

# **Model on Butterfly Swimming for Athletes in the Age 11-13 Years Group**

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## **Abstract**

The development research aims to produce an exercise model on butterfly swimming for athletes in the age group of 11-13 years. This research applies Research and Development (R & D) method. The testing of the exercise model was conducted to 20 athletes, testing for large group to 60 athletes, and effectiveness test to 40 athletes. The effectiveness test of the development model of butterfly stroke swimming found that  $t\text{-calculate} (16.66) > t\text{-table} (2.02)$  and  $H_a$  is accepted. It means that the new exercise model of butterfly stroke swimming is better than the old one. Based on the research findings, it is concluded that the exercise model of butterfly stroke swimming can enhance butterfly stroke swimming skill of athletes in the age group of 11-13 years, this exercise model of butterfly stroke swimming is more effective and efficient; therefore, the athletes are interested in and motivated to practice swimming in the butterfly stroke.

## **Keywords :**

Junior and Youth Sport, Butterfly, Exercise Model, Athlete development

## **1. Introduction**

Based on its function and application, Research and Development method is one form of research method that is relevant and can be used in the education field. It is also widely used to develop teaching materials, learning media, and learning management. In addition, it is a method of connecting or breaking gaps between basic research and applied research (Sukmadinata 2008). Argued that exercise is a systematic activity in a particular long time which is progressively and individually improved and leads to the characteristics of human physiological and psychochemical functions to achieve predetermined goals (Bompa and Haff 2009).

Exercise is a process that involves many aspects of knowledge because it involves body components that need to be systematically developed and science that supports exercises including physiology, motion learning, pedagogy, nutrition, biomechanics, psychology, sports health, tests, measurements, and statistics (Whyte 2009). Stimulation in exercise is needed so that an athlete starts changes in his/ her body (Pupisová et al. 2015). The speed in swimming is very important because it allows swimmers to allocate time as quickly as possible (Sanders et al. 1995). The pace of exercise at various swimming speeds and combinations is an important part of exercise before competition (Messinis and Platanou 2010). Swimming exercises can improve motor skills and basic swimming methods (Ganchar et al. 2017).

Defined motion skills as movements that follow a particular pattern or form that requires coordination or control of part or all of the body that can be done through the learning process (Widiastuti 2011). A person who is able to move his/ her skills well is called a skilled person. Swimming in a butterfly stroke technically includes body position, leg movements, breathing, coordination between foot movements, breathing and hand rotation, coordination between breathing and hand movements, improvement of stroke, and coordination of all movements during swimming. Research conducted by found that the application of properly-made exercise programs will make learners adapt to the aquatic environment, basic swimming skills, and foundation in practicing many complex swimming strokes (Ildikó et al. 2017).

The objectives of the research were developing drill-based exercise model on butterfly stroke swimming for athletes in the age group of 11-13 years; and improving butterfly stroke swimming skill for athletes in the age group of 11-13 years.

## **2. Research Methodology**

Research on the development of the exercise model of butterfly stroke swimming is developed as a guideline for coaches to provide variations in butterfly stroke swimming practice for athletes, especially in the age group of 11-13 years.

### Participants

Participants of this study were swimming athletes aged 11-13 years from 4 different swimming clubs consisting of Bina Taruna, Tirta Merta Bandung, Tirta Bayu and Bekasi Olympic Aquatics swimming clubs.

### Procedures

This study uses a qualitative and quantitative approach. The approach aims to find the answers through the formulation of research problems; i.e. effective exercise of butterfly stroke swimming for athletes aged 11-13 years. The final results on the exercise model of butterfly stroke swimming material will produce a product in the form of an exercise design complete with the product specifications. It also tests the effectiveness of the exercise model. Therefore, it can improve butterfly stroke swimming skills in athletes aged 11-13 years and be used as a guideline in exercise activities. The research and development of this exercise applies qualitative and quantitative approach and ten stages of the development model from Borg and Gall (Figure 1).

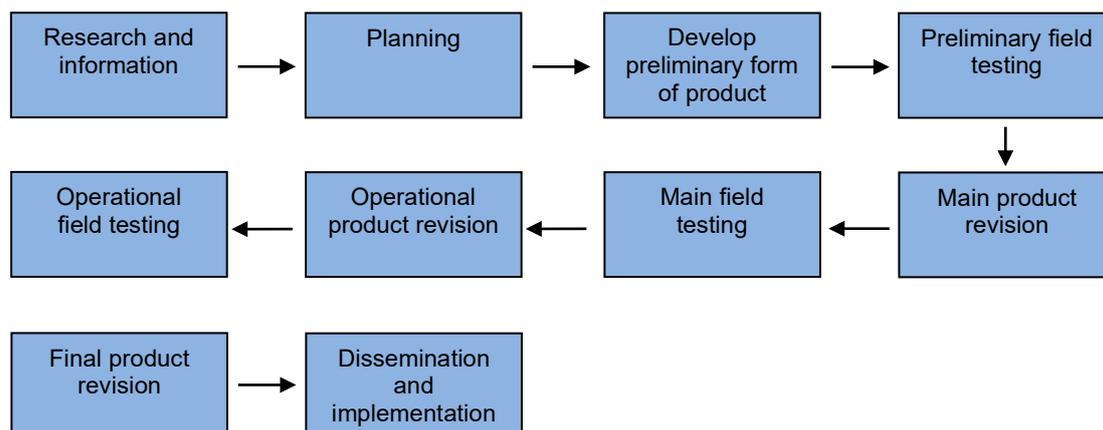


Figure 1. R & D Instructional Design (Borg and Gall 1983).

Source: Walter R. Borg and Meredith D. Gall, Educational Research: An Introduction, 4<sup>th</sup> Edition. (New York: Longman Inc., 1983)

### Need Analysis

The literature study was carried out by previous researchers which included studies in collecting field data, process observations, identification of various problems encountered in butterfly stroke swimming exercises, their descriptions, and field findings. It examined field conditions with the aim of knowing that the product to be developed can be utilized by the subject. Thus, the researchers know whether the product is very necessary or not. The researcher will also conduct an assessment of the research subject and the results will be analyzed to obtain conclusions from the data that has been previously collected. The conclusions of the data were taken from the assessment of the research subjects and settings to obtain results in the field and the results of the analysis. Important findings were described and analyzed based on how the model (butterfly stroke swimming exercise) is currently carried out as well as how the weaknesses and strengths of butterfly stroke swimming exercise based on the conceptual model on the characteristics and criteria of this research and development.

### Model Development Planning, Product Design

The process of making the initial product in the form of a series of model development, finally can be utilized as a guideline in improving quality, skills, and accuracy. The initial product is applied to the exercise model. The development of an exercise model is intended for systematic and logical development so that this product has feasible effectiveness and efficiency in its utilization. In the product development, researchers must consult these products to the experts to produce the perfect product.

### Design Validation

Design validation is the third stage in research and development of exercise model of butterfly stroke swimming for athletes aged 11-13 years. After the exercise model is completed, the next step is to evaluate the model. This evaluation is carried out to improve and refine the exercise model made for children aged 11-13 years. Expert studies, in exercise model of butterfly stroke swimming, aim to revise parts of the exercise model that need to be improved, eliminated or perfected. This process is carried out on the results of the initial draft in the form of writing / drawing sketches and direct application techniques in the field during the exercise model design of butterfly stroke swimming. The experts chosen to revise the R&D product are coaches and lecturers in swimming course. The revised results from experts will help the researchers in refining the exercise model design of the butterfly stroke swimming before being tested on small groups.

### Product Testing in Small Group

20 athletes became the sample in the implementation of small group testing. The results of this group testing data were generated from filed notes of the results of the model testing. The results of the input from the small group trial were used to revise the drill-based exercise model of butterfly stroke swimming in swimming for

athletes in the age group of 11-13 years. It needs to be carried out before it is being tested with more number and heterogeneous respondents. The results of testing carried out by athletes in small groups became the second revision after the previous revision from the experts.

**Product Revision**

Inputs from the questionnaire and field note results in the small group testing were used to revise the product. It was carried out to perfect the model that has been felt and experienced by the research subjects aiming to test the next group.

**Product Testing in Large Group**

In this research of drill-based exercise model of butterfly stroke swimming for athletes in the age group of 11-13 years, large group testing activity was field testing carried out after passing revision activities from the results of small group testing. Field testing was carried out for athletes aged 11-13 years consisting of 60 athletes. Athletes who conducted field testing consisted of male and female athletes.

**Product Revision**

The results of the conclusion from the field testing are the stages of improvement and perfection to the final product of exercise model of butterfly stroke swimming. It is a picture of the athletes after trying the exercises directly as an improvement in model development.

The final revision of the exercise model of butterfly stroke swimming for club athletes is the one that gone through the improvement according to input from the field test. Therefore, the exercise model of butterfly stroke swimming product is considered appropriate for distribution or use.

**Effectiveness Test**

The effectiveness test was conducted to (1) find out whether the final model design is good and correct to be applied by the coaches in the exercise, and (2) how effective the results of the final model implementation are for the objectives of this research. Thus, the quantitative approach was applied to find the effectiveness, along with the pre-experimental research design in the form of one group pretest-posttest design.

**Table 1. Research Design in Effectiveness Test of the Model**

Subjects	Pre-Test	Treatment	Post-Test
R	O <sub>1</sub>	P	O <sub>2</sub>

The steps taken in this testing include: (1) determining the research subject group, (2) implementing the pre-test (O1), (3) testing the developed model, (4) implementing the post-test (O2), (5) searching for the average score of the pre-test and post-test and compared between the two, (6) conducting the prerequisite testing of statistical analysis with the normality test. It was continued by testing the hypothesis (t-test) which aims to find out the significant differences from the use of the model of data processing from the results of the research subjects using the t-test procedure.

**3. Result And Discussion**

The technique used in processing research data was obtained from sports experts, swimming club coaches, and swimming athletes using percentage techniques. The following table presents data from preliminary studies, validating data from all three experts, small group testing, large group testing, field implementation testing, and the draft of the final model.

**Table 2. Need Assessment**

No	Components	Result
1	Preliminary Study a. Literature study	<ol style="list-style-type: none"> <li>1. Butterfly stroke swimming skill are carried out through five stages of assessment which include: 1) body position, 2) leg movement, 3) breathing, 4) arm movement, 5) coordination movement.</li> <li>2. Movement skill is a movement that follow a series of patterns or certain forms that involve coordination and control of part of the body or the whole body that can be done after going through the learning movement process.</li> <li>3. Swimming is a form of water skill whose mastery requires repetitive exercise at a certain time before really mastering it.</li> <li>4. Initially, the breaststroke is modified by the butterfly stroke with the same foot movement as the breaststroke. However, the arm movement is in the opposite direction of the recovery movement in the breaststroke performed outside the surface of the water.</li> <li>5. The exercise model of butterfly stroke swimming for athletes in age group of 11-13 years can be developed and applied during the exercise. In addition, it improves drill-based butterfly stroke skill.</li> </ol>

No	Components	Result
1	b. Need analysis (through observation)	<ol style="list-style-type: none"> <li>1. The exercise is still not optimal in improving butterfly stroke swimming skill for athletes in the age group of 11-13 years.</li> <li>2. The coaches have not used specific exercise model to improve butterfly stroke swimming skill for athletes in the age group of 11-13 years.</li> <li>3. Based on the results of field observation, the exercise process shows that athletes play in the pool and lack specific exercise because many athletes are free to play without any instruction; only limited to the supervision of the coach.</li> <li>4. The exercise given to athletes in the age group of 11-13 years has not been focused.</li> <li>5. The coaches carry out a general exercise process because the number of athletes is very large and the age group is varied. It is inversely proportional to the small number of coaches during the exercise process.</li> </ol>
2	Expert Validation a. Validation results from the swimming experts (n=3)	<ol style="list-style-type: none"> <li>1. Validation results from the three swimming experts obtain the score of 91.69% for the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years. Therefore, the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years is very suitable to use.</li> <li>2. The researchers develop the concept of an initial exercise model as many as 50 models. After fruitful discussion with the experts, they suggested to improve the model by paying attention to the level of difficulty, variations in drilling and its infrastructure.</li> </ol>
	b. The validation results from the swimming experts (n = 3) through a questionnaire instrument containing 288 questions.	<ol style="list-style-type: none"> <li>1. The validation from the three swimming experts obtained the result of 85.86% for the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years. Therefore, the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years is very suitable to use.</li> <li>2. The three swimming coaches give input on modeling the exercise from easy to more difficult variations. Based on input from coaches, the sequence of exercises for basic butterfly stroke swimming skill includes: (1) body position, (2) leg movement, (3) breathing movement, (4) arm movement, (5) overall movement.</li> </ol>
3.	Testing a. The results of small group testing (n = 20) using 288 questions	<ol style="list-style-type: none"> <li>1. The validation from the three swimming experts obtained the result of 82.06% for the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years. Therefore, the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years is very suitable to use.</li> <li>2. Small group testing receives inputs which include (a) Model 13: waist movement, legs remain tight and not bend the knees to 90°, keep the body balance in the surface of the water (streamlined), movements of the hip groin, and stomach, not bend the knees, waist movement up and down, head remains relaxed. (b) Model 16: keep the body from sinking, both feet tight, and the movement starts from the waist in which both hands keep crossing in front of the chest. (c) Model 18: not too high when taking breath, only limited to chin.</li> <li>3. It needs an explanation of the focus point so that the objectives of the exercise can be achieved.</li> <li>4. The explanation of the rules of implementation must be further refined.</li> <li>5. In swimming exercises, the coaches must be stricter in watching the athletes to avoid the risk of drowning in the pool.</li> </ol>

No	Components	Result
3	b. The results of field testing (n = 60) using 288 questions.	<ol style="list-style-type: none"> <li>1. The validation from the three swimming experts obtained the result of 84.35% for the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years. Therefore, the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years is very suitable to use.</li> <li>2. Based on the note of the results of the field testing, the security level the use of tools in swimming exercises for swimming athletes in the age group of 11-13 years is considered to be safe and feasible to use.</li> <li>3. The athletes' enthusiasm will increase if the swimming exercise is in the form of varied models and does not reduce the core value of the exercise itself.</li> <li>4. According to experts, the use of assistive devices that are accessible is good. However, they must be used based on the needs.</li> <li>5. The exercise modeling starts from an easy level to a more difficult level. The experts stated that the model is well-arranged.</li> <li>6. The experts stated that the effectiveness of the exercise model for swimming athletes in the age group of 11-13 years is effective in helping club coaches to achieve the goal of swimming exercise, especially for butterfly stroke swimming.</li> <li>7. Generally, all athletes are able to carry out instructions in accordance with what the researchers expect.</li> </ol>
4.	Final Model	After conducting a series of testing, revision, and improvement to the draft model, it finally compiled the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years consisting of 48 forms of variations in drill-based exercise models.

**Effectiveness Test of the Model**

To find out the effectiveness of implementation of the final model in achieving the research objectives, a quantitative approach was used to find its effectiveness. It applied a pre-experimental research design in the form of the one group pre-test post-test design. The effectiveness test of this model was carried out through several requirements including: 1) test of data analysis requirement and (2) t-test, as follows:

**Test of Data Analysis Requirement**

Research data need to be tested before being analyzed by normality test as the requirement for data analysis. Based on the results of the normality test for the initial test data, the L-calculate value is 0.1353 smaller than L-table of 0.1401. Therefore, it is concluded that the data in the initial test were normally distributed. The results of the final test data obtained the L-calculate value of 0.1379 smaller than L-table of 0.1401. In conclusion, the data in the final test were normally distributed.

**t-Test**

After normality test was carried out, it was followed by a t-test to determine the effectiveness of the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years. The results of the calculations are presented in the following table:

**Table 3. Differences in Effectiveness Test on the Drill-Based Exercise Model of Butterfly Stroke Swimming Skill for Athletes in the Age Group of 11-13 Years**

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	FINAL_Test	19.30	40	1.436	.227
	INITIAL_Test	15.05	40	1.358	.215

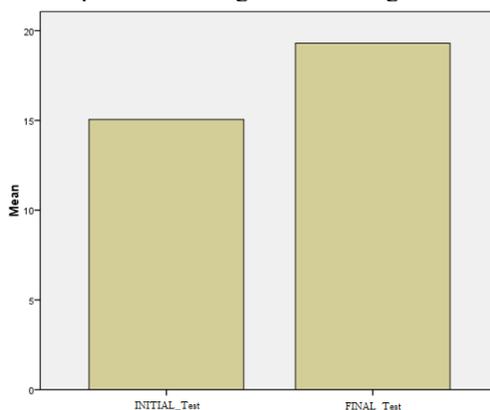
  

Paired Samples Correlations				
		N	Correlation	Sig.
Pair 1	FINAL_Test & INITIAL_Test	40	.334	.035

**Paired Samples Test**

		Paired Differences				T	df	Sig. (2-tailed)	
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower				Upper
Pair 1	FINAL_Test – INITIAL_Test	4.250	1.613	.255	3.734	4.766	16.662	39	.000

Based on the data analysis, the average value of pre-test is 15.05, the average value of post-test is 19.30, the standard deviation of pre-test is 1.36 and the standard deviation of post-test is 1.44, the average of pre-test and post-test is 4.25 and the standard deviation is 1.61 with the t-calculate value of 16.66. Based on the table above,  $df = 39$ . Therefore, the t-table value is 2.02 and the significance level is 0.05. Since the t-calculate value (16.66)  $>$  t-table value (2.02) then  $H_0$  is rejected. Based on this data, the exercise model of butterfly stroke swimming for athletes in the age group of 11-13 years is effective and can improve their skills. The following is a comparison results of the athletes' ability level before and after the treatment using exercise model for athletes in the age group of 11-13 years which is presented using the following bar chart:



**Figure 2. Bar Chart**

**Discussion**

In this research is to make a drill-based butterfly-style swimming exercise model, with the concept of the exercise model paying attention to the effectiveness of the butterfly-style swimming exercise model. In previous research swimming butterfly with a shorter stroke will help to maintain the tempo and if combined with the instruction to pull immediately, the pause between recovery and catch will be reduced. It should be noted that this is in opposition to the previous drills that emphasise a longer and more effective push through at the back of the stroke, this raises the important point that drills should be prescribed for specific purposes, and targeted on the swimmer's individual weaknesses; adjustments may need to be made as the swimmer progresses (Osborough 2015). Cross-sectional studies showed that young swimmers performance is highly influenced by kinematics and hydrodynamics (Morais, Jesus, et al. 2012). At least classical techniques are less sensitive to such residual variances. However, those variances are of major interest in latent growth curve modeling (Voelkle 2007). In butterfly stroke must be notice about coordination stroke, With increasing race pace, the velocity, stroke rate, and synchronization between the arm and leg key points also increased, indicating that velocity and stroke rate may operate as control parameters (Seifert et al. 2007). Butterfly swimming training models using hand/fin aids can improve the ability of swimming in a butterfly (Cholis, Nur 2015). Core stability training model using stability ball can improve the ability of swimming butterfly (Pradana et al. 2018). Latent modeling is a comprehensive way to gather insight about young swimmers' performance over time (Morais, Marques, et al. 2014). Based on the testing results from small and large groups, the drill-based exercise model of

butterfly stroke swimming skill for athletes in the age group of 11-13 years can be used in the swimming exercise for athletes in the age group of 11-13 years and is very effective in improving their butterfly stroke swimming skill.. This discussion section will present 4 explanations which include (1) model strengths, (2) model weaknesses, (3) model supporting factors, and (4) model inhibiting factors.

#### ***Model Strengths***

The strengths of the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years can be seen from the final product in the form of a module and exercise media for butterfly stroke swimming skill focusing on athletes in the age group of 11-13 years. Swimming coaches will be greatly helped by the existence of module and media of the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years to improve the athletes' skill in swimming the butterfly stroke. In addition, the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years makes an application. Thus, swimming coaches can understand model variations more easily which helps the them in achieving their goals.

#### ***Model Weaknesses***

The weaknesses of the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years are that each variation of the exercise model is interrelated so that the athletes must master variations of the exercise model properly. If one variation of the exercise model cannot be mastered well, it will hinder the process of exercise model which is more difficult. The weakness of the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years is that it is arranged with the combination of easy-to-difficult movements. Therefore, the athletes must be more focused in the exercise process.

#### ***Model Supporting Factors***

The product, that has been developed, aims to increase the chances in achieving the objectives of swimming exercise for athletes in the age group of 11-13 years, which is also very beneficial for the coaches. Therefore, it indirectly motivated the authors to create the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years. The enthusiasm of a number of swimming clubs that become the research setting for small and large group testing made it easy for the researchers to carry out a series of research processes and data collection. The swimming competition in the near future motivates the authors to complete the drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years so that some clubs can use this exercise model to increase their butterfly stroke swimming skills.

#### ***Model Inhibiting Factors***

The ability of researchers has been optimal in carrying out this research. However, the researcher found many obstacles in the research process as material for consideration in generalizing the determination of research findings. The inhibiting factors in the research process are as follows:

- a. Field testing was carried out in 2 areas consisting of 4 clubs including: Bina Taruna, Tirtamerta Bandung, Tirta Bayu Cimahi, Bekasi Olympic Aquatic (BOA).
- b. The time for giving the treatment is very limited in order not to disrupt the club's exercise program.
- c. The treatment was not optimal because Tirta Bayu swimming pool was used for training the soldiers.
- d. The budget for conducting the research is very limited.
- e. Some psychological factors also affect the research findings.

Factors that cannot be controlled by the researchers include: athletes' interest, athletes' trust, and other psychological factors.

#### **4. Conclusions**

The drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years can be developed and applied in swimming exercise to improve butterfly stroke swimming skill. The exercise model is based on the principle of butterfly stroke swimming skills and is very useful as a reference for swimming coaches. The swimming model that has been developed contains effective data results. The drill-based exercise model of butterfly stroke swimming skill for athletes in the age group of 11-13 years is very simple, easy to understand and can be applied based on very attractive aspects, variations, and packaging. It can be seen from the book product that is equipped with exercise media that make it easier for coaches and athletes to understand exercise material and increase effectiveness in the exercise process.

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