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THE EFFECT OF SIMPLE MODELING IN LEARNING PHYSICS FOR ENGINEERING STUDENTS

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Abstract: The research aims to determine the effect of simple modeling in learning physics for engineering students. The sample of this study were all 1st semester engineering students at the Medan Area University are 36. The research method used was the ex post facto method, by not providing treatment but directly conducting related evaluations. Engineering students' abilities in learning physics can be helped with simple modeling. Data analysis technique used is by regression analysis. From the results of the analysis it was found that Freghitung= 4.382 and Freg-table = 4.230 (Freg-count >Freg-table), so the conclusion of this study is that there is a very large the effect of simple modeling learning physics for engineering students at the University of Medan Area.
Keywords: Simple modeling; Physics; Engineering student

Abstrak: Penelitian ini bertujuan untuk mengetahui pengaruh pemodelan sederhana dalam pembelajaran fisika pada mahasiswa teknik. Sampel penelitian ini adalah seluruh mahasiswa teknik semester 1 Universitas Medan Area yang berjumlah 36 orang. Metode penelitian yang digunakan adalah metode ex post facto, dengan tidak memberikan perlakuan melainkan langsung melakukan evaluasi terkait. Kemampuan mahasiswa teknik dalam belajar fisika dapat terbantu dengan pemodelan sederhana. Teknik analisis data yang digunakan adalah dengan analisis regresi. Dari hasil analisis diketahui bahwa Freghitung= 4,382 dan Freg-tabel = 4,230 (Freg-hitung >Freg-tabel), sehingga kesimpulan dari penelitian ini adalah terdapat pengaruh yang sangat besar dari pembelajaran pemodelan fisika sederhana terhadap mahasiswa teknik di Universitas Medan Area.
Kata kunci:pemodelan sederhana;fisika; mahasiswa Teknik

INTRODUCTION

Physics is one of the parts of science that discusses physical objects and the things that affect them. To learn it uses a lot of understanding, reasoning, logic and formulas [1].

In order to better understand a physical phenomenon and for the development of physics, it is necessary to conduct an experiment [2]. Experiments are something that absolutely must be done in the field of physics, because experiments are the judge of truth in physics. Experiments are always needed for theory testing and the development of new theories, besides that in the teaching and learning process experiments can also help to better understand the laws of physics [3]. However, in conducting an experiment in the field there are always obstacles, among others caused by several factors, namely:

a. The physical phenomena studied are relatively fast, making it difficult to measure and visualize them

b. The size of the object to be studied is relatively small (micro) so it is difficult to measure

c. The symptoms studied tend to be dangerous,

d. The equipment required for the analysis of a symptom is relatively expensive or difficult to operate

e. The experimental data obtained is quite large and not linear so it is difficult to analyze.

The above constraints cause the characteristics of a physical phenomenon cannot be fully disclosed, this will of course cause information and will interfere with the development of physics itsel [6]. In other matters, in the discussion of theoretical physics, the laws of physics are formulated in the form of mathematical language [7-9]. The relationship between a physical quantity and another in a system can generally be expressed in the form of a mathematical model [4].

The mathematical model is developed deductively based on natural laws that have been tested for their truth. Based on the mathematical model of a physical system, the characteristics of the physical system can be known, and through the characteristics of the physical system it can be predicted what will happen if the system is given a certain treatment [10].

Several fields of physics with various subject matter that generally have problems in terms of experiments and solving mathematical models,

such as:

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1. Subject of Mechanics
2. The subject of thermodynamics
3. Subjects of Electric Magnets
4. Topics of Quantum Mechanics
5. Subjects of Atomic and Nuclear Physics

The topics discussed above often make people who study exact sciences, especially physics, tend to be boring and make them lazy to study them, because studying physics is a frightening specter. On the subject of mechanics there are constraints in terms of experiments, such as nonlinear mechanical vibrations, particle motion in 1, 2 and 3 dimensions, particle motion in 2 and 3 dimensions is constrained, and systems of many particles [11-13]. Whereas in terms of solving mathematical models there are constraints, such as linear mechanical vibrations N degrees of freedom, nonlinear mechanical vibrations, constrained particle motion in 2 and 3 dimensions, many-particle systems, analysis of rigid bodies for inhomogeneous bodies and arbitrary shapes, and gravitational fields by non-homogeneous objects and arbitrary shapes [5]. From the results of observations made at the Faculty of Engineering, University of Medan Area, it was obtained; average midterm exam results on physics and physics lecturers always remind the use and mastery with simple modeling.

LITERATUR RIVIEW

Computational physics is an integral part of the development of problems or physical phenomena and the ability to anticipate them using computer devices. Making simulations of these physical phenomena can be done with algorithms and computer programs. The application of computers in physics is seen in solving complex analytical problems and numerical tasks for interactive solutions. Therefore, computational physics offers a combination of three disciplines and sciences, namely physics, numerical analysis and computer programming [3].

When viewed from the academic staff, there are still many teaching staff who are still reluctant to use computers, while computers are the main tool for the development of computational physics. In fact, more broadly, computers can be used as a tool for typing, data processing, experimentation or simulation tools, etc., supported by computer software capabilities [21], so that in general it can be said that the existence of computer technology can help the development of science physics.

The scope of the discussion mostly focuses on kinematics issues. Newton's Second Law can be used to help solve motion problems in one and two dimensions. Limiting the problem to one-dimensional and two-dimensional motion is not the final solution to all computational physics problems. Therefore, further studies are needed about the various physical symptoms that exist [5-6].

One example of a problem that can be raised for one-dimensional motion is to consider what is the velocity and acceleration of an object as it falls? If an object falls without air friction, then the acceleration of the fall is: a = g where g = 9.8 m/s2.

An object that falls has an action force equal to the object's own weight. By using Newton's second law can be written:

mg = ma

If a = constant, a simple equation will be obtained as follows:

then a simple equation will be obtained as follows: vt = vo + gt assuming that the object begins to fall at a speed vo This equation can be used to find the velocity vt in certain time intervals after the object moves and before it reaches the ground. All physics problems like this where acceleration is constant can be solved using conventional mathematical analysis such as algebra, trigonometry and calculus. The form of the vt equation above can only be applied when there is no air resistance[9-11]. Experiments show that an object moving in the air always depends on the speed of the object, therefore the acceleration is not constant. And the force of motion of objects is expressed in the form:

F.a = =1/2 CρAv2

C is the air friction coefficient (drag coefficient). A is the surface area of the object, is the density of the air (about 1.2 kg/m3), and v is the object's velocity. C relates to the shape of objects. For small objects like balls with area:

A = πr2, the magnitude of C is approximately 0.46.

So, air resistance cannot be simply ignored. As an example are natural events that cannot ignore air friction, such as paratroopers, sky divers, jumping squirrels, and other small creatures that have also proven this [4], [20].

METHODS

Method is Ex post facto. The definition of ex post facto is after the fact, namely research conducted after an incident occurred [6].

This method was chosen because researchers cannot control independent variables through manipulation or experimental treatment because treatment already exists and has occurred before by other people who are not researchers [7].

The test technique used to test the hypothesis in this study is regression analysis. This regression analysis is used to predict how far the value of the dependent variable changes if the value of the independent variable is manipulated/changed or increased and decreased [8].

The sequence of the algorithm is arranged as follows:

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Step 1. Determine the value for the interval h
Step 2. Determine the initial velocity v0= 0
Step 3. The while t <= t max loop
Step 4. Calculate the acceleration with the equation F.a = =1/2 CρAv2
Step 5. Print time t, acceleration a, and velocity v.
Step 6. Multiply h and a and add the speed to get

No	Interval	Frequency
1.	30-38	6
2.	39-47	5
3.	48-56	8
4.	57-65	11
5.	66-74	3
6.	75-83	3
Amount		36

the new value of speed.
Step 7. Increment the time with h.
Step 8. Return to the loop in step 4 until t > tmax
Step 9. Finish/Exit.

The general equation of simple linear regression is $Y = ax + b$ (1)
Then calculate the value of F using the formula:
$F=S^2_{reg}/S^2_{sisa}$ *(2)*
F-count compared to F-table with dk quantifier = 1 and dk denominator = n-2 uses an error level of 5% with the criteria F-count > F-table [18].Then determine the correlation coefficient between the two variables using the rough product moment correlation formula as follows:

$$r_{xy}=\frac{n\Sigma X_iY_i-(\Sigma X_i)(\Sigma Y_i)}{\sqrt{\left(n\Sigma X_i^2-(\Sigma X_i^2)\right)\left(n\Sigma Y_i^2-(\Sigma Y_i^2)\right)}}$$

By criteria; if the price of Freg>Ftable with a significant level of 5% then the data is significant [18].

RESULTS AND DISCUSSION

RESULT

The results of the student achievement test on the subject of learning physic before making simple modeling the lowest score of 27 and the highest score of 77 while the average score was 50.5 on tabel 1 and figure 1. The following data is in the form of a distribution tabel:

No.	Interval	Frequency
1.	27 – 35	2
2.	36 – 44	9
3.	45 – 53	12
4.	54 – 62	6
5.	63 – 71	5
6.	72 – 80	3
Amount		36

Tabel 1. Frequency Distribution of Data from Learning Physic before making simple modeling.

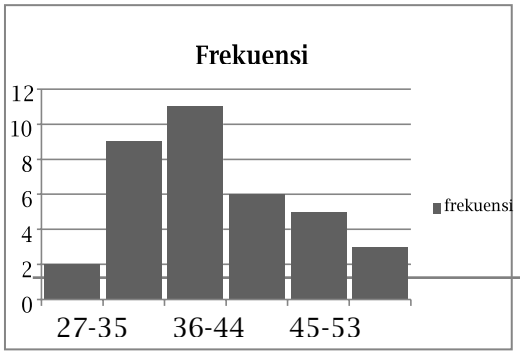

Figure 1. Frequency Distribution of Data from Learning Physic before making simple modeling.

Tabel 2. Frequency Distribution of Data from Learning Physic after making simple modeling.

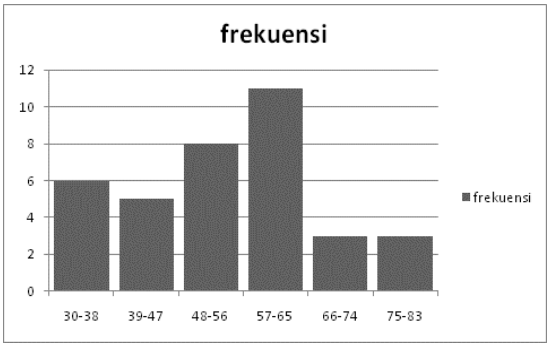

Figure 2. Frequency Distribution of Data from Learning Physic after making simple modeling.

While data on physics abilities, especially mechanica, the lowest value data obtained was 30, the highest value was 80 and the average value was 54.06. The following is complete data in the form of tabel 2 and figure 2.
Tabel 2 and figure 2 explained that there was a significant increase compared to table 1 and figure 1 of 3.56.

DISCUSSION

That the existence of computational physics, experimental physics and theoretical physics are mutually supportive for the development of physics and its applications. Experimental physics and theoretical physics are mutually dependent, especially in terms of conducting theory trials, theoretical proposals, experimental proposals and experimental interpretation [14-17]. Meanwhile, experimental physics and computational physics need each other, especially in terms of generating data, data analysis, tool control, experimental proposals and real modeling. On the other hand, computational physics and theoretical physics also need each other, especially in terms of theory proposals, accuracy of calculations, development of mathematical equations and interpretation of results. programming techniques and programming languages. Computational physics is a merger of three disciplines, namely physics, numerical methods and computer programming [19-21].

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From table 1 and figure 1 learning physics has not used simple modeling, the average value is 50.5, while in table 2 and figure 2 learning physics has used simple modeling, the average value is 54.06. this means an increase of 3.56.

CONCLUSION

The conclusion from this study is that there is a positive effect of using simple modeling on learning physics for engineering students.
The sample of this study were all 1st semester engineering students at the Medan Area University are 36. The research method used was the ex post facto method, by not providing treatment but directly conducting related evaluations. Engineering students' abilities in learning physics can be helped with simple modeling. Data analysis technique used is by regression analysis. From the results of the analysis it was found that Freghitung= 4.382 and Freg-table = 4.230 (Freg-count >Freg-table), so the conclusion of this study is that there is a very large the effect of simple modeling learning physics for engineering students at the University of Medan Area.
The effect of simple modeling makes it easier for engineering students to learn physics, especially those who use a lot of difficult formulas.

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