleyball is not only seen from the speed of the rolling ball because not all techniques are influenced by the speed of the ball. Because with the accuracy of the service ball, right in doing passing and smashes will certainly make the game more leverage in producing points. Therefore the researcher will develop a technical instrument for digital volleyball game service skills. From the results of this development, the components used will be better, digitally based, android application systems, and of course priority to the precision of the ball measured by using a sensor. Of course the volleyball game service skill test instrument is more effective and efficient compared to the instrument in the previous research.

## 2. Material Method

The research approach used in this research is the research and development of Research and Development (R&D), which are as follows: 1) Research and information collecting, 2) Planning, 3) Develop preliminary form of product, 4) Preliminary field testing, 5) Main product revision, 6) Main field testing, 7) Operational product revision, 8) Operational field testing, 9) Final product revision, and 10) Dissemination and implementation [12].

### 2.1. Research Subject

The research subjects were 28 male at Bina Darma University. Purposive sample technique was chosen in the research of research subjects.

$$\text{Rumus} = \frac{\text{SH}}{\text{SK}} \times 100\%$$

Information:

SH : Calculate Score

SK : Criteria Score or Score Ideal

### 2.2. Data Collection Techniques and Instruments

Data collection techniques in this study (1) observations of spaciousness where the research subjects were carried out, (2) interviews with trainers. Data collection instruments used a questionnaire and volleyball skills tests. Questionnaire can be a closed / open question / statement. According to Sugiyono (2012) the types of questionnaires

according to their shape are divided into three, viz. (1) Multiple choice questionnaire, (2) Check list. (3) Rating scale

### 2.3. Data Analysis Technique

Data analysis includes all the activities of clarifying, analyzing, using and drawing conclusions from all data collected in action. Whereas quantitative data were obtained by giving a score on a qualitative based on a Likert scale that was converted to a scale value of 4.

**Table 1.** Skala Likert

Skala	Information
1	Very Inadequate / Good / Suitable
2	Not Decent / Good / Suitable
3	Decent / Good / Suitable
4	Very decent / good / appropriate

Percentage is intended to find out the status of something that is presented and presented as a percentage. The formula for calculating eligibility according is as follows [13].

The results of subsequent data calculations are made in the form of a percentage multiplied by 100% and in the four categories of eligibility by using the Scale as follows. Percentage of Eligibility Category [14].

**Table 2.** Percentage of Eligibility

Score as a percentage	Eligibility Category
<40%	Not Good / Not Eligible
40%-55%	Poor / Inadequate
56%-75%	Good enough / decent enough
76%-100%	Good / Decent

Note: (1): Strongly disagree / very improper, (2): Not appropriate / not feasible, (3): Appropriate / feasible, (4): Very appropriate / very feasible.

## 3. Result / Findings

A small group trial was conducted on 12 Universitas Bina Darma volleyball players. The test subjects performed all digital-based volleyball skill testing tests.

Based on the results of a small trial in the diagram above, in the aspect of originality the digital-based volleyball under service skill test instrument scores 82.2% in the "Good" category means that the digital-based volleyball service skill test instrument is "feasible". The excellence aspect of digital based volleyball under service skills test instrument score 84,3% in the category of "Good" means that the digital based volleyball under service skills test instrument is "feasible". The aspect of the use of digital based volleyball under service skills test instrument scores 81% in the "Good" category means that the digital based volleyball under service skills test

instrument is "feasible". The safety aspect of digital based volleyball service skill test instrument scores 82.3% in the "Good" category means that the digital based volleyball under service skill test instrument is "feasible". The excellence aspect of digital-based volleyball under service skills test instrument scores 80,1% in the category of "Good" means that the digital-based volleyball under service skills test instrument is "feasible". So the average value of the results of small-scale trials is 82% in the "Good" category which means that the digital-based volleyball under service skills test instrument is "feasible". Large group trials were conducted on 12 male and female volleyball players at Bina Darma University.

Based on the results of large-scale group trials in the diagram above that in the aspect of originality the digital-based volleyball under service skills test instrument scores 85,5% in the "Good" category means that the digital-based volleyball under service skills test instrument is "feasible". The excellence aspect of the digital-based volleyball under service skills test instrument scores 86% in the "Good" category means that the digital-based volleyball under service skills test instrument is "feasible". The aspect of the utilization of digital based volleyball service skills test instrument scores 84,5% in the category of "Good" means that the digital based volleyball skills test instrument is "feasible". The safety aspect of the digital based volleyball under service skills test instrument scores 85% in the "Good" category "Means that digital volleyball under service skill testing instruments are" feasible ". The excellence aspect of digital-based volleyball skills test instrument score 85,4% in the category of "Good" means that the digital-based volleyball under service skills test instrument is "feasible". So the average value of the results of large-scale group trials is 85,3% the category of "Good" which means that the digital-based volleyball skills test instrument is "feasible". Large-scale group trials were conducted on 16 male and female volleyball players at Bina Darma University.

## 4. Discussion

This developmental research aims to provide a new alternative in evaluating the service skills of volleyball game techniques that are more, varied and effective. The product developed is a digital-based volleyball under service skills test kit, where researchers utilize digital technology as the main component to make this test kit. The technology used is the latest development both in software and hardware, so as to produce a good and appropriate product used to measure volleyball service skills. Furthermore for volleyball service tests, previous studies only looked at how fast the smash shots were carried out by volleyball players, using camera radar as a detector, in contrast to the development carried out in this

study [15]. Development research conducted by Insook Kim and Bomna Ko the conclusion that, in the world of education there is also a need for development between K-12. Thus, development research is very effective to be used as a research method [16]. This research makes smas test kits with the aim of being applicable with volleyball games of the same size where players service exactly at the time of the game. Therefore, the test equipment is made in accordance with the area of half the volleyball court where the test equipment is placed then given numbers as a target. The research with the title "Development of android-based learning media in the form of digital pocket books for basic competency accounting subjects makes an overview of the accounting cycle of service companies in class XI MAN 1 Yogyakarta 2014/2015 academic year" Yogyakarta State University. This research develops an Android-based pocket book learning model. Based on several different elements both in terms of physical / component and software aspects, of course the research on the development of volleyball service skills test is a new innovation and of course the original has not been done by other researchers [17].

In addition, this product will be very helpful in carrying out volleyball service skills tests for beginner athletes as well as students and the general public.

This product has utilized digital technology so that very new and more objective data are generated. Thus the data cannot be changed by athletes so as to minimize data manipulation actions. Obviously with an objective result the coach or teacher will know the actual service skill level of each athlete or student. This digital-based service instrument product clearly has a technological renewal because it uses the Android application so that in operating the tool can immediately see the test results through a smartphone or tablet. In terms of time, of course, this tool is more effective and efficient in implementing volleyball service skills testing

## 5. Conclusions

Based on the results of the research and discussion above the conclusions and this research is that there is a significant and effective renewal of the existing tools before. The renewal of them, among others, in terms of components of digital-based service test kits is more complex and sophisticated, equipped with quality sensors so that the accuracy of the data is better. In terms of technology the application is equipped with features that are easily understood by every user and is based on Android so that it can be used on smartphones and tablets to see directly the results of tests for each athlete or volleyball player. In terms of time the use is more effective and efficient, and instruments can be used by the age group of 9-30 years, so this tool is really useful for

technological advances in the field of sports especially for volleyball.

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# Learning of Badminton Model through Animation Video on Physical Education Students

Silvi Aryanti\*, Hartati, Syafaruddin

Department of Physical Education, Faculty of Teacher Training and Education, Universitas Sriwijaya, Palembang, South Sumatra, Indonesia

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**Abstract** The purpose of this study was to develop a badminton learning model through animated videos on physical education and health students of Faculty of Teacher Training and Education Universitas Sriwijaya. The media used is only in the form of images so that the use of the media is still not optimal. Furthermore, students participate in learning less actively. This research method is Research and Development. The research sample was conducted on the third semester. These steps were adapted into the following seven design research and development procedures: information gathering in the field, information analysis, early product development (draft model), expert validation, small-scale field trials and revisions, large-scale field trials and revisions, and manufacture of the final product. The data collection techniques in this research are documentation, walkthrough, questionnaire and tests. The results of research on small-scale trials conducted on 20 students obtained a percentage of 63.1, which is included in the category of "good enough" to be continued at the next stage, namely large-scale trials. The results of research on large-scale trials obtained a percentage of 82.59, which is the average result of 55 respondents included in the "feasible" category. The finding of this research is that badminton learning model can be developed by video animation. The implication of learning this video animation based learning model can be used by students for learning badminton.

**Keywords** Badminton, Learning Model, Animation Video

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## 1. Introduction

According Mulyasa, Education is a means to prepare present and future generations. This means that the current educational process is not solely for today, but for the future. Education is a means to strengthen national identity in the process of industrialization and encourage changes in Indonesian society in the era of globalization [10]. Rusman, The principle of organizing education is that education is held as a process of civilizing and empowering students that lasts throughout life. In the educational process required lecturers who provide role models, build will and develop the potential and creativity of students [13]. Linda, Students' success in Physical and Health Education depends largely on the learning process in which teaching method is a greater part [9].

Physical education is one of the efforts to improve human quality directed at the formation of character and personality, discipline and high sportsmanship, as well as increase achievement that can arouse a sense of national pride. Sports activities are also included in education in Indonesia. Sports activities cover a variety of branches such as athletics, games, water sports, martial arts, and so on. The aim of Physical Education is educational sports which originate from the human movement with the aim of forming human beings who can stand alone and are full of creativity and also sports can be a powerful tool for the physical and mental formation of the nation. Hartati et al,

Physical education puts more emphasis on the development of concepts with a variety of teaching methods in accordance with the study materials taught. Physical education has an enormous relationship with science and technology [4].

One of the lecture materials for the third semester students is the deepening of the badminton sports branch with a weight of 2 credits. Students can get many benefits by playing badminton, including a good posture, anatomic, physiological, health and physical abilities. According to [2] Chandra, badminton is a small ball game with a racket and cock that is hit through the net which is stretched in the middle of the field. This game can be played by two people (single) and four people (double). Badminton rules are set by the IBF (International Badminton Federation). Therefore, it should provide appropriate learning in order to get optimal results.

The results of observations made by researchers in the semester III Physical Education study program students when learning badminton is done directly and lectures. Lecturers provide material for students and students pay attention. Therefore, learning outcomes in badminton learning are still low. This can be seen from the number of students who do not understand the basic techniques in feather play. The media used are only images so the use of the media is still not optimal. Furthermore, students participate in learning less actively. In the learning process, students are still passive; they are not focused, feel ashamed to ask questions, do not record material in the learning process, and only accept what is conveyed by the lecturer. In addition, learning activities are more centered on lecturers or one-way communication, namely from lecturers to students. Therefore, the need to use media can be motivating and fun.

Kittidachanupap, N., Singthongchai, J., Naenudorn, E., Khopolklang, N., & Niwattanakul, S, Assimilation in use with multimedia applications and learning activities can increase children's interest during the learning process, so that it can be easier in understanding learning material [7]. The use of media in the learning process makes student learning activities more interesting and easier to understand. Therefore, in the learning process, lecturers should use the media as a tool. Djamarah, media as a tool in the learning process is a reality that cannot be denied [3]. Sumantri, the use of instructional media in the learning process can clarify the presentation of messages and information, increase and direct the students' attention and it can lead to learning motivation, and self-regulation [14]. Zin, et al, All challenges and a new strategy helps student to achieve a better understanding in a study field. Diversity in learning combinations of media such as graphics, animations, texts and graphics can certainly boost the academic level and their interest in the learning process [15].

The development of badminton learning models should meet the characteristics of students. Various forms of

learning models have helped Lecturers in applying the learning process. Aryanti, based on the results of the validation of badminton game, experts obtained a percentage of 67.85% in the category of "quite feasible". Validation from experts in Physical Education, Sports and Health obtained a percentage of 69.64 in the category of "quite feasible". Long forehand service learning can be used for badminton learning [1]. Hartati, Destriana, & Silvi, Multimedia can be used as a communication system. It is a system because it is a group of objects that relate and work together to produce a desired result. However, the Physical Education Lecturer has never developed a badminton learning model through animated video [5]. Putra, the use of videos in multimedia such as animation as learning materials for badminton techniques is very useful. This will be useful if the trainer does not have the technique or ability to give examples of movements well, then videos such as animation can be utilized [12]. The novelty of this research is that the badminton learning model is made in the form of animated videos. Material about badminton service, punches and smashes.

Based on the description above, the researchers are interested in conducting further research entitled Learning of Badminton Models through Video Animation in Physical Education Students Semester III

## 2. Materials and Methods

This research is research and development. Subject in this study were students who received physical education Faculty of Teacher Training and Education Universitas Sriwijaya in the third semester. These steps have been adapted into the following seven development research design procedures:

- 1) Collection of information in the field
- 2) Analysis of the information that has been collected
- 3) Initial product development (Draft Model)
- 4) Expert Validation
- 5) Small-scale field trials and revisions
- 6) Large-scale field trials and revisions
- 7) Making the final product

The planning and development phase consists of literature review and field study. The study is carried out through a literature search on learning models. The approaches are alternative multimedia, and science, technology, engineering, and mathematics (STEM), material on basic techniques of badminton. Literature is in the form of journals, dissertation and thesis research results, and handbooks. In the second stage, needs analysis was carried out by studying the resources available in the study program that is planned to be a place of research at Faculty of Teacher Training and Education Universitas Sriwijaya. In the third stage, the initial draft of the product is made. The next analysis process is the product development stage of the badminton

learning model through video animation that can be useful and helps lecturers in learning and learning activities. The fourth stage is Expert Validation, Trial, and Improvement. Before a small-scale trial of the initial product is carried out, the product must be validated by material experts, namely: (a) material expert (b) media expert, and (c) and linguist. The validation process is expected to give input on the initial product. In the next stage, a small-scale field trial is carried out to see the extent to which the product can be used; after the small-scale trial phase, a product revision is carried out. Product revisions are made after expert input and the results of small-scale trials.

The next stage after the product revision is the second stage of validation. This validation is intended to see products that have been tested and revised. The next stage is large-scale trials and revisions. In the final stage, the final product is ready to be tested for its effectiveness.

### 3. Result and Discussion

The needs analysis of this research aims to determine the problems that occur in the field. This relates to the multimedia model in badminton courses. Theoretical material when implementing learning is not optimal because the learning media do not yet support. Based on the existing problems in the field, it was developed using animated videos that can improve badminton learning outcomes of the third-semester students. The focus of developing a multimedia model is to improve badminton learning outcomes.

Small-scale trials are a step in research and development. The aim of small-scale trials is to find out the extent to which the effectiveness of the video animation-based badminton learning model is developed. Small-scale trial respondents were 20 students. The results of trials on a small scale about the development of learning models based on video animation badminton courses obtained a percentage of 63.1 which is the average result of 20 respondents who have been tested. The trial results obtained by 63.1% are included in the category of "reasonable enough" to be continued at the next stage.

Large-scale trials are conducted after the second phase of revision. The purpose of large-scale trials conducted is to determine the extent to which multimedia-based video animation can be used in basketball learning. The test was conducted on 55 students. Respondents in this study were students of Physical Education Faculty of Teacher Training and Education Universitas Sriwijaya. The results of the study on a large-scale trial development of learning models based on video animation in badminton subjects obtained a percentage of 82.59. Results of trials on a large scale of 82.59% included in the category of "feasible" are used as multimedia. Multimedia learning based on video animation badminton courses can be said to be a product of development.

Based on research conducted by Nishihara, Y., & Yonemura, K, the results of this study suggest the possibility of perceiving the teaching materials, objectives, content, students, and the setting as an integral whole. Video annotation also enabled the teachers to grasp the difference in difficulty between clarifying concrete teaching problems and actually improving those problems to achieve results in daily classes [11]. Kok, M., Komen, A., van Capelleveen, L., & van der Kamp, J, Self-controlled video feedback without guidance of a teacher on movement technique led to similar learning effects as traditional guidance of the teacher in a Physical Education context. Self-control of feedback delivery (i.e. timing and frequency) seemed to have positive effects on self-efficacy and perceived learning effect, but did not lead to superior motor learning or perceived enjoyment. This study indicates that self-controlled video feedback as applied in this study can be implemented in Physical Education [8]. Ho, L. H., Sun, H., & Tsai, T. H., as well as motion graphic animation video media, its effectiveness has been tested in improving students' achievement, especially the experimental group. Hence, the interactive motion graphic media is effective in improving the students' knowledge in the science subject of the fifth graders [6].

The research product in the form of an animated video is suitable for learning badminton games. There are various kinds of learning models for basic badminton techniques such as serves, punches, and smashes It can help students understand the basic techniques of badminton games. The use of animated video-based badminton learning models can be used by students. This can assist students in understanding the techniques in badminton. The animated video presented varies; the instructions are clear and there are examples of how to implement.

### 4. Conclusions

Advances in information and communication technology, especially computer technology in learning activities are expected to help solve the learning problems encountered. The selection of the right learning media can help convey the message correctly, effectively and efficiently. Based on the results of a small-scale trial conducted on 20 Faculty of Teacher Training and Education Universitas Sriwijaya Physical Education students, a percentage of 63.1 was included in the "feasible" category to be continued at the next stage, namely a large-scale trial. The results of a large-scale trial of developing multimedia subjects in work (basketball) that is 82.59 is the average result of 55 respondents included in the "feasible" category. This shows that it can be used as multimedia. Multimedia based video animation in badminton courses can be said to be a multimedia development product. The research product in the form of

a learning model with animated videos can be recommended for lecturers in teaching, and can be used by coaches to train badminton athletes.

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# Development Model for Android-based Shot Put Orthodox Styles

Ucok Hasian Refiater\*, James Tangkudung, Hernawan

Postgraduate Program, Physical Education Study Program (S3), Jakarta State University, Jakarta, Indonesia

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**Abstract** This study aims to develop an Android-based model of measurement in orthodox shot put styles. The research method used is research and development which adapted from Borg and Gall's theory including the 10 stages of development. The research subjects were 12 males and females athletes. Data collection uses observation, questionnaire, interview, and test. Data analysis technique used in this research is descriptive qualitative and statistics analysis. The result showed the average value of the small-scale trials with 8 subjects of athletic athletes is 82% in the category "Good" which means the android-based shot put gauge is "feasible" to be used as an orthodox shot put style. The average value of large-scale group trial with 12 subjects of athletic athletes is 86,2% also in category "Good" meaning the Android- based shot put is also "feasible" to be used as a gauge for orthodox shot put style. The conclusion from this study is the Android-based in orthodox shot put measurement test instrument which is feasible to be applied to measure the results of shot put. Future research can develop further in sensor system. However, the sensors used in UDM devices use laser sensors.

**Keywords** Measurement Model, Shot Put, Resistant, Orthodox, Android

of sports has drastically changed to become more technical that challenging scientists and coaches in applying their knowledge with the constant technological development. The terminology regarding technological objects to facilitate or enhance sports is not consistent. The terms of "sports technology" is used as a synonym for technical objects used for sports. Different from what commonly used terms as "sports equipment", the concept of sports technology encompasses various objects which have a technology base [1]. Technology is philosophically defined as a physical instrument that can be used for problem-solving [2]. A number of studies on technology in sports have previously been used such as: systematic reviews of global positioning systems (GPS) and micro sensor technology in team sports [3], reviews based on motion analysis in sports [4], video usage in training [5], integrated technologies such as GPS, accelerometers and heart rate monitors in team sports [6].

Recently, sports technology can be seen as part of the athlete's needs, enabling the integration of humans and objects, also enabling the emergence of recent discoveries through more specific analysis [7]. An interesting example of technological development taking place in sports through the application of innovative technology taken from other disciplines is the use of drones (unmanned camera sets) [8]. These advances have made it possible for researchers and applied sports scientists to easily measure key aspects of performance in the field, which previously often could be done in a laboratory only. [9]. In addition to technology, athlete performance is also supported by good and tiered training.

## 1. Introduction

Along with the development of sports science, the field

Athletes must be trained perfectly to get the best result in their performance. This is reinforced by the opinion of James Tangkudung [10] that "achievement can only be achieved if coaching can be worked and focused on aspects of training that fully included: athlete's personality, physical condition, technical measurement, tactical measurement and mental ability, these five aspects constitute a unified whole. 'Paralysis with analysis' is a general result that results from conscious control of a movement that is usually automatic, which is very likely caused by information overload and ongoing monitoring [11]. Therefore, a large number of studies have analyzed measurably differences in performance from year to year on throwing numbers in athletic sporting branches [12].

One of the most prominent advances in the field of data collection and processing methods is the computer analysis system. Computer vision uses algorithms to detect identification features in video clips such as patterns or color differences [13]. A computer analysis system requires several cameras to be placed around a sports area, and can require manual input as a calibration of the game event [14]. Meanwhile, developments in the use of computer analysis technology to automate the capture of player movements continue with evaluations developed [15]. Evaluation is done by measuring students' physical fitness tests [16]. For example, accurate player tracking data collection can be a problem when several players are collected in a small area [17]. Slow-motion technology using computers also plays a role in the development of motion analysis in biomechanics and other sports sub-disciplines, with products such as Microsoft Kinect™ being used as a low-cost solution for analyzing motion [18]

The increasing distance from the throwing performance of athletes makes athletes in the athletics throwing branch realize that a more accurate and uniform device is needed to measure the distance from the throw. Finally, the development of distance measurement technology has developed rapidly. One technology that continues to develop in distance measuring devices in athletics is the Electronic measurement device (EDM). Electronic Distance Measurement (EDM), used in eight events in athletics: high jump, long jump, triple jump, pole jump, discus throwing, shot put, hammer throw, and javelin throwing. EDM tools during its development have been through many improvements to become a tool that has high precision as it is now [19].

The problem that currently exists in athletics, especially the number of throwing, is that there are still very few EDM tools owned by the PASI organization at the provincial or district/city level in Indonesia. This certainly can affect the implementation of an athlete's training results especially when they want to take the shot put because if using a manual test it will affect the results obtained are not accurate. Also, when a race event does

not use accurate and digital measuring instruments, it can cause chaos because the results using manual measuring tools are not accurate.

Based on these problems, it is necessary to research the development of measuring devices with the aim that the resulting product will provide an easy and effective solution used to measure shot put skills. According to Seels and Richey in Ardani, development can be interpreted as a process of translating or describing design specifications into physical features. Tessmer and Richey state that development focuses not only on needs analysis but also on broad issues about initial analysis, such as contextual analysis [20]. The development of volleyball learning model produces product models learning [21]. The results of his research are the development of scoring applications in soccer games [22]. The results of his research on the development of service-learning are products for volleyball [23]. The results of his research are computer-based volleyball skills test instrument products [24].

Based on these problems, the researchers wanted to develop orthodox style shot put measuring devices based on Android. After this measuring device has been made and has been tested for the feasibility of the tool, it is expected that the shot put gauge can be a solution to make it easier for athletes, coaches and sports teachers to evaluate the results of orthodox style. The Orthodox style is also called a sideways style. The meaning of in shot put is a technique of putting a bullet that is performed sideways to produce repulsion as far as possible using the strength of the arms, legs, feet thighs and hips. Orthodox is one of styles in shot put. It is usually used by athletes in competition because is still relatively easy compared to other styles.

## 2. Research Method

The research approach used in this study is research and development, chosen based on the suitability of the objectives to be achieved in the form of a development model for Android-based shot put distance measurement tool or system.

### 2.1. Place of Research

The study was conducted at the East Jakarta Rawamangun Athletic Stadium.

#### Refresh Subject

The subjects of this study consist of 12 shot put athletes from Sports Faculty State University of Jakarta. In details, there are 8 male athletes and 4 female athletes in the range of 17-20 years old. In general, they have large and tall posture and relatively big strong muscles.

## 2.2. Data Collection Technique

Data collection techniques in this study; (1) Field observation where the research subjects were being analyzed, and (2) Interviews, direct communication with athlete trainers.

### 1) Observation

The observation was held to find out and observe the situation and its conditions regarding the instrument used and other supporting facilities at the research site. Researchers participate directly as a process of observing according to the circumstances in the field.

### 2) Interview

Interviews were conducted with the trainers.

## 2.3. Data Collection Instruments

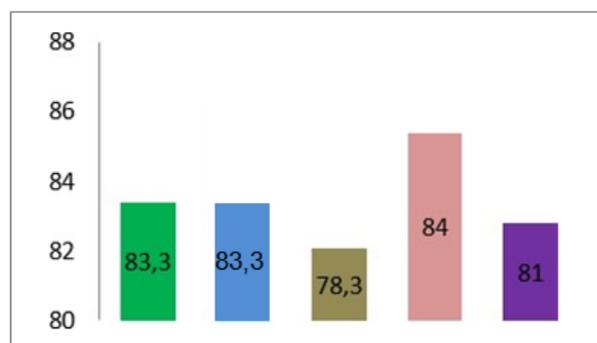
The instrument in this research development is to use several data collection methods. Sugiyono stated [25] the questionnaire is a data collection technique by giving written questions to respondents. Questionnaire can be in a closed/ open question/ statement. According to Sugiyono the types of questionnaires are divided into three; (1) Multiple choice questionnaire, (2) Checklist. (3) Rating scale [25].

## 2.4. Data Analysis Technique

Data analysis includes all the activities of clarifying, analyzing, using, and drawing conclusions from all data collected in action. Whereas quantitative data were obtained by giving a score on a qualitative based on a Likert scale that was converted to a scale value of 4. The Percentage is intended to find out the status of something that is presented through a percentage. The formula for calculating eligibility according to Sugiyono is as follows. The results of subsequent data calculations are made in the form of a percentage multiplied by 100% and in the four categories of eligibility by using the Scale as include [25]. Percentage of Eligibility Category by Arikun [25].

Note: (1): Strongly disagree / very improper, (2): Not appropriate / not feasible, (3): Appropriate / feasible, (4): Very appropriate / very feasible.

## 3. Results and Discussion

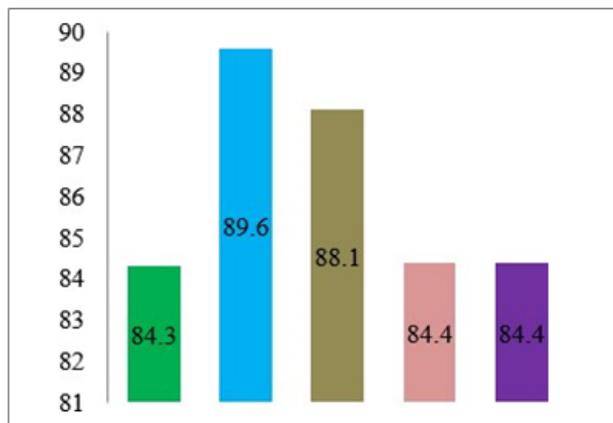


Captions:

Originality
Superiority
Usage
Safety
Implementation

Figure 1. Diagram of Small Scale Trial Results

Based on the diagram figure 1 above, the results of large-scale group trials in the aspect of originality the android-based shot put gauge obtained 83.3% in the "Good" category. It means that the android-based shot put gauge is "feasible" to proceed to the stage of tool implementation. The superiority aspect of android-based shot put measuring devices gaining 83.3% in the "Good" category that show digital-based athletic measurement test kits are "feasible" to proceed to the stage of tool implementation. The aspect of the use of android-based shot put measuring instruments obtains a score of 78,3% in the category of "Good". It also means that the android-based shot put gauge is "feasible" to proceed to the stage of tool implementation. The safety aspect of the android-based shot put measuring device scores 84% in the "Good" category, showing that the android-based shot put gauge is "feasible" to proceed to the stage of tool implementation. The aspect of using android-based shot put measuring devices has a value of 81% in the category of "Good" meaning that the android-based shotgun gauge is "feasible" to proceed to the stage of tool implementation. So the average value of the results of large-scale group trials is 81,98% in the category of "Good" which means that the android-based shot put gauge is "feasible" to proceed to the stage of tool implementation.



Captions:

Originality
Superiority
Usage
Safety
Implementation

Figure 2. Diagram of Small Large Scale Trial Results

Based on the diagram figure 2 above, the results of a small trial in the diagram in the aspect of originality the android-based shot put gauge has an 84.3% score in the "Good" category meaning that the android-based shot put gauge is "feasible" to proceed to the large-scale trial phase after being corrected accordingly with the advice given. The great aspect of the android-based shot put measuring device scores 89.6% in the category of "Good" which means that the digital-based athletic measurement measuring instrument is "feasible" to proceed to the large-scale trial phase after being corrected in accordance with the advice given. The aspect of the use of android-based shot put gauges with a score of 88.1% in the category of "Good" means that android-based shot put gauges are also "feasible" to proceed to the large-scale trial phase after being corrected in accordance with the advice given. The safety aspect of android-based shot put gauges is 84.4% in the "Good" category, meaning that android-based shotgun gauges are "feasible" to proceed to a large-scale trial after being corrected according to the advice given. The aspect of using an android-based shot put gauge has an 84.4% score in the "Good" category meaning that an android-based shot put gauge is "feasible" to proceed to a large-scale trial phase after being corrected as the advice given. So the average value of the results of small-scale trials is 86.2% in the category of "Good" which means that the android-based shot put gauge is "feasible" to proceed to the large-scale trial phase after being repaired.

#### 4. Discussion

This development research is based on the needs of the members of the PASI organization who currently do not have an Android-based throwing number measurement

tool yet. So, with the existence of this development product, this can be used by all people and organizations of PASI. This tool is named Ucok Distance Measuring (UDM). Development research conducted by Insook Kim and Bomna Ko conclude that, in the world of education there is also a need for development between K-12. Thus, development research is very effective to be used as a research method[29].

The Android-based Orthodox style shot put gauge products are as follows:



#### 1. Novelty

The novelty of this development research includes various aspects, in terms of technology used, the function of the tool, and the shape of the measuring instrument which certainly has a difference with the previous measuring devices.

#### 1) Novelty of Technology

Table 1. Compare the Types of Technology Used in Manufacturing Tools

Alge Distance Measuring Devices (ADMD) (Theodolites)	Ucok Distance Measuring (UDM)
Tripod	Tripod
Target	Microprocessor
Prismatic Reflector	Penahan Laser
Serial Cable	Laser
Null Modem/gender Changer	Scrup Penyambung Laser dan Penahan
Sighting Unit	Tombol pengukur
Battery Charger	Dudukan Peyambung Tripod
Battery	Led Android 14"

Based on a detailed table 1 of the technology components used in making each measure above, there are many different types of components used. In terms of the price per unit component, of course, the UDM shot put gauge components are cheaper and easier to obtain. Then the most prominent thing is, UDM has used Android 14

"LED technology as a supporting component in the operation of tools that have been connected with the Android smartphone application.

## 2. Novelty of Usage

Android-based UDM shot put gauge is quite easy to understand by its usage. The applications are accessible through the smart phone or android application so the users can use and know the results in any circumstances without coming to the exact location. The procedure is not complicated as after conducting the test. The data will be stored in the application automatically, making it easier for users to access the document results of the tests performed. The results also can be directly ranked, so the determination of the champions can be immediately known unlike in Alge system as the calculation is manual and takes a long time, errors often happen as human errors is normal and inevitable which can harm the athletes.

Thus, in UDM system, the track record of each athlete will be stored properly, so it will be more objective and trustworthy. The trainer will also simply evaluate and make reference data when compiling an exercise program. Particularly for the umpire and judges of the shot put, a transparent judging process as the data of the results can be known by the audience, coaches, athletes, and other media through the existing monitor display.

## 5. Conclusions

Based on several stages of validity test and expert validity, the calculation of small-scale group trials and large-scale group trials obtained an average. The result of the small-scale trial average value is 82% in the "Good" category, which means the Android-based shot put measuring instrument is "feasible". Furthermore, the average value of the large-scale group trials is 86.2% in the "Good" category, which means the Android-based shot put measuring instrument was "feasible" for measuring the Orthodox style. Android-based in orthodox shot put measurement test instrument is feasible and recommendable to be applied to measure the results of shot put. Future research can develop further in sensor system however the sensors used in UDM devices use laser sensors.

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# Jakarta Athletics Training during the COVID-19

Aisya Kemala, Khurotul Aini\*, Elly Diana Mamesah

Department of Physical Education and Health Recreation, Islamic University 45 of Bekasi, 17113, Bekasi, Indonesia

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**Abstract** In 2019, all countries experience the corona virus including Indonesia. The spread of the Covid-19 virus outbreak caused obstacles in the athletics training process. This study used a Google form help questionnaire by asking 10 questions to 104 Elite athletes respondents in DKI Jakarta. The results showed 100% were athletes in DKI, as many as 65.4% stated that athletes experienced co-19 effects. As many as 73.1% said exercise could still be done during the outbreak, 76.9% of athletes stated that the training program was conducted well online. 26.9% respondents said the exercise was done online with the trainer. As many as 87.4% of athletes knew the training procedures online 25% had difficulty training with online trainers; 34.6% did not always and 40.4% had no difficulties. 64.4% of respondents stated online exercises made the training process easier and 35.6% said there were no obstacles. Barriers to equipment availability are the most dominant experienced by athletes. The results found that online training is suitable for athletes to use in the new normal era.

**Keywords** Athletic, Athlete, COVID-19

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## 1. Introduction

During the pandemic, the results of the study stated that community activities were more sedentary, resulting in physical inactivity [1]. This virus can spread by close contact, which includes large droplet spray and inhalation of microscopic droplets, and by indirect contact via contaminated objects[2]. World Health Organization (WHO) has developed a strategy for interruption of human-human contact, isolation of patients at an early stage, identification and reduction of transmission from animal sources, address of the important mystery about the virus and accelerate research, communicate information properly to the public and minimize social and economic impacts [3].

### Case

Location	Confirmed ↓	New cases (last 60 days)	Cases per 1 million people	Get well	Died
The whole world	20,624,316		2,652	12,831,800	749,421
Indonesia	132,816		498	87,558	5,968
Jakarta	27,153		2,521	17,449	959
East Java	26,220		675	19,125	1,931
Central Java	10,944		338	7,008	751
South Sulawesi	10,675		1,210	7,450	338

<https://news.google.com/covid19/map?hl=id&mid=%2Fm%2F03ryn&gl=ID&ceid=ID%3Aid>

Figure 1. Data on covid-19 cases in Indonesia,

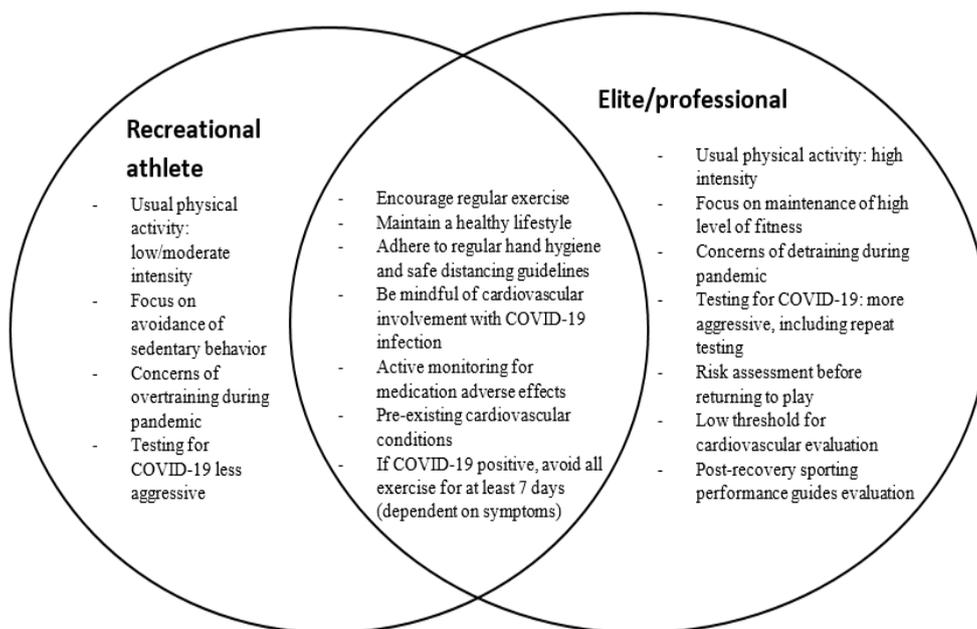


Figure 2. Considerations for sport and exercise amidst the Covid-19 pandemic

Confirmed data as of August 13, 2020, as many as 132,816 Covid cases in Indonesia were confirmed and 27,153 cases occurred in Jakarta, 17,449 were declared cured and 959 died. The highest confirmed cases of Covid-19 occurred in the Jakarta area than in other regions in Indonesia, so that community activities outside the home need to be reduced. Sports activities are mostly carried out outdoors or in open spaces and require a wide scope of space such as fields and buildings which are places for mass gathering or crowds. The closure of all sports facilities forced everyone to do sports at home with limited facilities and infrastructure. The activity of doing sports at home is usually called TFH (Training From

Home). TFH can be done alone or with a companion such as a teacher or trainer. The importance of awareness of healthy living during the Covid 19 pandemic makes everyone take the time in the morning to sunbathe, adjust a healthy diet and do physical activity at home. This is an effort to keep the body's immune system stable and avoid the spread of the Covid 19 virus. Another important issue is that we cannot exclude that Covid-19 infection can cause chronic health consequences [4]. The considerations for sports actors, whether recreational athletes or elite athletes during the pandemic [5] can be seen in Figure 2 above:

This consideration is certainly important for

professional athletes to maintain performance even in times of a pandemic. The development of achievement in the scope of DKI Jakarta Province is carried out in several phases, starting from the pre-adolescent, adolescent, junior to adult stages. Acting as an athlete has a responsibility to keep training in this pandemic. The coaching carried out is divided into several phases according to the age category, both from the Sports Club Level, POPB (Continuous Sports

Training Center) which is intended for Athletes aged under 14 years, PPOP (Student Sports Training Center) who is under 17 years old, PPLM (Central Student Training Education) aged 18-24 years and adult athlete level at PELATDA (Regional Training Center). It is likely that the transition from junior to adult level in high performance sport is a complex process that involves a unique mix of genetic and environmental influences [6]

So it is precisely the development of achievements in the Athletic Branch in DKI Jakarta Province from adolescence to Adulthood aims to provide the best performance. It is not surprising that the DKI Jakarta Province has become a barometer of the progress of sports achievements in Indonesia. Of course, it is not only the government that is fully responsible for the achievements, but the cooperation between coaches and athletes which plays a very important role in determining sports achievements in Indonesia. Applying such training program for adolescent athletes is certainly different from the training portion for adult athletes, It is recommended that young athletes keep training diaries not only with the view of understanding their training loads but also to understand the loading implications of their attendance, performance, and health [7]. So that giving different volume, intensity and training program items is necessary because the growth and development of the physiology of adolescent and adult athletes is different, and the age of training is also the reason why the provision of training portions is different. Evaluating training monitoring data is crucial to ensure that athletes are exposed to sufficient training to prepare them for the requirements of competition, whilst ensuring the athletes are appropriately adapting to the training program [8]. Social support is also needed by athletes to support training performance to avoid decreasing athlete's performance. The results of research conducted by the results obtained will be the level of urgency of the coach's social support to the positive feedback perception and development of athletes during the competition [9].

The implementation of TFH of an athlete must be supervised by their respective coaches, so that the training program can be monitored and evaluated directly through electronic media. The relationship between coaches and athletes is a very close relationship, like the relationship between parents and children, brothers and sisters, even like siblings. It is believed that such a methodological strategy would allow us to more clearly determine how

the coach's perspective influences their athlete's perceptions of the coach athlete relationship as well as their ensuing subjective well-being [10]. The role of online methods is considered good and effective for athletes and coaches can provide training programs and evaluate movements through online such as Zoom, Google Meet or any media that can be done live or in person.

Training monitoring is about keeping track of what athletes accomplish in training, for the purpose of improving the interaction between coach and athlete [11]. Of course there are many obstacles that will be faced by athletes, including deteriorating physical condition, difficulties in facilities and infrastructure to nutrition problems. In this condition, athletes must be able to exercise independently and be self-disciplined, the role of the coach is of course not easy, especially in making a varied training program that can make athletes not get bored and maintain body condition to stay in shape. Some of the problems that arise from Covid-19 in athlete training activities such as no competition, no group training, in some countries there is no outdoor training and no doping tests[12]. The government's decision to cancel all sports events by the end of this year has made athletes only undergo training programs that are maintenance or maintaining body condition. Unable to burn the exercise program because there is still a corona virus everywhere and worrying that heavy training will make the athlete's body's physical condition drop / body immunity decrease so that it is easy to catch viruses / bacteria.

The pandemic has demonstrated the importance of public health. Individual and community actions influence health outcomes. Local protection is used to protect patients and health staff, while regional public health is carried out by planning measures to prevent transmission of the virus [13]. The COVID-19 virus can be transmitted by close contact through respiratory droplets (such as coughing) and by fomites (any inanimate object or substance capable of absorbing, retaining, and transporting contagious or infectious organisms) and COVID-19 can persist on inanimate surfaces such as metal, glass, or plastic for up to 9 days if there is no inactivation by surface disinfection procedures. Given this alarming scenario, a strategy to effectively combat COVID-19 is to maintain physical distance from other people, a term commonly referred to as social distancing [14] The habit of maintaining personal hygiene and health creates new habits for Indonesian athletic athletes, Covid has changed human health habits which require the introduction of a health care system to create a new normal [13]. Activities in normal new activities certainly experience changes in training activities. Covid 19 has caused a lot of harm to athletes. For athletes, significant reduction in training and loss of physical performance capacity can mean loss of competitiveness upon returning

to competition [14]. It's necessary to collect data on training for athletes in the new normal era at this time.

## 2. Research Methods

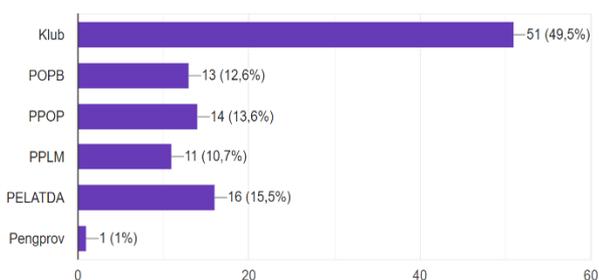
In this study using descriptive qualitative research methods that are using Google form help questionnaire. Data analysis applied percentage techniques. The data were collected from research subjects with a total of 104 respondents conducted on 12-16 June 2020. The data collection technique was done by giving a questionnaire to all respondents via Google form. The following is part of the instrument, including: (1) origin athlete and (2) online exercise.

## 3. Result

Based on the results of collecting a questionnaire via Google Form, the following results were obtained:

### 3.1. Origin of Athletes

Distribution of the origin of the athlete's training center is presented in Figure 3 below:



**Figure 3.** Distribution of origin athlete training center

The distribution of data in Figure 3 shows that 49.5% of respondents came from clubs, 12.6% from the Center for Continuing Development (POPB), 13.6% from the Student Sports Training Center (PPOP), 10.7% from the Student Training Center. (PPLM), 15.5% from Regional Training (Pelatda) and 1% from DKI Pengprov

### 3.2. Online Exercise

Several other aspects included in the questionnaire for athletes in athletic sports are about online exercise, which are obtained in the table 1.

According to table 1, the respondents in this study were professional athletic athletes who were registered under the auspices of the DKI Jakarta Provincial Government, from the beginner school to university. The impact of Covid-19 on the training process shows that 65.4% stated that Covid-19 had an impact on the athlete profession and 34.6% stated that Covid-19 had no impact on the athlete's

profession. the results obtained were 73.1% stated that they had done exercises online and 22.1% stated that sometimes the exercises were done online. As many as 26.9% stated that the training material has been carried out well, 52.9% stated that sometimes the material was presented well and 20.2% stated that the training material was not conveyed properly online. In carrying out daily exercises accompanied by a trainer online, 26% Respondents stated that daily exercises were done online with the coach, 52.9% sometimes and 20.2% did not. 87.4% of athletes have already known online training procedures and 12.6% have not known online training procedures. 64.4% Respondents stated that online made the training process easier and 35.6% said they did not. The finding revealed that the implementation of athletic training routine in DKI Jakarta during pandemic period has already been going well. however this requires refinement of social media as a liaison between coaches and athletes [15]. The results of other studies suggest that the use of social media continuously can reduce the aim of the exercise, so that the use of social media must be improved for better quality.

**Table 1.** Specific data of Column/Row

No	Aspects	Respondents' answer		
		Yes	No	Sometimes
1	Respondent profile	100%		
2	The impact of covid-19 on the professional athlete	65.4%	34.6%	
3	Distribution of online exercises in the new era	73.1%		22.1%
4	Distribution of online exercise material delivery	26.9%	20.2%	52.9%
5	Online daily exercises	26%	20.2%	52.9%
6	Distribution of online exercise procedures	87.4%	12.6%	
7	Distribution of ease of exercise when done online	64.4%	35.6%	

## 4. Discussion

Based on the results obtained, it is known that athletic training activities for athletes in the DKI Jakarta Province in the new normal period can still be done both offline and online. In online training, athletes are assisted by a coach virtually even though there are various obstacles during training. The offline / direct implementation is carried out by paying attention to health protocols, such as wearing masks, maintaining distance and washing hands. Covid has forced people to keep their distance and prevent the spread by continuing to exercise and staying active at home [16]. Sports events that are almost entirely conducted on a competitive basis are delayed at all levels [17]. This is because there is a strategy from a public

health program to anticipate the spread of Covid-19 through limiting interactions between individuals [18].

Sports activities that have great potential to create mass groups are now transformed into activities that are carried out independently

[19]. Sports activities at home cause many athlete problems such as career disruption, social communication, disruption of effective training and postponement of race events [20]. To minimize the pressure faced by athletes, it is necessary to recommend physical activity that can be done in their respective homes. During a pandemic WHO recommends 60 minutes/day of moderate-to-vigorous physical exercise activity for children aged 6–17 years, and vigorous 75 minutes / week or 150 minutes / week moderate physical activity for adults and adults, including 3 and 2 days / week, respectively, by strengthening muscles and bones [21]. In activities in the new era, it is normal for athletes to do physical activity outside the home because of the need for standard sports facilities and to support the athlete's cognitive and affective conditions. Participants reported the number of minutes spent in outdoor physical activity per week along with the importance of nature and whether the activity occurred in a natural environment. Moreover, a certain item of the natural entanglement scale is utilized based on its impact on physical activity behavior. The natural connectedness scale asks questions about natural relationships in the context of measuring a person's cognitive and physical affective relationships with nature[22]. In training activities in the new normal period, coaches and athletes must follow the recommended health protocols.

Using effective hand hygiene practices to prevent and control infection [23]. Simulation facilities (SF) should provide appropriate hand sanitizing agents. For washing hands, plain soap is sufficient. In the absence of water, alcohol-based cleaners can be used as recommended by the World Health Organization (WHO). The hand rub formulation can also be prepared by SF according to WHO guidelines. Instructions on how to rub and wash hands provided and posters published by WHO can be used. Training activities during the Covid-19 period no longer aim to achieve achievements, now they have switched goals to maintain physical condition, reduce injuries, maintain movement quality and maintain the psychological condition of athletes [5]. The difference in the need for exercise for recreational athletes and professional athletes is very different during a pandemic. Professional athletes need to prepare themselves for upcoming race events and need access to standard sports facilities, a team of professional coaches which results in the need for physical activity outside the home [2], thus offline training is also required by professional athletes.

For professional athletes, towards the new normal that will be implemented by the government, the training program provided by the coaches is still in general preparation with of maintaining performance. Meanwhile,

special training programs, pre-competition and competition cannot be implemented. This is because there are no events held this year. Athlete training programs that are usually carried out at home in the new normal can already be done at the stadium but in a limited number of athletes and a limited time. Meanwhile, the health protocol must still be applied.

## 5. Conclusions

The purpose of this study was to find the suitability of sports training using online training for athletes in DKI Jakarta, Indonesia in the normal new era. The results showed that in the new normal period which is very necessary to maintain personal health and the environment, it shows that online and offline training activities can still be carried out properly by athletes, although there are some problems, if done online there are some difficulties such as limited quota, difficulty making movements which is true if you do not receive direction from the trainer, limited exercise equipment at home and must use health protocols when done offline or face to face in the field. Some training problems that are needed by athletes must be reviewed by the coach so that current activity deficiencies can be properly resolved.

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# The Appropriation of Product Design as Solution to Minimise Risk of Exertional Heat Illness among Marathon Runners

Mohd Najib Abdullah Sani<sup>1,\*</sup>, Azrul Amri Amran<sup>1</sup>, Muhammad Jameel Mohamed Kamil<sup>1</sup>,  
Hanim Romainoor<sup>2</sup>, Louis Ringah Kanyan<sup>3</sup>

<sup>1</sup>Department of Product Design, Universiti Sains Malaysia, USM, 11800, Penang, Malaysia

<sup>2</sup>Department of Graphic Communication Design, Universiti Sains Malaysia, USM, 11800, Penang, Malaysia

<sup>3</sup>Design Technology Programme, Universiti Malaysia Sarawak, Kota Samarahan, 94300, Sarawak, Malaysia

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**Abstract** The intensity of environmental heat stress during a marathon race increases the runner's metabolic heat production. Based on series of participatory studies and interview sessions with 100 respondents among runners, the contributing factors to this homeostatic imbalance risk are the excessive amount of body-water deficit from extensive sweating, and the rapid increase of cardiovascular and thermal strain while running. In addition, environmental factors such as humidity, the increase of air temperature, wind speed and solar radiation contribute to the marathon runner's low performance during running with the paucity of cooling strategy that results in the increase of core body temperature with symptoms of exertional heat illness. This paper elucidates the integration of the statistical and theoretical studies of exertional heat illness and the human physiological responses complementing with the product design context. The integration demonstrates the synchronisation of design thinking process within the ergonomics ergosystem framework to develop the appropriate prototype design for marathon runners. As outcome, this research has successfully developed a running suit as its design proposal to minimise exertional heat illness risk and promote the runner's safety, wellbeing and performance in the heat.

**Keywords** Environmental Heat Stress, Exertional Heat Illness, Design Thinking, Prototype Design

## 1. Introduction

This paper is a study about the risk of exertional heat illness among marathon runners within the context of product design research. The main objective of this paper is to demonstrate the possible extension of the statistical and theoretical studies complementary with the design practice that aims to generate further product design innovation coherency to the user need through the development of Vapor X suit prototype design. Furthermore, this study demonstrated de Looze [1] propagation on (1) comfort is affected by factors of a various nature (physical, physiological, psychological) and (2) comfort is a reaction to the environment. The development of this Vapor X suit was based on the ergonomics ergosystem framework. This framework was adopted from the structural ergonomics view of work system by Bridger [2] (Figure 1) and adapted by Mohd Najib [3] (Figure 2). The framework consists of sets of

elements that relate between one another to the surrounding parameters. The foundation of the framework consists of the synchronisation of ‘people’ and ‘machine’ interactions to form a function towards designing and producing some form of output. The auxiliary elements in the form of matter, design criteria and information, supply input that varies between the levels of human performance research as propagated by Bridger [2]. This research adapted the framework as a template for the optimisation of the system’s operations to develop the Vapor X suit. This template can also be applied to other design disciplinary fields such as industrial design, engineering, environmental medicine and operations research. This study is considered as the first report to objectively understand the runner’s endurance and physical condition during a marathon race. The study synchronises the application of ergonomics ergosystem framework with various factors that are taken into consideration such as human physics, psychology, anatomy, physiology and engineering, and utilises the Design Thinking process to illuminate the improved thermal sensation and thermal comfort of the Vapor X marathon running suit design. The explanation provided in relation to the Ergonomics and Design Thinking relevancies, the demonstration of the prototype design process aspires to give a larger spectrum to the body of knowledge that would in turn lead to further design research exploration based on the integration of cross-disciplinary studies with Sports Science relevancy.

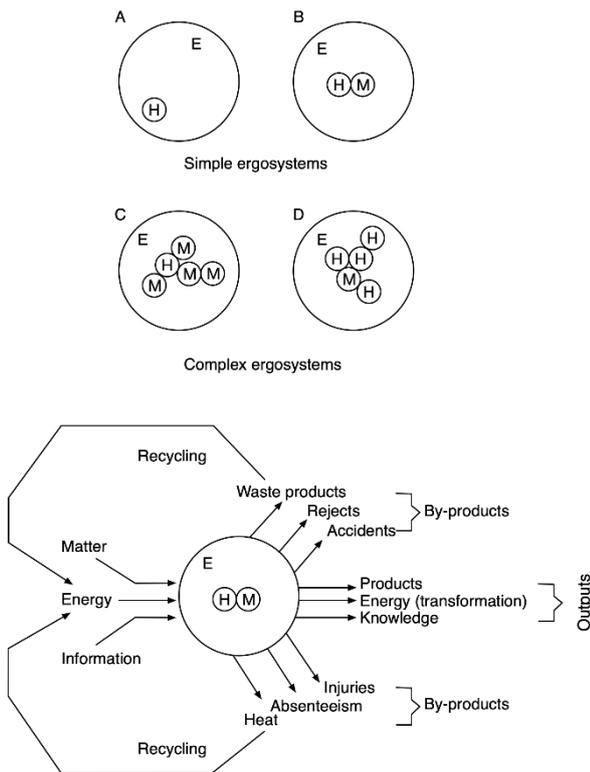


Figure 1. The structural ergonomics view of the work systems (Ergosystem) as propagated by Bridger [2].

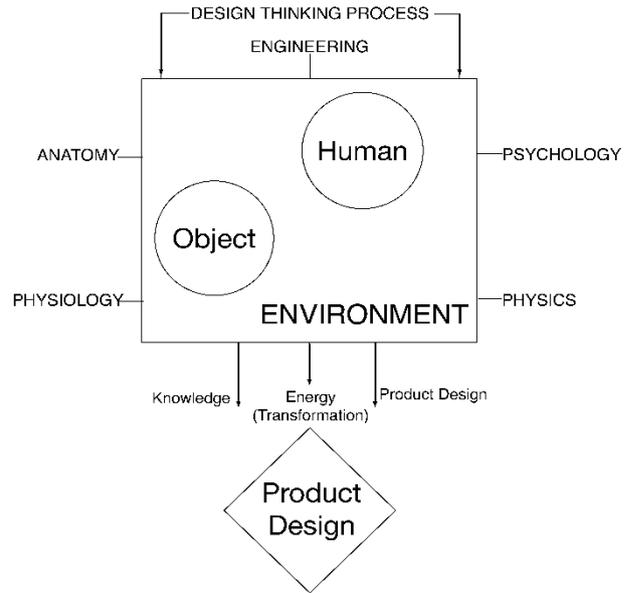


Figure 2. The Mohd Najib [3] ergosystem framework redesign based on Bridger [2] work system

## 2. Materials and Methods

The Vapor X suit was created to address the needs of the marathon runner to minimise the risk of exertional heat illness. A series of participatory studies were conducted to observe and experience the marathon race at 5 different series of local Malaysian marathon event, including interview sessions with 100 respondents among runners: 80 respondents during the day events and 20 at night event to understand further the runner’s endurance and physical condition during the marathon race. The average temperature for the day events was 36° to 37° degree Celsius and 28° degree Celsius at night.

### Symptoms of heat-related illness experienced by runners during a marathon race

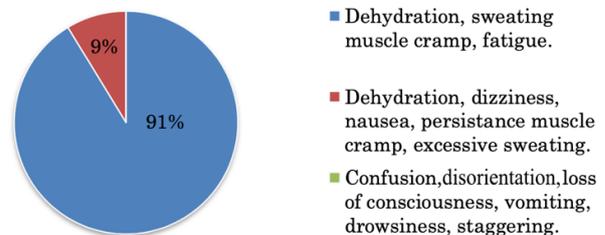
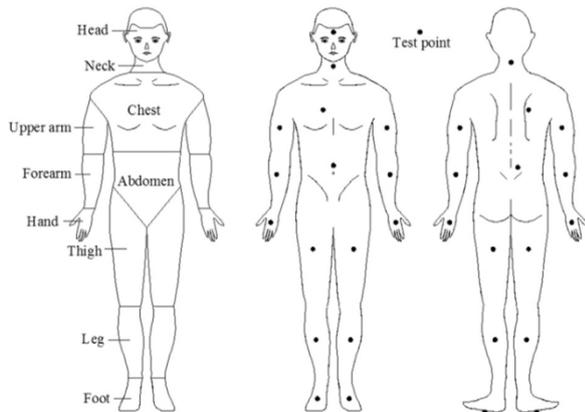


Figure 3. The marathon runners’ heat-related illness symptoms survey results based on the runners’ responds at the 5 local marathon events.

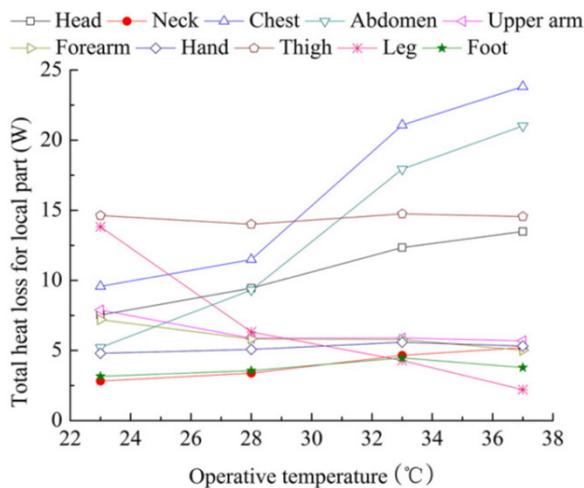
### 2.2. Design Development

The design development process was steered by the foundation set by Lijuan Wang et. al [4], who investigated

the effects of operative temperature and total heat losses, and the relationship between the heat loss and thermal sensation. Their research, that is also in accord with previous researchers such as Ouyang [5] on Clothes Hygiene, Hasebe et. al [6] Usefulness of ReR Interval and Its Variability in Evaluation of Thermal Comfort, Huizenga et. al [7] Skin and Core Temperature Response to Partial- and Whole-Body Heating and Cooling, Zhu [8] Building Environment, Shi [9] Numerical Simulation of the Influence of Clothing on Human Thermal Comfort and Wang and Yu [10] The Temperature-Regulating Function of Clothing, finds that the thigh, leg and chest experience much heat loss in low temperatures, while the chest, abdomen, thigh and head face great heat loss at higher temperatures. This data is significant for clothing design.



**Figure 4.** The divided parts of human body and the significant points of each part of the body tested by Lijuan Wang [4] for heat loss factors and effects



**Figure 5.** Lijuan Wang et. al [4] summary of total heat loss for the body, used as the foundation in prototyping the Vapor X suit.

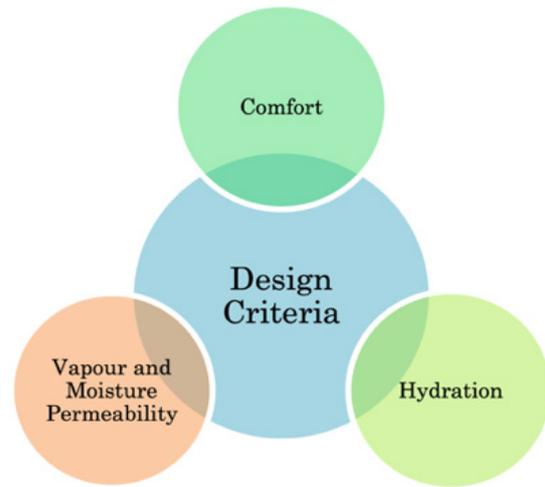
Figure 5 establishes the significant guideline for clothing design. The design development involving the synchronisation of the ergonomics ergosystem framework and design thinking process that informs a comprehensible design direction is as follows:

2.2.1. Phase 1

Gaining an empathetic understanding of the problem.

2.2.2. Phase 2

Generating ideas and outlining the design criteria (Figure 6) based on understanding of the users and their needs and having analysed and synthesised the observations in Phase 1 to produce a human-centred problem statement. This involved brainstorming session, sketching, detail drawing on paper and technical 2D (Figure 7) and 3D CAD modelling.



**Figure 6.** The Vapor X suit design criteria

2.2.3. Phase 3

The prototype technical aspects are investigated; flaws in the design were re-examined and rectified on the basis of the users' experiences. At the end of this stage, the researchers and designers obtain a better idea and clearer view of the constraints inherent to the running suit, understand how real users would behave, think and feel when using the end product (Figure 8).

2.2.4. Phase 4

Testing the completed Vapor X suit using the best solutions identified during the prototyping phase. Although this is the final stage of production, in an iterative process, alterations and refinements are made to rule out problem solutions and derive as deep an understanding of the running suit and its users as possible.

2.2.5. Phase 5

The final working prototype is established and confirmed following the serial iteration phases that involve garment alterations to fit the appropriate comfort of the user's psychological and physiological response. The aspects of aesthetic properties concerning the current sportswear style or fashion and the technical consideration emphasising on the garment ventilation system for the thermal and body movement comfort are the key properties confirming the finished end product.

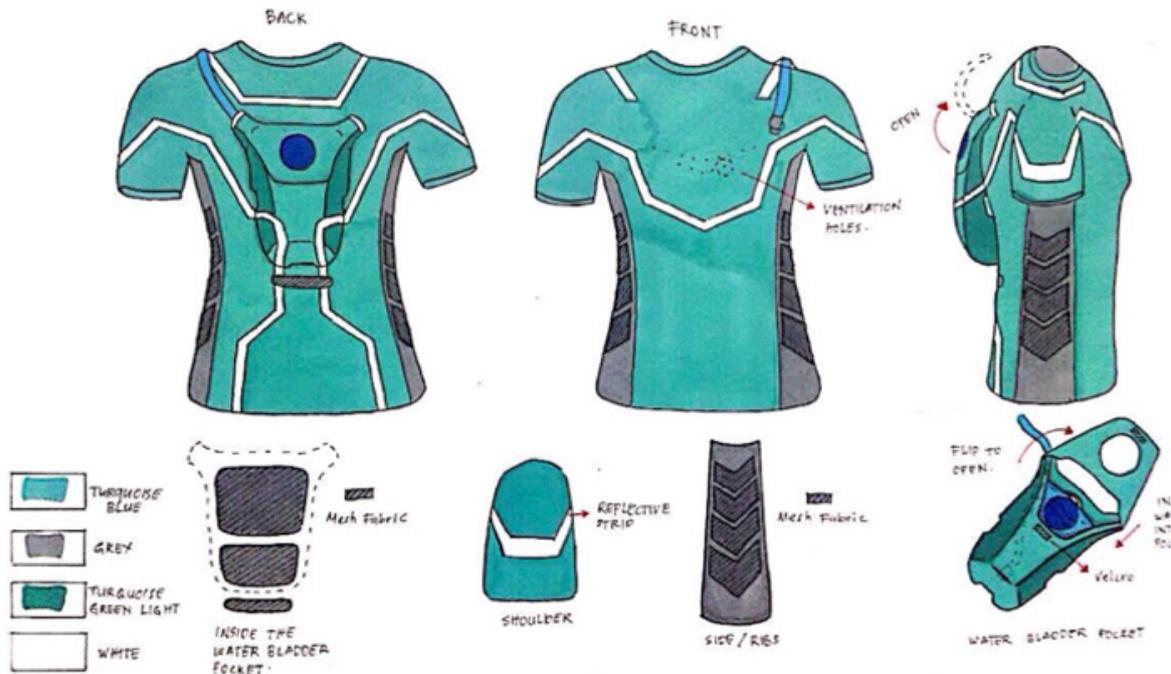


Figure 7. Detail drawing on paper and technical 2D.

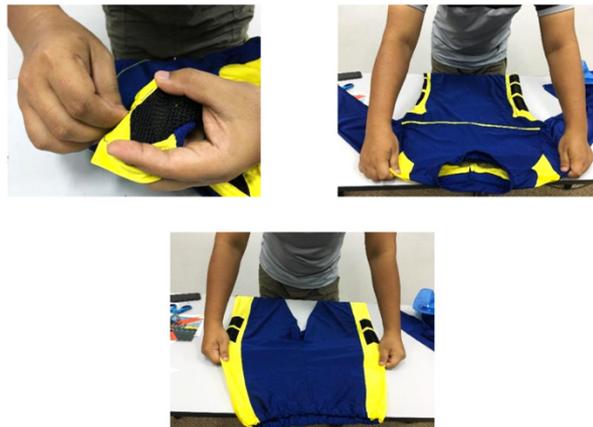


Figure 8. The prototyping processes

### 2.3. Results and Discussion

The design of the Vapor X suit has established the possible integration of the statistical and theoretical study complementing with the product design context. By implementing the design thinking process and aligned with the design criteria that comprises of (1) comfort, (2) vapour and moisture permeability and (3) hydration, Vapor X provides zonal cooling that incorporates ventilation system designed at the width of the chest and both sides of the suit high waist to dissipate heat and improve the runners' physiological response and cardio-respiratory fitness. The two-litre hydration bladder pocketed at the runner's dorsal, aggrandised the cooling and performance enhancement strategies featured in the

design of the running suit. The hydration bladder will be filled with water and cooled in the freezer prior to the running event. The bladder coldness will be sustained during the running and the runners warm body temperature will slowly melt the frozen water and making it convenient for the runner to drink from the hydration bladder tube that attached at the runner's shoulder. In terms of runners' safety on the road, this suit is also sewn with reflective fabric to ensure the runners' visibility during day and night running. The integration of Sports Science studies and the Product Design research context extend Vapor X sportswear definition to an unconventional perspective. The aesthetic design, the fusion of materials in the garment construction and prescribed with the ergonomics criterion have predominantly established this significance. In addition, the synchronization of the empathic protocol in the Design Thinking research process demonstrates the importance of user's input, given that the users are considered as significant stakeholder in design practice. In this regard, the functionality and the usefulness of designed product are determined by the issue addressed by the user. The Vapor X suit is a preventive countermeasure to enhance thermal comfort and a cooling strategy to minimise the risk of heat illness through the engagement of the product design research context. The design criteria have successfully outlined the user's need for thermal comfort in the running suit. However, user testing on the suit's performance is required to validate the appropriateness of the suit design to provide thermal comfort for the runner in a running event.



**Figure 9.** The Vapor X suit design tailored based on the total heat loss for local part and the cooling strategy outlined in the design criteria.

### 3. Conclusions

This research has successfully developed a running suit as its design proposal to minimise the risk of exertional heat illness, to promote runners' safety, their wellbeing and performance in the heat. Ergonomic comfort characteristics such as (1) thermo physiological comfort, (2) tactile comfort, (3) physical dexterity and (4) psychological comfort, are significant to the construction of active sports garments such as running, in parallel to what is proposed by Vishal and Rajesh [11]. What is associated with the construction of comfort running suit is

the use of knitted microfiber polyester fabric that promotes greater body dynamic movements and the transmission of body vapour.

### Acknowledgements

Vapor X copyright number: AR2018005138 is patented under the ownership of Universiti Sains Malaysia.

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# The Relationship of Running Agility and Speed with the Ability to Dribble the Student Participants in the Extracurricular Futsal Activities

I Bagus Endrawan<sup>1,\*</sup>, Martinus<sup>1</sup>, Rabwan Satriawan<sup>2</sup>, Khairul Amar<sup>2</sup>

<sup>1</sup>Faculty of Teacher, Education Science and Language, Universitas Bina Darma, 30264, Palembang, Indonesia

<sup>2</sup>Program Study Physical Education and Recreation, STKIP Taman Siswa, 84113, Bima, Indonesia

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**Abstract** Futsal is one of the many games favored by people in all parts of the world. Those who play this kind of big ball sport have a special preoccupation. Many futsal tournaments are held in regions, from student level to club level. This is of course a great opportunity for sports lovers in general and futsal in particular. Apart from clubs, futsal is also very popular among students ranging from elementary, junior high, high school to tertiary institutions in Indonesia, especially in the Palembang area. The purpose of this study is to determine the relationship of agility and running speed to the ability to dribble students extracurricular participants futsal Public Junior High School, the method used is the correlation, and the sample amounted to 20 men who follow extracurricular students. Data analysis used is simple correlation analysis for each independent variable with related variables, whereas for together with double correlation of research result between variable X1 with Y obtained  $r_{hitung} = 0,586 > r_{tabel} 0,444$  then  $H_0$  rejected and  $H_a$  accepted, variable X2 and Y obtained  $r_{hitung} = 0,792 > r_{tabel} 0,444$  then  $H_0$  rejected and  $H_a$  accepted, and variables X1, X2 with Y obtained  $r_{hitung} = 0,817 > r_{tabel} 0,444$  then  $H_0$  rejected and  $H_a$  accepted and value  $F_{hitung} = 17,044 > F_{tabel} 3,59$  means  $H_0$  rejected and  $H_a$  accepted. Because the three variables show a positive direction, it can be concluded that there is a relationship between agility and running speed to the ability to dribble students extracurricular participants futsal

Junior High School.

**Keywords** Agility, Running Speed, Dribbling Capability

## 1. Introduction

Futsal is one of the many games favored by people in all parts of the world. Those who play this kind of big ball sport have a special preoccupation. Muhammad Mulyono, (2014) [10]. Many futsal tournaments are held in regions, from student level to club level. This is of course a great opportunity for sports lovers in general and futsal in particular. Apart from clubs, futsal is also very popular among students ranging from elementary, junior high, high school to tertiary institutions in Indonesia, especially in the Palembang area. One of the schools that have futsal extracurricular activities, based on the results of interviews with extracurricular advisers, futsal is the most popular activity.

Jhustus Lhaksana, (2011) [7], this game itself is carried out by five players for each different team with eleven soccer players per team. The size of the field and the size of the ball are smaller than the size used in grass

field football. To get good performance in futsal, of course, must be supported by better mastery of basic techniques. The basic technique of playing futsal includes several things. According to Sukirno, (2010) [17], The basic techniques that must be mastered in playing futsal are passing, holding the ball (control), chipping, dribbling, shooting, dribbling an important role in futsal, according to Jhustinus Lhaksana, (2010) [7], dribbling technique is an important skill and absolutely must be mastered by every futsal player.

Dribbling is the ability each player has in possession of the ball before it is given to his friend to create opportunities to score goals. Agility and speed are needed by a futsal player in dealing with certain situations and match conditions that require elements of agility and speed in controlling the ball and in defending in avoiding collisions that occur. Based on my observations, students who take part in extracurricular activities do not all have basic skills, especially the ability to dribbling is still relatively low, it can be seen that when they play it is still difficult to bring the ball to the point closest to the goal. Meanwhile, the dribbling test is still rare, so it is not known how much the students' agility and speed towards the dribbling skill.

The extracurricular participants also do not know much about what factors influence them to be able to dribble well. Therefore, to achieve this target requires maximum effort to develop students' dribbling skills by providing an understanding of the factors that influence dribbling techniques. In 2016 the extracurricular has participated in inter-school futsal competitions several times but has yet to get any achievements, this is also a reference that students Junior High School still needs improvement in basic techniques of playing futsal. For this reason, the first thing to do is to measure the extent to which students have the basic skills of dribbling the ball, as well as knowing what things affect them in order to dribble well. Dribbling requires good skills and support for good physical conditions such as agility and speed.

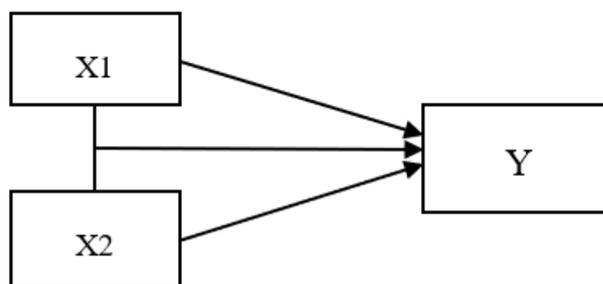
According to Ismaryati, (2011) [6], agility is one component of physical fitness that is indispensable in all activities that require rapid changes in body position and its parts. Agility is also needed in freeing oneself from opponent's control by dribbling the ball.

According to Teguh Sutanto, (2016) [18], speed is the ability of the fastest movement. In terms of the motion system, velocity is the basic ability of the central nervous system's mobility to display movements at a certain speed. From a mechanical point of view, velocity is expressed as the ratio between distance and time. Based on the description above, the writer would like to conduct a research entitled: "The Relationship of Running Agility and Speed with the Ability to Dribble the Student Participants in the Extracurricular Futsal Activities for Junior High School".

## 2. Material and Methods

This research is a correlation study. According to Suharsimi Arikunto, S, (2006) [15], correlation research aims to find out whether there is a relationship and if there is, how close the relationship is and the meaning or not the relationship is.

Research design is a design made by the researcher, as a prefix to the activities to be carried out. Suharsimi Arikunto, (2006) [15]. Besides that, to find out whether there is a relationship between the objects to be studied. The research design is divided into two, namely agility data collection (X1), running speed data collection (X2) and dribbling ability data collection (Y), so that the data for variable X can be correlated with variable data Y. The research framework can be described as follows:



(Source: Sugiyono, (2010) <sup>[13]</sup>)

Information:

X<sub>1</sub> : Agility

X<sub>2</sub> : Running speed

Y: Ability dribbling futsal

**Picture 1.** The Research Framework

Variables are anything in the form that is determined to be studied so that information about it is obtained, then the conclusion is drawn. Sugiyono, (2011) [14]. Research variables are basically everything in any form determined by the researcher to be studied in order to obtain information about it, then.

The variable X in this study is as follows:

- Agility in futsal extracurricular activities at Junior High School.
- Running speed for futsal extracurricular participants at Junior High School.

As for the dependent variable in this study is the ability to dribble futsal.

The operational definition in this research is the agility in this research is the body skill of the futsal team players at the Junior High School, to move quickly in all directions, namely the ability to start and stop making movements quickly as measured by the dogging run test in seconds.

## 3. Result and Discussion

This research was conducted to determine the

relationship between Agility and Running Speed on the ability to dribble the Futsal Extracurricular Participants in Junior High School. This research was conducted at 31 Palembang State Junior High School. The subjects of this study were male students who took part in extracurricular activities totalling 20 students.

This study consisted of three variables, namely two independent variables (Agility and Running Speed), and one dependent variable, namely the ability to dribble. Furthermore, the variable is represented as X1 for agility, X2 for running speed, and Y for the dependent variable of the ability to dribble in futsal extracurricular students. The tabulation of rough data from measurement results can be seen in the:  $r_{hitung} = 0.792 > r_{tabel} = 0.444$  then  $H_0$  is rejected and  $H_a$  is accepted, meaning that the correlation in this study is positive, so it can be stated that there is a significant relationship between running speed and the ability to dribble. And the closeness of the relationship is strong because the coefficient (Pearson correlation) = 0.792 means strong.

From it can be seen that the Pearson correlation value between the Agility variable and running speed on the ability to dribble is obtained  $r_{count} = 0.817 > r_{table} = 0.444$  then  $H_0$  is rejected and  $H_a$  is accepted means that the correlation in this study is positive, it can be stated that it means there is a significant relationship between running agility and speed on the ability to dribble. And the closeness of the relationship is very strong because the correlation coefficient (pearson correlation) = 0.817 means that it is very strong.

1. The third hypothesis states "There is a significant relationship between running agility and speed on the ability to dribble for students participating in the extracurricular activities at the Junior High School."
2. That the Pearson correlation value between the Agility variable and running speed on the ability to dribble is obtained  $r_{count} = 0.817 > r_{table} = 0.444$  then  $H_0$  is rejected and  $H_a$  is accepted means that the correlation in this study is positive, it can be stated that it means there is a significant relationship between running agility and speed on the ability to dribble. And the closeness of the relationship is very strong because the correlation coefficient (Pearson correlation) = 0.817 means that it is very strong.
3. If the probability value is  $0.05 > \text{Sig. F change}$ , then  $H_0$  is rejected and  $H_a$  is accepted.

The probability value (sig.F change) = 0,000 is obtained because the sig.F change value is 0,000  $< 0.05$ , then the decision is that  $H_0$  is accepted and  $H_a$  is rejected. This means: agility and running speed are simultaneously and significantly related to the ability to dribble.

**Table 1.** Distribusi nilai Ftabel Significance 5% dan 1%

N	The level of significance	
	5%	1%
1	0.997	0.999
2	0.950	0.990
3	0.878	0.959
4	0.811	0.917
5	0.754	0.874
6	0.707	0.834
7	0.666	0.798
8	0.632	0.765
9	0.602	0.735
10	0.576	0.708
11	0.553	0.684
12	0.532	0.661
13	0.514	0.641
14	0.497	0.623
15	0.482	0.606
16	0.468	0.590
17	0.456	0.575
18	0.444	0.561

## 4. Discussion

It is well known how important agility is for almost any sport. Therefore agility must always be included in the physical condition training program for players. In doing dribbling in the futsal game, agility is needed in dribbling so that the dribbling is done better and optimally. Therefore agility affects the results of futsal extracurricular dribbling. At present stage, one of the most important tasks of physical education at second year of children's studying in comprehensive educational establishment is their rational adaptation to new conditions of educational activity (Klyus O.A, (2014)) [9].

Inconsistent findings have been reported on risk factors for metabolic syndrome. However, the majority of conducted studies have suggested the positive effects (Seyyed Reza Attarzadeh Hosseini and Keyvan Hejazi, (2016), [12].

If the results obtained are linked to the framework of thought and the theories that underlie it, basically the results of this study support the existing theory. This can be explained that if the athlete has good or normal agility, he will be able to dribble well and optimally.

Participants in the exercise condition showed a larger decrease in two of the three indicators of study-related fatigue (i.e., overall fatigue and need for recovery) as compared to controls. Additionally, sleep quality and some indicators of cognitive functioning were improved more among exercisers than among controls. No effects were found for self-efficacy, and physical fitness. The initial effects of the exercise intervention lasted at follow-up (T2 and T3). At 12-week follow up (T3), 80% of participants in the exercise condition still engaged in regular exercise, and further enhancements were seen for emotional exhaustion, overall fatigue, and sleep quality (Juriena D. de Vries, Madelon L. M. van Hooff, Sabine A. E. Geurts, Michiel A. J. Kompie, (2016)) [8].

Agility and running speed are needed and it can be said in all sports, therefore the physical elements, namely agility and running speed in futsal, have many factors that must be considered. One of the factors is physical condition, among others, agility and running speed, because the agility and running speed really support good dribbling skills in futsal games. Flexibility is the ability of an individual to move the body and its parts through as wide range of motion as possible without undue strain to the articulations and muscular attachments. Flexibility provides another dimension in performance that allows a higher degree of freedom and ease of movement coupled with some important implications for greater safety from injury. (Govind B. Taware, Milind V. Bhutkar, Anil D. Surdi, (2013)) [4].

Exercise is an integral part of human life. Referring to the classical principle of mens sana in corpore sano (a healthy soul exists in a healthy body), it is time for exercise to be a part of education today (Rabwan Satriawan, (2019)), [11].

That increased body mass correlates with decreased cardiorespiratory and musculoskeletal fitness. Interventions should be developed to target these important components of physical fitness in this demographic group, (Emmanuel Bonney, Gillian Ferguson, and Bouwien Smits-Engelsman, (2018)) [2].

## 5. Conclusions

The results of the research and discussion that have been described earlier can draw some conclusions. The following are some of the conclusions drawn:

1. There is a positive and significant relationship between Agility and the ability to dribble for students participating in the futsal extracurricular Junior High School.
2. There is a positive and significant relationship between running speed and the ability to dribble the students participating in the futsal extracurricular Junior High School.
3. There is a positive and significant relationship between Agility and Running Speed with the ability

to dribble for students participating in the futsal extracurricular Junior High School.

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# The Impact of Beta Brain Waves in Improving Cognitive Function through Brain Jogging Applications

Yudy Hendrayana<sup>\*</sup>, Jajat Darajat Kusumah Negara, Nuryadi, Agus Gumilar, Martina Lesyiana

Department of Sport Education, Faculty of Sport Education and Health, Universitas Pendidikan Indonesia, Bandung, 40154, Indonesia

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**Abstract** Cognitive function is a process of thinking systematically, logically, and analytically. In the present study, it is indispensable and has an important role in the learning process's success. The enhancement of cognition could change a person's behavior for the better. The thought process depends on the brain's electrical activity and a person's mental condition, which is indicated by brain waves, beta waves. Beta waves affect a person's concentration and awareness. Improvement beta waves on adolescents are positively correlated with improved cognitive function. In addition to cognitive function, they are stimulation by brain jogging or brain exercise. Brain jogging is a mental exercise model that combines cognitive and multitasking. This study used an experimental method with brain jogging treatment intervention for eight weeks, with 17 students who had met the sampling criteria. The beta wave measurement results increased significantly by 19.92% or (16.99±8.48 vs. 20.38±9.34) with a p-value of 0.0001\*\*. Cognitive function increased significantly by 44.36% or (290.88±31.92 vs. 419.94±97.01) with a p-value of 0.0001\*\*. Meanwhile, the Pearson correlation test results between beta waves and cognitive function in the pre-test obtained  $r = -0.642$  with a determinant coefficient of 0.054 or 5.4%, there was no significant correlation, while in the post-test it was obtained  $r = 0.482$  with a determinant coefficient of 0.232. or 23.2% with a p-value of 0.050\*. Research and analysis of brain jogging treatment have been shown to improve cognitive function and affect beta waves.

**Keywords** Beta waves, Cognitive Function, Brain Jogging

## 1. Introduction

Cognitive factors have an essential role in the success of students in the learning process. The ability of cognitive function will have a positive impact on students' learning outcomes. Therefore, we need a method or formula to improve students' cognitive function and look for any factors that can affect cognitive function development. Cognitive concepts refer to the ability to process information, apply knowledge, and change trends [1]. In line with the theory of Jean Piaget in [2] found that cognitive development is the combined result of maturity, maturity of the brain and nervous system, and adaptation to our environment.

Cognitive activity is an individual behavior that has an impact on gaining knowledge. In addition, cognitive is also a mental condition because of indirect observations of cognition. Hence, cognition cannot be measured directly but through observable behavior. According to Mayers, Cognition refers to all mental activities associated with thinking, knowing, remembering, involves many modes of understanding, such as perception, imagination, reasoning, observation, response, memory.[3] Cognition also involves forms of recognition, such as observing, seeing, watching, imagining, giving, guessing, and

judging. Cognitive is always the main thing to determine someone in responding, thinking, processing information, storing information to get a pattern from a new environment [4].

Cognitive function is a conscious mental activity such as thinking, remembering, learning and using language. Similar research with that cognitive function consists of 5 domains: Attention and Concentration, Memory, Visuospatial, Language, and Executive Functions. Concentration is one of 5 cognitive processes. Cognitive enhancement may be defined as the amplification or extension of the mind's core capacities by improving or augmentation of internal or external information processing systems [5]. The benefit if someone can concentrate well when participating in the learning process in class, including students, will more easily and quickly master the teaching material presented, likewise with four other cognitive function domains, namely memory, visuospatial, language and executive functions which can affect student learning and learning outcomes. To detect someone is focused or not and could be analyzing through brain waves [5].

Sports science researchers have been interested in the relationship between brainwaves and sports performance. In the normal activities of EEG,  $\theta$  and  $\delta$  activities are rare or non-existent. The activated cortex can produce  $\gamma$  activity and  $\beta$ , and sometimes  $\alpha$  activity [6]. Most researchers working on brainwaves in the past focused only on closed-skill precision sports and found that the  $\alpha$ -wave in the temporal lobe region is the basis of closed-skill sports [7]. Brain waves are divided into five distinct parts, which create a spectrum of levels of human consciousness. Brain waves can change throughout the day, which is influenced by the activities carried out. The activities carried out can be influenced by several factors: a person's emotional condition, adequate sleep time, and a person's stress condition. The brain is made up of billions of brain cells called neurons. Each neuron communicates with each other (establishes a relationship) by emitting electric waves. The electrical waves released by neurons in the brain are called brain waves. So what is called brain waves are electrical activities released by the brain? [8]. Similar research with the description above states that brain waves can be categorized into 5 (five) categories, namely delta, theta, alpha, beta, and gamma. Brain waves related to cognitive function are beta brain waves. The state of alert and full concentration is strongly influenced by beta brain waves (13-30 Hz) in beta brain waves, our mind remains sharp and focused on activities[9].

From the problems described above, it can be seen that cognitive function plays an essential role in the learning process. One way to influence cognitive function is the application of brain jogging, including light exercise and brain exercise.[10] Brain jogging is a mental exercise model that combines cognitive and multitasking. One of the mental training programs that can be given to students

at school is brain jogging training.[11] This training model provides new inspiration for every individual in mental training, especially in improving cognitive function. In its implementation, brain jogging combines three critical elements: cognitive, multitasking, and physical activity[12]. After reviewing several studies, results show that brain jogging affects increasing concentration, as proven by that the brain gym method affects improving students' concentration skills.[13] The other research found that brain jogging is one of the training methods to improve one's cognitive and mental aspects. This study proves that brain jogging training can significantly influence self-confidence and skills learning outcomes.[14]–[16].

## 2. Material and Method

The research design used pretest - posttest control design and experimental research that was carried out in one group randomly selected. This study population was 30 students who are members of the Softball Student Activity Unit at the Indonesia University of Education. The sample was selected based on simple random sampling amount 17 subjects that met the inclusion criteria, namely the Body Mass Index in the healthy category, had no history of chronic disease, as a beginner softball player or with less than one year of training experience, and gender Male. The research instruments used in this study included cognitive function (attention, memory, language, visual, executive function), measurement of attention with a grid exercise concentration test; memory measurement with digit span test; language, visuospatial, and executive function with tests of academic potency. Neurosky Mindwave Mobile's beta brain wave measurement is an electroencephalograph (EEG) research instrument that detects gamma brain waves in the frequency range 12-38 Hz range. WujiBrain software for mac v.127

Research protocol, all research subjects get information and socialization about the aims and objectives of the research. Furthermore, it continued by filling in the Inform Consent. Then the initial beta brain wave data were collected while performing cognitive function tests. The research intervention was carried out eight weeks three times per week, namely the application of the brain jogging program. After completing the treatment, the final data measurement was carried out again with the same test instrument as the initial test. Data were collected and analyzed using the comparative independent t-test analysis to compare the gain score between experiment groups with control groups data. The end of the study was analyzed and concluded according to the research objectives.

### 3. Result

Table 1. Demography of research subject

Parameters	Mean ± SD	Min	Max	N
Height (m)	1,68 ± 0,05	1,60	1,77	17
Weight (Kg)	64,06 ± 9,63	49	82	
BMI	22,54 ± 3,04	18,90	30,86	

BMI: Body Mass Index

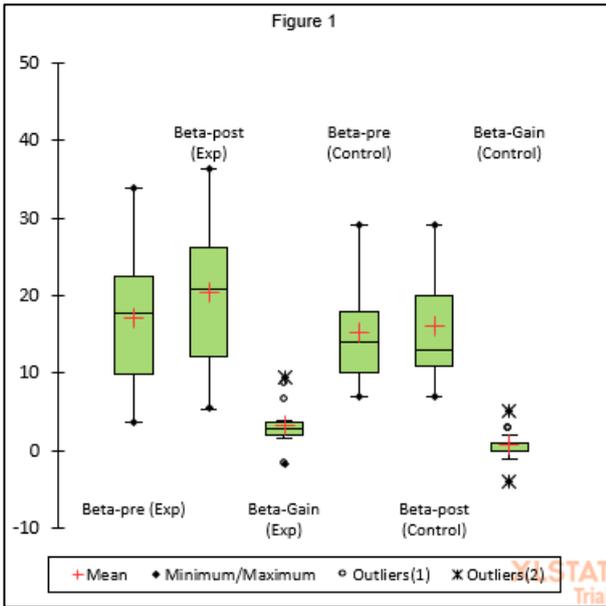


Figure 1. Beta waves data are shows of pre-post on experiment groups, (16,99 ± 8,23 vs. 20,38 ± 9,06). Pre-post on control groups, (15,24 ± 6,66 vs. 16,01 ± 6,92). Gain score the beta waves between experiment and control groups: (3,38 ± 2,65 vs. 0,82 ± 1,94).

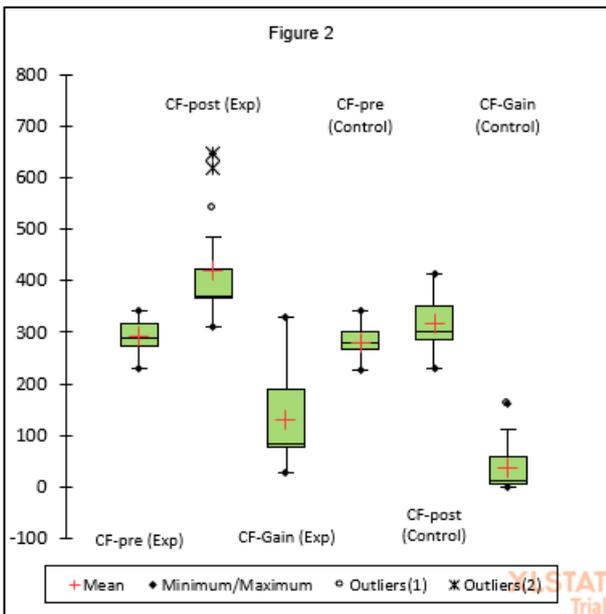


Figure 2. Cognitive function data are shows of pre-post on experiment groups, (290,88 ± 30,97 vs. 419,94 ± 94,12). Pre-post on control groups, (110,45 ± 130,24 vs 318,24 ± 50,29). Gain score the cognitive function between experiment and control groups: (129,06 ± 95,87 vs 37,49 ± 45,63).

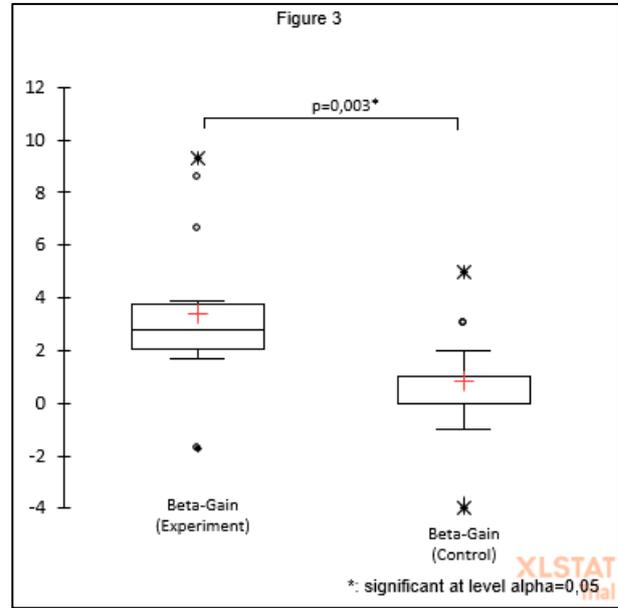


Figure 3. The result of independent t-test statistical analysis on beta wave experiment groups (19,92%) compare to control groups (5,41%). There is significant difference at p-value 0,003\*.

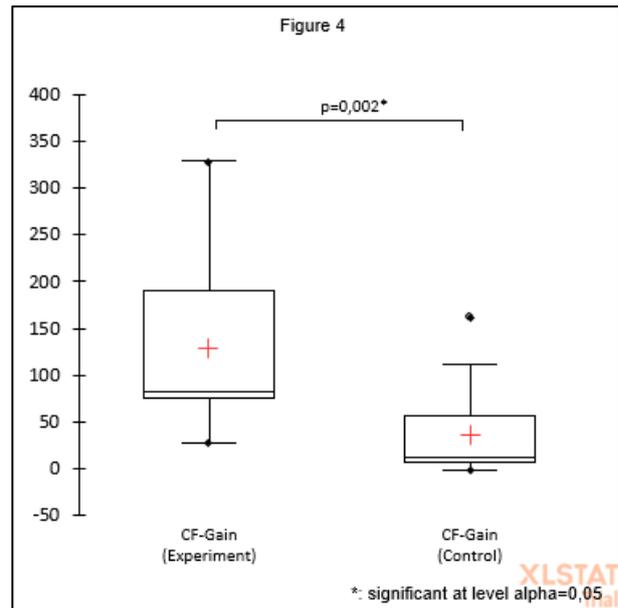


Figure 4. Base on independent t-test on cognitive function variable, experiment groups (44,37%) compare to control groups (13,35%). There is significant difference at p-value 0,002\*.

### 4. Conclusions

The results of the paired t-test analysis on beta wave variables and cognitive function showed a significant difference. That means that the application of the brain jogging treatment could affect beta waves and cognitive function following the aim of this study to determine the effect of brain jogging [17], which interacts with beta waves and cognitive function. The other side is with

research conducted by Jang et al. found that the increase in beta waves is a neurofeedback and can affect cognitive function improvement [17], [18]. The results of other studies suggest that brain jogging can improve cognitive and mental function.[13]. Beta wave and cognitive function have a similar increase on students who treated brain jogging application. Similar to this finding, significant enhancements of  $\beta$ -wave were found in some studies using bicycle dynamometer to perform high-intensity exercise and incremental intensity exercise [19], [20]. Youngstedt et al., observed that after acute exercises, although there were no correlated changes of body temperature and anxiety state, the brainwave activities of  $\beta$ -wave showed an upward trend. This study we found no significant differences in  $\beta$ -wave during running before the heart rate reaching [20]. However, when the heart rate of the participants exceeded 75–85% of the maximum heart rate in the process of high-intensity exercises, a decreased  $\beta$ -wave activity was reported when oxygen was lacking in the brain and blood flow [21]. Fumoto et al., observed participants performing bicycle ergometer exercise for 15 min and found that  $\alpha$ -wave was significantly increased in the accelerating process of exercise. In our study,  $\alpha$ -wave showed an upward trend but no significant differences in the running. It is contradictory at the beginning of the study, namely that an increase does not match the increase in beta waves in cognitive function. Several studies have found that beta waves can improve cognitive function.[5], [17], [27], [28] exercise even though the heart rate reached 150 min<sup>-1</sup> [22].

More significant amounts of physical activity and higher cardiorespiratory fitness levels are associated with better cognitive function in older adults [23]. For example, older adult athletes outperform their more sedentary peers on many different cognitive tasks, and fitter individuals are faster and more accurate on executive functioning and memory tasks [24]. Longitudinal studies of physical activity have also found that engaging in a greater amount of physical activity earlier in life is associated with better cognitive function later in life, [25] with larger effects for individuals engaging in more intense exercises. However, cross-sectional and longitudinal observational studies are often plagued by confounding factors that make it challenging to make causal claims about the link between physical activity and cognitive function.[26] Evaluation in each process and learning tools can solve learning problems[29].

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This research will be dedicated to the progress and development of softball and baseball athletes in West Java province and the Indonesian elite athletes.

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# Development of a Creative Gymnastics Model to Improve Basic Locomotor Movements for Students in Elementary School

Palmizal A.<sup>1,\*</sup>, Dian Pujianto<sup>2</sup>, Nurkadri<sup>3</sup>, Anak Agung Ngurah Putra Laksana<sup>4</sup>

<sup>1</sup>Faculty of Teacher Training and Education, Universitas Jambi, Jambi, 36361, Indonesia

<sup>2</sup>Faculty of Teacher Training and Education, Universitas Bengkulu, Bengkulu, 38371, Indonesia

<sup>3</sup>Faculty of Sport Science, Universitas Negeri Medan, Medan, 20221, Indonesia

<sup>4</sup>Faculty of Teacher Training and Education, Universitas Mahadewa, Denpasar, 80235, Indonesia

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**Abstract** This study aims to produce a creative exercise learning model for the basic locomotor movements of elementary school students. This study uses the Research & Development (R&D) development research method from Borg and Gall in Sugiyono. The small group test consisted of 10 students at the State Elementary School 40 / XI Talang Duku, Muaro Jambi Regency, the item model, in the large group trial of 18 students with 28 model items. The 10 students' effectiveness test used the locomotor test with the one-group pretest-posttest design by obtaining the effectiveness test value with an average pre-test result of 34.30 and an average post-test result of 69.90 with sig. 0.00 then the data is declared homogeneous. Therefore, the data read is equal variances assumed, so the t-count is greater than the t-table ( $20.463 > 2.26216$ ) with a significant expectation of 1%, df 9 and sig. (2-tailed) = 0.000 < 0.05 with an explanation of the application of the creative exercise learning model for basic locomotor movements of elementary school students effectively. Based on the results obtained, it can be concluded that: (1) With this creative exercise learning model, students can learn more effectively and efficiently, (2) with this creative exercise learning model, an increase is shown in the pre-test and post-test results. There is a significant difference.

**Keywords** Learning, Creative Gymnastics, Locomotor

## 1. Introduction

Education plays a very important role in creating the quality of human beings. This is because that education is a planned effort to create an atmosphere of learning and the learning process so that students actively develop their potential to have religious-spiritual strength, self-control, personality, intelligence, noble character, and skills needed for himself, society, the nation, and the state [1].

Learning is a relatively permanent change in behavior or potential behavior as a result of strengthened experience or practice. Learning is also a form due to the interaction between stimulus and response. "Learning is an activity or a process to acquire knowledge, improve skills, improve behavior, attitudes, and strengthen personality"[2]. These changes occur as a result of an experience or practice, in contrast to changes immediately due to reflexes or instinctive behavior.

Learning basic locomotor movements in elementary schools still shows some problems that can be used as a basis for improvement. For example, the basic locomotor movement of walking (a) Simultaneously swing between one side of the arm and leg (the arm should move freely in

the opposite direction of the leg ), (b) Failure to bend the ankles, knees (stiffness), or hips, causing a bouncing or stiff look, (c) incorrect posture indicated by the forward pulling of the head and torso, rounded shoulders or bending while the hips pushed forward (head and body should be upright), (d) shifting the heel on the floor (pushing up or forward starting from the toes).

Physical education is one of the subjects that must be carried out in school, namely as a main subject that must be followed by all students. This subject has uniqueness compared to other subjects, namely the use of physical activity as a means / media in educating students. "Physical education is education through physical activity by participating in physical activities, and students can master skills and knowledge, develop aesthetic appreciation, develop generic skills and positive attitude values, and improve physical conditions to achieve physical education goals"[3]. Gross Motor Skills Development plays a very important role in the field of Sports Studies. By constantly and scientifically monitoring their gross motor skills in the sports and recreational activities which they are involved in, such as martial arts, it can assure and guide the development of young children motor development. Also, it is important to find out which martial arts would develop more gross motor skills of these children [4].

Basic motion is a repetitive motion that is carried out continuously from the habit and from the experience of their environment. Basic motion development is a process to obtain motion that is constantly developing based on: (1) the process of developing nerves and muscles which is also influenced by heredity, (2) a result of previous experience of motion, (3) current experience of motion. Locomotor movement is a movement characterized by a movement of places, such as walking, running, jumping, and rolling [5]. Locomotor movements are the basis for the development of coordination of movements involving the gross-muscles, muscle growth, endurance and stamina. This movement usually makes children feel happy doing it.

Basic locomotor motion is the basis for various skills that really need guidance, learning and development so that children can carry it out properly. Some of the basic locomotor motion develops as a result of several stages. The process of forming motion does not occur automatically, but is an accumulation and process of learning and practicing, namely by understanding the movements and making repetitive movements accompanied by awareness of the movements being carried out [6]. The purpose of doing the repetition of the basic movements of walking, running and jumping is to improve the basic movement skills that are widely practiced in everyday life.

Rhythmic gymnastics is one of the choices of rhythmic activity in the basic competencies of learning Physical Education and Health. Its implementation must refer to

educational goals, including developing self-skills in psychomotor development and maintenance of physical fitness and a healthy lifestyle through various rhythmic activities at school. Besides, it is also stated that the purpose of Physical Education and Health is to understand the concept of physical activity and exercise in a clean environment as information to achieve perfect physical growth, healthy lifestyle and fitness, skilled, and have a positive attitude.

Gymnastics can educate students to love health. In addition, gymnastics can also be done to relax (peace of mind), for flexibility, freshness, and body fitness which are very important for one's survival. Gymnastics education is unique from other content because it plays a role in sports and daily life by helping people learn to manage their bodies efficiently and safely. Gymnastics is a competitive sport that involves a series of maneuvers that require strength, flexibility, balance and a high level of motor control [7], consisting of a variety of styles including artistic, rhythm-mic, trampoline and tumbling. Gymnastics is carried out on the basis of the principle of cardio rephrased exercise according to Batteneli's opinion, and this exercise is done two to three times a week with an intensity of 60-90% of the maximum pulse. "Gymnastics is a sport that is cheap, fun, mass, interesting and useful.

According to Jhon and Mery, gymnastics has a lot of influence for individuals when they come to exercise with good attitude and respect. "Gymnastics can be fun, exciting, giving a lot of charm, and you will feel confident in yourself and proud of the achievements you can achieve"[8]. Gymnastics will also train walking, running, jumping, strength, balance, rhythm, and flexibility.

One research method that is relevant and can always be used is Research and Development (R&D). Thus development research can be concluded as research that produces a products that have been analyzed beforehand the level of effectiveness in learning, and have been designed, evaluated and revised with the results of the development of the model [9]. In this case, what will be developed is rhythmic exercise with a creative gymnastics model to improve the basic locomotor movements of elementary school children. Therefore this study aims to develop a creative exercise model to improve the basic locomotor movements of students by making exercises that are interesting and easy to follow by students, using rhythms or children's songs that they often hear or sing so that it makes them happier and more.

The conceptual model is an analytical model, which states the components of the product, analyzes the components in detail and shows the relationships between the components to be developed. Theoretical model is a model that draws a frame of mind based on relevant theories and is supported by empirical data. Some opinions about the model that have been explained can be interpreted that the model is a picture that aims to clarify something [10]. The model intended in this research and

development is a pattern description which includes analysis, development, material creation, and evaluation to achieve the learning objectives of rhythmic gymnastics for basic locomotor movements, because learning requires a variety of learning models that can help the process of achieving maximum learning.

## 2. Materials and Methods

### 2.1. Type of Research

Research on the development of rhythmic gymnastics with a creative gymnastics model for basic locomotor movements of elementary school children uses the research and development model of R&D (Research and

Development) from Borg and Gall [11].

### 2.2. Characteristics of the Model Developed

Planning and design are made to provide clear instructions and guidance in conducting research later in learning, planning, and compiling learning models are factors that determine the success of a program. In this connection, the rhythmic gymnastics learning model that will be arranged in the form of modification and creativity in the form of rhythmic gymnastics learning to increase locomotor basic movement will be made and developed in the form of several new learning models and make children happier about learning creative gymnastics models. The characteristics of the learning model being developed are as follows figure 2.[11]

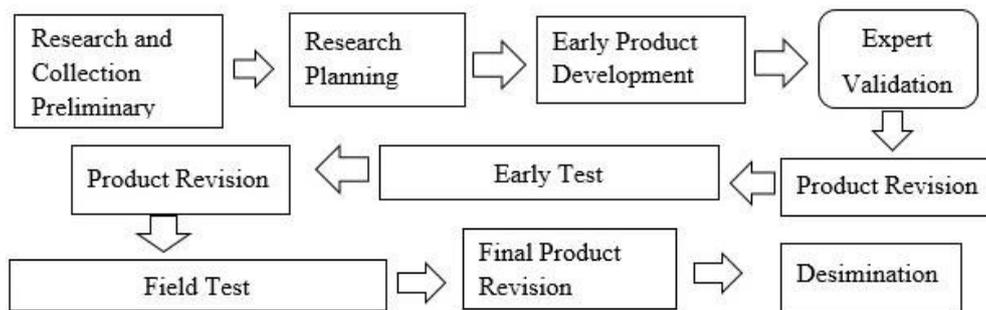


Figure 1. The Borg & Gall Development Model

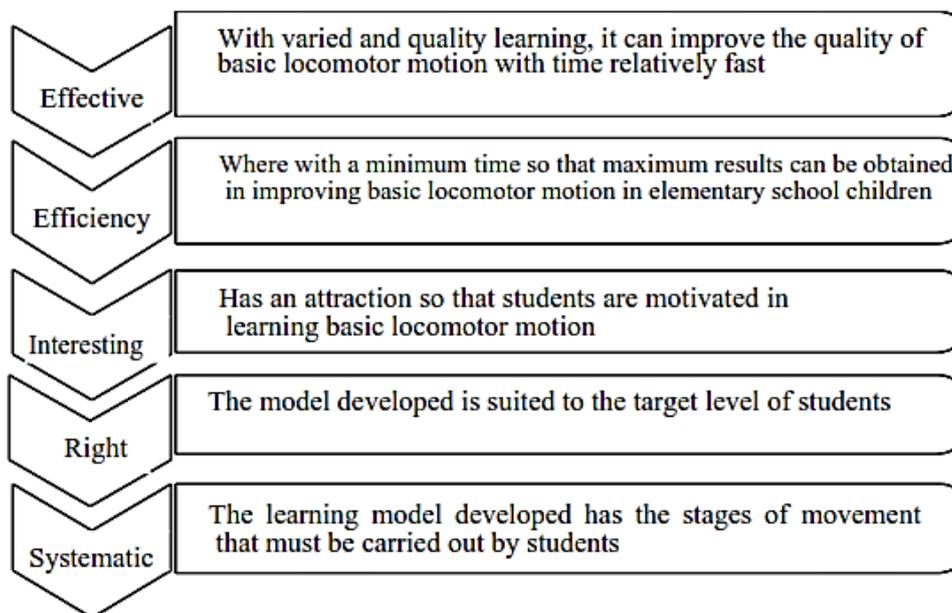


Figure 2. Characteristics of Developed Model [10]

### 2.3. Model Development Steps

The steps taken in the research and development of this model go through the following stages:

- 1) The first evaluation stage is carried out at the design stage of the model form by experts, and the initial evaluation is the first assessment of the experts to (a) determine whether the model is following the characteristics required in the rhythmic gymnastics model with creative gymnastics for basic locomotor movements for elementary school students, (b) whether the learning model developed is suitable for elementary school students' locomotor movement before it is tested, (c) whether the creative gymnastics makes it easier for students
- 2) The second stage of evaluation is carried out at the small group trial stage. In this evaluation, through the results of the response to the learning model in the trial phase, it was carried out by elementary school students, among others. (a) the learning model is easy to learn, (b) the learning model is attractive, (c) the learning model is very effective and others. Results of primary school students' responses based on the learning model development model that has been implemented are evaluations of the improvement of learning model products in elementary school students before the learning model is field-tested in heterogeneous groups of abilities and a larger number of students.
- 3) The final evaluation stage is carried out at the large group field test stage and the skill level is heterogeneous. The results of student responses to the learning model are the same as the questions in the previous evaluation stage which will later be a revision of the improvement of the results of rhythmic gymnastics models with creative gymnastics for elementary school students' locomotor movements and implemented. Research and development of this model uses the development steps of the Borg and Gall [11]. The steps for developing the model include the following:

**Table 1.** Description and Subject

Stages	Step	Activity
Pre Development	1	<ul style="list-style-type: none"> <li>• Initial data collection</li> <li>• Preparation of research proposals</li> <li>• Needs analysis</li> </ul>
	2	<ul style="list-style-type: none"> <li>• Designing the model to be applied</li> <li>• Validation by experts</li> <li>• Revise the results of expert evaluations</li> </ul>
Development	3	<ul style="list-style-type: none"> <li>• Small group trials.</li> <li>• 3 Performed with 10 people sample Students</li> <li>• Revise the test results small group</li> </ul>
Application	4	<ul style="list-style-type: none"> <li>• Large group evaluation with a limited scale of 10 students</li> <li>• Product revisions from test results try</li> </ul>
	5	Application or manufacture of mass products

### 2.4. Data Collection

The instrument used in the development of creative exercise model learning for elementary school students' locomotor movements was a questionnaire and a locomotor basic movement skill test. The questionnaire was used for needs analysis and expert evaluation (in phase I trials and phase II trials). The needs analysis questionnaire in this study was used to obtain teacher opinion data on the learning models that have been or are being used and what kind of learning model is desired.

### 2.5. Data Analysis

There are two data analysis techniques used, namely: qualitative analysis and quantitative analysis. If the data obtained is descriptive that cannot be converted into numbers, then the data analysis uses qualitative analysis. While the data collected can be classified or converted into numbers, quantitative data analysis is suitable. The data analysis technique used in this research is qualitative analysis techniques and quantitative analysis techniques. Qualitative analysis techniques are used to analyze data obtained from experts in the form of suggestions and input that cannot be converted into numbers, while quantitative analysis techniques are used to manage data obtained from the results of small group trials and large group field trials and effectiveness testing model.

The formula for processing data per trial subject.

$$P = \frac{X_i}{100\%}$$

Information:

P = percentage of evaluation results of trial subjects

X = The number of score answers by the test subjects

$X_i$  = The maximum number of answers in the assessment aspect by the test subject

$$100\% = \text{Constants}$$

## 3. Results and Discussion

### 3.1. Model Development Results

The results of the creative gymnastics learning model for elementary school students' locomotor movement are written in the form of a script which is presented in various forms of locomotor basic movement learning models.

### 3.2. Needs Analysis Results

After conducting interviews and observations or observations of elementary schools, there are two general objectives to be revealed in the preliminary study or needs analysis, namely, a) How important is the rhythmic gymnastics learning model through creative exercise for basic locomotor movements of elementary school students, especially the lower classes. b). What constraints and

support are found in developing a gymnastic learning model for basic locomotor movements of elementary school students. After carrying out the data collection stage and drafting a creative exercise learning model for elementary school students' locomotor movement, the next step is to do an expert test where the goal to be achieved is to get the feasibility or validity of the model made by direct assessment of the experts. The author validates with 2 experts in assessing the feasibility of creative gymnastics learning models for elementary school students' locomotor movements, 1 person as a material expert, and 1 person as a media expert. The following is a model validation process from experts.

### 3.3. Expert Validation

Based on expert validation from small group trials conducted by the author that there are 28 worthy of the 34 forms of learning models that have been applied, based on expert tests conducted on learning models of creative gymnastics models for basic locomotor movements of elementary school students, the following conclusions can be drawn : (1) Based on the expert test, it can be concluded that the item models 18, 19, 20, 30, 31 and 33 are learning models that are not feasible to be given to students in the primary school category (2) For learning model items 18, 19, 20, 30, 31 and 33, it is still difficult for students to do this in the primary school category. (3) Implementation instructions must be made clear so that they are easy to understand (4) Based on expert testing conducted from 34 items of learning models, 28 items of learning models will be tested at the next stage.

Based on the small group trials, the following conclusions can be drawn: a). All items of learning models can be done and applied but must be adjusted from easy to difficult levels so that elementary school students' basic locomotor mobility can be improved. b). When doing the creative exercise learning model, it is often not serious, the teacher must provide direction so that students can carry out learning correctly according to the teacher's direction so that students will get the expected results.

### 3.4. Model Eligibility

The conclusions from the expert tests carried out are

summarized in the following table: Based on the expert tests conducted, it can be concluded that this creative exercise learning model is feasible and can be used in improving the basic locomotor movement skills of elementary school students: a). The movement model given must be following the level of difficulty for students in the category of elementary school students. b). The facilities or music provided must also be adapted to the category of elementary school students by using children's song music. c). Implementation instructions must be made clear so that they are easy to understand. d). Each given learning model must have clear objectives so that it contributes to basic locomotor movement skills.

### 3.5. Model Effectiveness

#### 3.5.1. First Stage Results / Small Group Trials

The learning model of creative gymnastics for basic locomotor movements of elementary school students that the author made after being evaluated by an expert, then underwent a stage I revision. The data obtained were used as a basis for revision in the first stage, then the second stage trial, getting the results of the revision of 28 model items which are composed of easy, medium, and difficult ones.

The next step after the model underwent a revision from the expert, and it was continued by testing the product in a large group using 10 students as research subjects because they were still in a new normal state taken from Talang Duku public elementary school students of 40 / IX, especially the low class.

**Table 2.** Paired Samples Test

	Mean	N	Std. Deviation	Std. Error mean
Pair 1				
Pretest	34,30	10	3.743	1.184
Post Test	69,90	10	7.249	2.292

**Table 3.** Correlation Test

Pair 1	N	Corelation	Sig
Pre test & Pos test	10	.669	.035

**Table 4.** Paired Differences Test

Pair 1	Paired Differences					T	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pos Test - Pre Test	35.60	5.502	1.740	31.664	39.536	20.463	9	.000

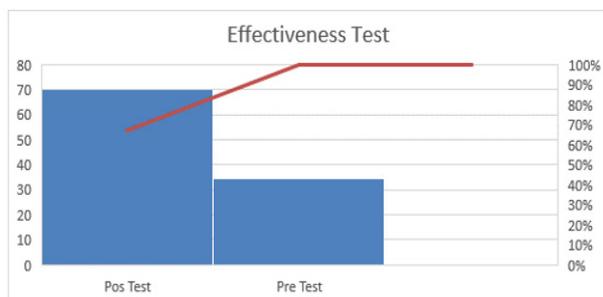
### 3.6. Effectiveness Test of Experiment Group and Control Group

Before carrying out research or providing model treatments, the authors first performed a preliminary test and a final test after the treatment was applied using a locomotor basic movement skill test instrument made and developed by the author and validated by an expert. The treatment of 28 items of the creative gymnastics learning model was divided into 10 meetings. The following is a table of treatment for 10 meetings. Due to the condition of COVID-19, the assessment data was only carried out by 10 students before and after being given a creative exercise learning model treatment for basic school students' locomotor movements and the results of the control group that were not given a creative exercise learning model or treatment as shown in the following table 5:

**Table 5.** Effectiveness Test Data Results

No	Subjek	Effectiveness Test	
		Pretest	Posttest
1	X1	32	74
2	X2	27	62
3	X3	34	69
4	X4	40	79
5	X5	37	70
6	X6	34	68
7	X7	31	65
8	X8	36	77
9	X9	34	57
10	X10	38	78
Average		34	70
Amount		343	699

Based on the results of the output using SPSS 22, it can be seen that the value of the effectiveness test with an average pre-test result of 34.30 and an average post-test result of 69.90 means that from the average value above it can be concluded with the treatment model. learning the basic locomotor movement of creative gymnastics has increased significantly.



**Figure 3.** Histogram Effectiveness Test

## 4. Discussion

### 4.1. Product Enhancements

Based on the research process that has been carried out, creative gymnastics learning model is produced for the basic locomotor movements of elementary school students. This learning model is made so that students are more active in moving and excited, especially in basic locomotor movements of walking, running, and jumping. The foundation for creating or making this learning model based on previous learning models seems monotonous and less creative. Seeing the shortcomings and advantages of the products made, there are inputs that researchers will convey to achieve the improvement of this product, while the input is as follows: a). In this model, it is necessary to adjust the movements of students who use this creative exercise model. b). The characteristics and understanding of students in the primary school category require teachers to provide direct examples and practice for students to learn movements that are new and difficult to do.

### 4.2. Product Discussion

The creative gymnastics learning model created by this author is a product that aims to assist teachers in delivering and providing creative exercise learning material to students, improving basic movement skills, and as a reference for learning materials. This creative exercise learning model is made based on the level of students' needs, especially elementary school students, especially the lower classes. This product, after being reviewed regarding several weaknesses that need improvement, can be conveyed several advantages of this product, including a). Improve basic locomotor movement skills. b). Creative exercise models are more effective and efficient. c). Can help teachers in the learning process at school more interestingly and make students happy. d). As a reference for learning at school. e). This exercise model is done systematically from easy to difficult things. f). The models used are varied and the music or songs used are children's songs that they often sing so that it makes students interested and enthusiastic about carrying out the exercise.

### 4.3. Product Limitations

There are still some limitations that must be recognized and put forward as a consideration for the research achieved. The limitations include the following: a). This research field trial is limited due to the presence of COVID-19 so that the scope and sample are limited, and it would be better if it was carried out in a wider scope. b). The products used are far from perfect. c). The facilities and infrastructure used are still limited. d). The explanation and regulations in the creative exercise

learning model are still far from perfect. e). There are psychological factors that are thought to have contributed to the uncontrolled research results, including interest, trust, and other psychological factors.

The application of cheerful gymnastics is able to improve fine motor skills in early childhood group B children 4-5 years old [12]. Another opinion stated that the RC one rhythm gymnastics learning model for the basic motion of elementary school children is declaredly effective in improving the basic motion of elementary school children [13]. Based on the results, it can be concluded that: (1) With this RC one rhythm gymnastics learning model, students can learn more effectively and efficiently, (2) by RCone rhythm gymnastics learning model, obtained improved shown in the final result. Physical education learning has problems in the learning process due to inadequate facilities and infrastructure that the school has so that students have difficulty in improving basic motion skills [14].

## 5. Conclusions

Based on the data obtained from the research results obtained data in small group trials of 10 students with a model that was applied as many as 34 items of locomotor basic movement learning models, then a revision of the model was carried out to gymnastics experts against the model that the researchers had applied to small group trials, from the revised results then into 28 model items, in a large group trial with a total of 18 students, after a large group trial the researcher revised the model that had been applied to the experts and found that 28 models of rhythmic gymnastics were feasible to be applied to primary school students. Based on the effectiveness test against 28 models to 10 elementary school students, the pre-test average score was 34.30 while the post-test average score was 69.90 with a difference of 35.6. It can be concluded from these data that the creative exercise learning model treatment for elementary school students' locomotor movement has increased so that this model is considered effective, with field trials and discussion of research results it can be concluded that, 1). The learning model of creative gymnastics for basic locomotor movements of elementary school students can be applied. 2). With the creative gymnastics learning model created, it can effectively improve elementary school students' locomotor movement.

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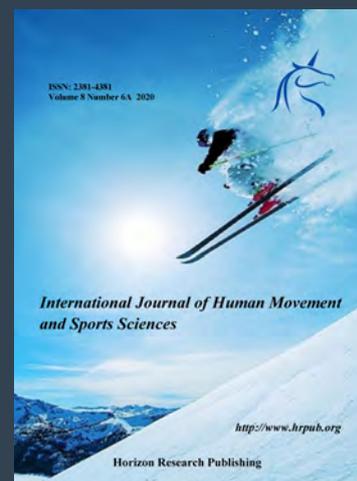
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