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Relationship between speed ability and endurance ability of freestyle swimming speed

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Abstract

Someone who competes in a swimming sport surely will take a distance, therefore a swimmer to reach that distance will involve physical factors namely endurance and speed so that the swimmer is able to swim with maximum speed and endurance. This study is conducted by survey methods with a correlation analysis technique that connects the three independent variables to the dependent variable so that this study has no control over the treatment as well as no change in research. Based on the results of the testing of the first hypothesis, it shows that there is a positive relationship between speed ability and endurance ability of the freestyle swimming speed of the male athlete in Tirta Prima Medan.

1. INTRODUCTION

The achievement swimmers must pay attention to swimming techniques and mechanics that are mentioned correctly, besides mentality, championship and physical maturity. According to (T. Bompa & Buzzichelli, 2015), "there are four main aspects that need to be prepared in conducting exercises throughout the sport, namely: (1) physical preparation, (2) technical preparation, (3) tactics preparation, (4) psychological preparation". To get a good handling technique, the most important factor in an exercise program is the development of physical conditions. (T.Bompa & Buzzichelli, 2019) And other things such as hereditary

such as: body parts, proportion of body parts, types of muscle fibers and maturity. There are several elements of the physical condition that must be built in a person to support mastery of the technique well, this was stated by Sajoto, namely: "strength, endurance, explosive power, speed, flexural power, agility, coordination, balance, accuracy and reaction".

Many important factors in the effort to catch up swimming achievements both at the world level, nationally, as well as the regions, among others, must have good infrastructure, human resources, lack of competition/swimming championships, ideal posture for a swimmer, good nutrition, health, management, finance, age validity, doping, children's talents, and psychology/mentality and many other factors.(Hlukhov et al., 2022; Stanula et al., 2012)

Someone taking part in a race in a swimming sport surely will take a distance, therefore a swimmer to reach that distance will involve physical factors namely endurance and speed or speed so that he is able to swim with maximum speed and endurance. To obtain swimmers who are qualified and able to achieve optimal achievements need to know how big the factors that influence the results of freestyle swimming speed so that swimming performance is expected to be achieved well not only in the breaststroke but also in freestyle.

A swimmer will achieve a maximum achievement when mastering good swimming techniques, such as: start, stroke, foot movements, reversals, breathing and coordination. Besides that, swimmers must have good physical condition.(Marani et al., 2020; Silva, 2020) According to Counselor, quoted by Soejoko H, there are three main element groups so that a swimmer can perform a good swimming performance, namely "strength, endurance and flexibility, coordination, balance and reaction".

Swimming is a physical activity carried out in water. This sport has elements such as body shape, basic techniques of motion mechanism, mentality

and physical condition as a unity that must be owned by someone to be able to float and move from one place to another. Swimming is usually done by swimmers, in each race consists of four styles, which include: 1) freestyle or crawl stroke, 2) breaststroke, 3) butterfly stroke and, 4) back stroke.(Elango et al., 2019; Ganchar et al., 2022) The four styles each have their own level of difficulty. The style of crawling by some people is called freestyle. This term is wrong, because freestyle is the name of the swimming race number, while the crawl style is one of the swimming techniques. In each freestyle number race, almost all swimmers choose the crawl style, the crawl style is often called freestyle. Many swimmers choose crawl style when competing in freestyle numbers because the crawl style is the fastest swimming style compared to the other three styles, namely breast force, backstroke and butterfly style.

Endurance of Freestyle Swimming Speed

As explained above, that freestyle swimming has several basic techniques such as body position techniques, Kicking, Pull, Breathing, Coordination, Start Movement, Turn, Finish and so on. A good swimmer is a swimmer who can master these techniques correctly and with the support of adequate physical abilities. An athlete's appearance is dominated by three main components delivered according to namely: "strength, speed and endurance, these three factors are known as biomotorabilitiy". Endurance of swimming speed is the ability of a swimmer to carry out pleasure quickly without experiencing fatigue which means that in this case freestyle pleasure, because in swimming sports that are measured is the best time (best time) of a swimmer where the better the time achieved then the more also good achievements will be achieved.(Setiakarnawijaya et al., n.d.)

Swimming competitions at the regional, national and international levels, a swimmer will make repeated recalls in one race session according to the race number he participated in and break only a few series from the race, so a swimmer

is required to have that ability. In swimming sports, especially freestyle on single events and multi events, competing 3 numbers, namely: 50, 100 and 200 meters. Seprang swimmers can perform well when able to swim quickly according to the number of the race. This speed endurance is usually owned by swimmers on 4x25, 4x50 and 4x100 meter race numbers because in this number a swimmer is required to be able to finish the distance quickly where a swimmer will repeatedly make a reversal along that distance quickly without any good time difference. In the first 50 meters to 50 meters the fourth. A person must have both ability and speed endurance.

Endurance is the ability to do work for long periods of time without facing significant fatigue.(Lundgren et al., 2015) Muscle endurance refers to a muscle group capable of contracting successively (for example: push-ups or sit ups), or being able to maintain a static contraction for a long time (for example: hanging on a restock, holding a load straight to side for quite a long time), refers to a person's ability to continue the ability of a person to contract (sub maximum) that continues for a long time, which uses a number of arm muscle groups with a period of time and intensity that requires circulation and breathing support, to do work in a relatively long time ". Many investigations about endurance have proven that there are at least two types of endurance, namely:(Degens, 2019)

Aerobic endurance and anaerobic endurance. Aerobic endurance is by using oxygen,(Knudsen, 2020) which applies to long-term activities / work activities but with moderate intensity where the energy used is balanced with oxygen intake, while anaerobic endurance without using oxygen is characterized by activity in a short time but using high intensity where taking oxygen is not enough to meet the balance of energy expenditure so that the muscles experience a lack of oxygen or oxygen debt. Give an example with a long-distance swimming athlete on the 800-meter swimming number, an athlete is required to have good

endurance and stamina to be able to complete this long distance from the start to finish.

In addition to physical factors that can support a person's success in carrying out sports movements is the level of motivation he has. One of these aspects is mental / psychological, which greatly affects the performance of the sport being carried out. Speaking of mental problems and including one's personality, there are some psychological symptoms that influence the performance that can be understood and predicted directly, which is specifically related to one's motivation and attitude. If someone has a very big motivation, the struggle will be carried out as much as possible to achieve the goals that have been expected.(Werner, 2019)

The amount of motivation that is in a person's soul will be influenced by motives that are in him as well. The motive by itself will build a great strength to do something that is being practiced. One of the motivations that are needed in sports activities is achievement motivation.

To study achievement motivation must first be reviewed by the motivation itself. Motivation comes from the Latin word Movere which means to move. Understanding of motivation then continues to grow so that various notions of motivation are born. Sudibyo, defines "motivation is a source of driving and driving individual behavior meets the need to achieve certain goals".

Motivation according to Mc. Donald in Hamalik is "a change in energy in one's personal self that is characterized by the emergence of feelings and reactions to achieve goals". Meanwhile, the word motivation is used to describe a drive, need or desire to do something special and general. And one of the uses of the concept of motivation itself is to describe a person's general tendency to reach a certain goal.

2. METHOD

The aim is to determine the relationship between variables. The variables that studied are independent variables and dependent variables. Independent variables namely (1) speed ability, (2) endurance and (3) achievement motivation. While the dependent variable is the endurance ability of freestyle swimming speed.

The research design used is as follows:

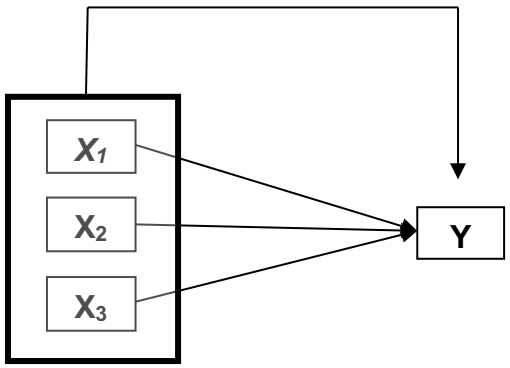

Figure 1 Research Constellation

According to Suharsimi Arikunto the population is the whole subject of research. The population in this study were all male athletes who were included in the Tirta Prima Medan swimming team which amounted to 30 athletes.

"Samples are partially or representative of the population studied". Meanwhile, according to I Made Putrawan, "the sample is part of the population, so the representative sample really reflects the characteristics of the population". Therefore, the sample chosen must be representative and in accordance with the research design. The research sample consisted of 10 athletes. Sampling in this study uses purpose sampling, namely the technique of sampling data sources with certain considerations.

For data obtained because of research so that it can be generalized to the existing population, it was previously observed various possibilities that could influence the results of the research, namely the research sample must have the

same characteristics: a) The male ath letesof Tirta Prima Medan b) The male athletes in the age group III up to the senior age group. c) The male athletes with freestyle specialties. d) All athletes have a predetermined training schedule and have practiced more than 5 years.

e) All athletes studied have participated in various regional, national and international championships.

3. RESULTS AND DISCUSSION

The description of the data from the results of the study aims to provide an overview overspread of data distribution, both in the form of a measure of the location of the frequency distribution. The prices presented after processing the data using descriptive statistics, namely the average price, standard deviation, mode, median, frequency distribution and histogram graphic.

The summary results of the statistical calculation of the description are presented as follows:

Table 1. Summary of Research Results

STATISTIK	VARIABEL			
	X_1	X_2	X_3	Y
Total Sample (n)	10	10	10	10
Maximum Values	8,52	12,2	239	33,25
Minimum Values	3,37	10,2	108	28,41
Range	5,15	2,03	131	4,84
Average	5,562	11,175	188,2	30,003
Median	5,18	11,13	188	29,465
Standard deviation (s)	1,40	0,63	41,90	1,39
Variance (S^2)	1,96	0,40	1755,51	1,92
Mode	5,2	11,13	188	29,5

1. Variable Endurance Ability of Freestyle Swimming Speed (Y)

Based on the data obtained in the field regarding the endurance ability of freestyle swimming speed (Y) which was then statistically processed, the lowest score was 28.41 and the highest score was 33.25. The average value is 30.003, the median is 29.465, the standard deviation is 1.39, and the variance is 1.92.

Based on the raw data about the endurance ability of the freestyle swimming speed (Y), the frequency distribution can be arranged as follows:

Table 2. Frequency Distribution List of Endurance Ability of Freestyle Swimming Speed Score (Y)

No	Interval Class	Lower limit	Upper limit	Absolute Frequency	Relative Frequency (%)
1	28,41 – 29,61	28,405	29.615	5	50.0
2	29,62 – 30,82	29,615	30.825	3	30.0
3	30,83 – 32,03	30,825	32.035	1	10.0
4	32,04 – 33,24	32,035	33.245	1	10.0
	Total			10	100

Based on data from 10 people in the study sample if the results of each respondent were compared with the average, it turned out that those who got the endurance score of freestyle swimming (Y) above the group on average were 5 people (50%), under the group an average of 0 people (0%), and as many as 5 people (50%) were in the average group.

The results of research on the endurance ability of freestyle swimming speeds can be displayed in the form of the following histogram:

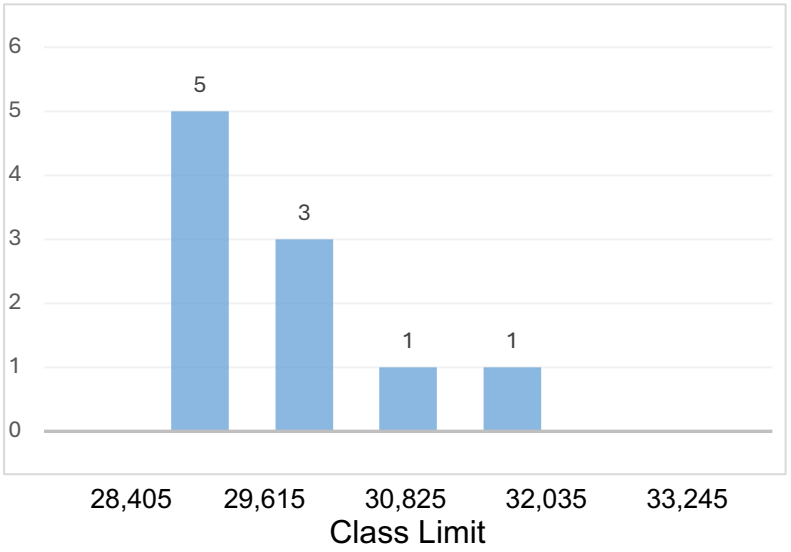

Figure 2. Histogram of Speed Endurance Ability

2.Speed Ability Variable (X_1)

Based on the data obtained in the field regarding the speed ability (X_1) which was then processed statistically, the lowest score was 3.37 and the highest score was 8.52. The average value is 5.562, the median is 5.18 the standard deviation is 1.40, and the variance is 1.96.

Based on the raw data about the speed ability (X_1), the frequency distribution can be arranged as follows:

Table 3. Frequency Distribution List of Speed Ability Score (X1)

No	Interval Class	Lower limit	Upper limit	Absolute Frequency	Relative Frequency (%)
1	3,37 – 4,65	3,365	3.375	1	10.0
2	4,66 – 5,94	4,655	4.665	6	60.0
3	5,95 – 7,23	5,945	5.955	2	20.0
4	7,24 – 8,52	7,235	7.245	1	10.0
	Total			10	100

Based on data from 10 people in the study sample if the results of each respondent were compared with the average, it turned out that those who got a speed ability score (X_1) above the average group of 3 people (30%) were below the average group of 1 people (10%), and as many as 6 people (60%) are in the average group.

The results of research on speed ability can be displayed in the form of the following histogram:

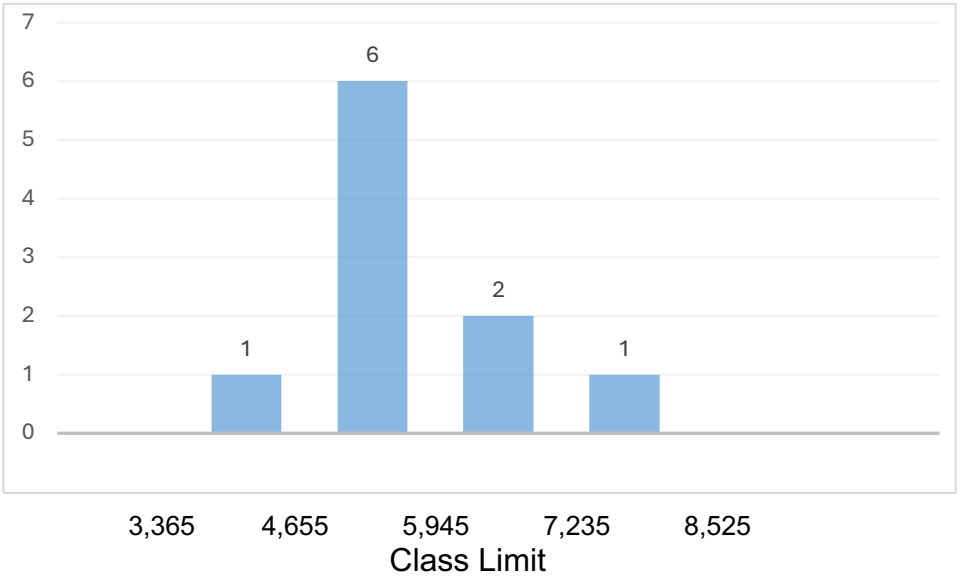

Figure 3. Histogram of Speed Ability

3. Endurance Variable (X_2)

Based on the data obtained in the field regarding Endurance (X_2) which was then processed statistically, the lowest score was 12.2 and the highest score was 10.2. The average value is 11,175, the median is 11, 13 standard deviation is 0, 63, and the variance is 0, 40.

Based on the raw data on Endurance (X_2), the frequency distribution can be arranged as follows:

Table 4. Frequency Distribution List of Endurance(X_2)

No	Interval Class	Lower limit	Upper limit	Absolute Frequency	Relative Frequency (%)
1	10,17 – 10,67	10,165	10.675	2	20.0
2	10,68 – 11,18	10,675	11.185	5	50.0
3	11,19 – 11,69	11,185	11.695	1	10.0
4	11,70 – 12,2	11,695	12.205	2	20.0
	Total			10	100

Based on data from 10 people in the study sample if the results of each respondent were compared with the average, it turned out that those who got an endurance score (X_2) above the average group of 3 people (30%), were below the average group as much as 2 people (20%), and as many as 5 people (50%) are in the average group.

The results of research on endurance can be displayed in the form of the following histogram:

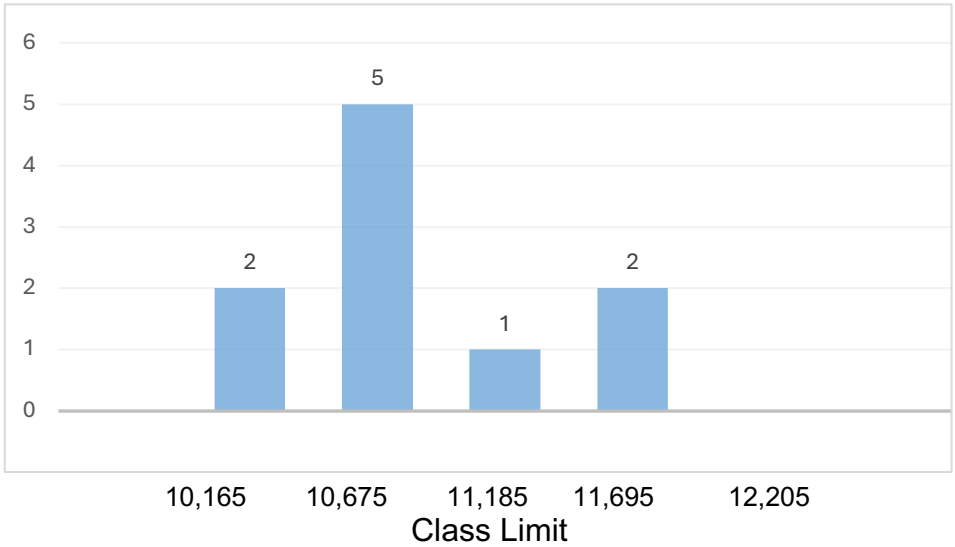

Figure 4. Histogram of Endurance

4. Achievement Motivation Variable (X_3)

Based on the data obtained in the field regarding Achievement Motivation (X_3) which was then processed statistically, the lowest score was 108 and the highest score was 239. The average value was 188.2, the median was 188, the standard deviation was 41.90, and the variance was 1755, 51.

Based on the raw data on achievement motivation (X_2), the frequency distribution can be arranged as follows:

Table 5. Frequency Distribution List of Achievement Motivation Score (X3)

No	Interval Class	Lower limit	Upper limit	Absolute Frequency	Relative Frequency (%)
1	108 – 140	107,5	140,5	1	10.0
2	141 – 173	140,5	175,5	2	20.0
3	174 – 206	173,5	206,5	3	30.0
4	207 – 239	206,5	239,5	4	40.0
	Total			10	100

Based on data from 10 people in the study sample if the results of each respondent were compared with the average, it turned out that those who got an achievement motivation score (X_3) above the average group were 0 people (0%), below the average group as much as 6 people (60%), and as many as 4 people (40%) are in the average group.

The results of research on achievement motivation can be displayed in the form of the following histogram:

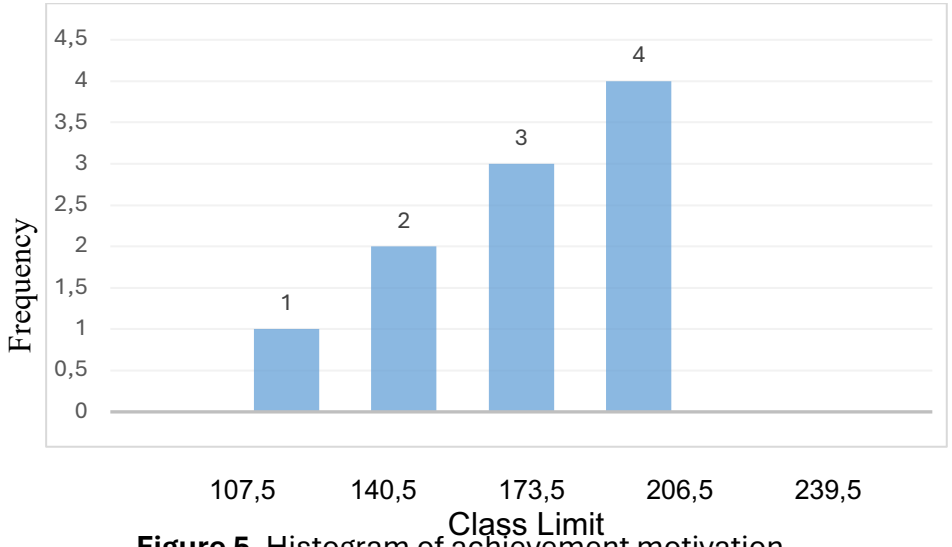

Figure 5. Histogram of achievement motivation

5. Testing Requirements of Data Analysis

Due to the processing of data in this study using statistical tests with regression techniques and correlations it is necessary to test the requirements analysis, so the results can be used to draw a conclusion, in this study the intended test requirements include:

1. Test the estimated error normality
2. Variance homogeneity test with Bartlett test
3. Linearity and significance of regression coefficients and correlations

5.3 Linearity Test

Linearity testing is done to find out the shape of the relationship between the dependent variable and each of dependent variable. The analysis used is simple regression linearity analysis. Linearity of the relationship between independent variables can be seen from the regression line equation formed by each independent variable and the dependent variable.

If the price of F_{count} is smaller than F_{table} for the price of F tuna it matches at a significant level, then the relationship between the two variables is linear.

Table 8. Summary of Data Linearity Test Results

No	Variables	F_{count}	F_{table}	Conclusion
1	Y on X_1	0,47	11,93	Linier
2	Y on X_2	3,19	237,00	Linier
3	Y on X_3	0,87	19,33	Linier

From the table above, the value of $F_{count}$for each independent variable on the dependent variable, at the level of confidence α = 0.05 and the confidence of 0.01 indicates that the relationship between independent variables and the agreement is linear.

After the analysis is done, the results obtained are used to test the proposed hypothesis and measure the percentage of influence between variables. Conclusions on the hypothesis raised.

The results of the decision on the proposed hypothesis can be explained as follows: Relationship of Speed Ability(X_1) with Endurance Ability of Freestyle Swimming Speed (Y)

The first hypothesis in this study is that there is a positive relationship between speed ability (X_1) and Endurance Ability of Swimming Speed (Y). By using regression expressed through a regression equation: $\acute{Y} = 6.99 + 0.860X_1$

From the calculation results obtained the correlation coefficient $\rho_{y1} = 0.836$ with $t_{count} = 4.31$ and $t_{table} = 1.86$ at α = 0.05. Therefore, $t_{count} > t_{table}$ then the correlation coefficient is significant with another statement H_0 is

rejected. From these calculations the Speed Ability has a positive effect on Speed Endurance Ability.

After calculation and analysis of the Speed Ability (Y) Ability regression equation for Speed Ability (X1), the results obtained can be explained in Table 4.7 below:

Table 9. Table ANAVA for Testing Significance and Linearity Regression $\hat{Y} = 6.99 + 0.860X_1$

No	S. Variance	dk	JK	RJK	F_{count}	$F_{table,5\%}$	Information
1	Coefficient (a)	1	24900.10				
2	Regression (b|a)	1	634.99	643.99	18.61	5.32	Significant regression coefficient
3	The rest	8	276.91	34.61			
4	Tuna Suitable	6	162.41	27.07	0.47	11.93	Linear lines
5	Galat	2	114.50	57.25			
	Total	10	25821.00				

From the results of the significant partial correlation coefficient between speed ability and endurance ability ofswimming speed by controlling the ability variable obtained the results of $t_{count} = 4.439 > t_{table} = 2.36$ at a significant level $\alpha = 0.01$. This means the *persial* correlation coefficient between Y and X1, if X2 in the control is significant. The results of this analysis prove that there is a relationship between speed ability and endurance ability of freestyle swimming speed.

The testing of this hypothesis shows that the athlete's endurance swimming speed is influenced by speed ability, with a contribution of 83.6%. This means that the better the speed ability, the better the endurance ability of the athlete's freestyle swimming speed.

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The results of calculations about the hypothesis which states that there is a significant relationship between speed ability ($_{X1)}$ and Endurance Ability of Freestyle Swimming Speed (Y) shows a simple regression equation model = 6.99 + 0.860X_1 Through analysis of variance for significance obtained F_h= 18, 61< F_t = 5.32, whereas for linearity F_h = 0.47 is smaller F_t = 11.93 so the simple regression equation = 6.99 + 0.860X_1 is stated to be very significant and linear. This means that if the speed ability is increased by one score, then the ability of Endurance Ability of Freestyle Swimming Speed increases 6.99 score at 0.860 constant.

DISCUSSION

Furthermore, the correlation coefficient between X_1 speed ability with Endurance Ability of Freestyle Swimming Speed is 0.836 Through the t-test, thit is 4.31 greater than t_{tab} of 1.86 so that the correlation coefficient (r_{y1}) is declared significant at 0.05 level which means that the higher the speed ability, the higher Endurance Ability of Freestyle Swimming Speed. Conversely, if the low-speed ability will bring a low consequence the Endurance Ability of Freestyle Swimming Speed.

Based on the correlation coefficient (r_{y1}) it also obtained a determination value of 0.836. This means that speed ability can be

explained by the ability of endurance Swimming Speed of the Freestyle of 83.6%.

The findings in this study are in line with the theoretical study stated earlier that the male athlete of Tirta Prima Medan has good speed ability that will have optimal Endurance Ability of Freestyle Swimming Speed. Thus, it can be said that the Endurance Ability of the Freestyle Swimming Speed is related to the speed ability of the concerned Prima Medan male athlete.

Besides that, the results of this study also show that important speed ability are possessed and enhanced by every male athlete of Tirta Prima Medan to increase the Endurance Ability of his Freestyle Swimming Speed.

If viewed partially the relationship Speed ability with Endurance Ability of Freestyle Swimming Speed by controlling the variable ability obtained by the partial correlation coefficient (r_{y12}) of 0.836. This means that this linkage has limited the involvement of relationships towards other independent variables. Furthermore, controlling these variables shows the increase in the closeness of the relationship between speed ability and endurance ability ofFreestyle Swimming Speed, so that the partial correlation coefficient is significant. This is because t_{count} (4.31) ≥ t_{table} (1.86).]

4. CONCLUSION

Based on the results of the testing of the first hypothesis, it shows that there is a positive relationship between speed ability and the endurance ability of the freestyle swimming speed of the male athlete in Tirta Prima Medan

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