



TRIGONOMETRY SIMULATION LEARNING USING SCILAB BUDI DARMA UNIVERSITY

Siti Nurhabibah Hutagalung¹, Melda Panjaitan²

^{1,2}Department Technical Information, Budi Darma University, Jl.S.M.Raja N0.338, Medan, North Sumatera, 20219, Indonesia

E-mail: Sitinurhabibahhutagalung1@gmail.com¹, meldapjt.78@gmail.com²

ARTICLE INFO

Article history:
Received: April, 01 2022
Revised: May, 11 2022
Accepted: May, 30 2022

Keywords:
Learning, Scilab, Simulation,
Trigonometry.

ABSTRACT

The research in this case aims to analyze learning in the form of simulations that can provide explanations and shape the character of the independence of Budi Darma University students to understand trigonometry material which so far has memorized the concept of formulas without knowing where it came from and the display form of the calculation results of basic concepts, graph functions and Pythagoreans and trigonometric angle ratio. The research stages consist of theoretical analysis, formulation of trigonometry, determination of input variables, program code input, simulation of display results and comparative analysis between theory and the resulting program simulation. The formation of trigonometric simulation concepts can be applied to learning in the fields of computers, engineering and everyday life.

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1. Introduction

In learning media the most important thing is how it can be understood in the use of Scilab software applied to provide understanding to students, in this case Budi Dharma University students on trigonometry teaching materials. The basics in the explanation of trigonometry understand the concept of triple Pythagoras, basic concepts of triangles, basic concepts of triangles, comparison of right triangles and the concept of trigonometric comparisons for related angles.

Students' view of mathematics is that learning mathematics is useful in helping with basic calculations of computer calculations. Without having a view of mathematics as annoying and some students have limited conceptual because they learn in a rigid structure and direction. In early research studies teaching working on problems regarding trigonometric comparisons, students have difficulty because they are accustomed to memorizing formulas without knowing where the formulas come from, [1].

The word media comes from Latin which means intermediary, something that can connect information between sources and recipients of the information. media as a means of communication (means of communication), [2]. Tools that carry messages from one individual to another can be said to be a communication channel, [3]. The media are also seen as forms of mass communication that involve a system of symbols and production and distribution equipment, [4]

In improving the learning of trigonometry teaching materials, several media and methods are used, including the Teams games tournament type cooperative learning model, [5]. In View From Learning Obstacles, [6]. Quizizz Online Learning, [7]. Based on Interactive Multimedia, [8], Via Whatsapp Group, [9]. Practical Test of Schoology-Based Trigonometry E-Module for Online Learning, [2], student error analysis in solving Higher order thinking skill type of trigonometry questions Review from gender, [10].

Some of the uses of the Scilab software, including: (1) in the field of mathematics and applied, which is used to do various mathematical operations and data analysis which are often found in the field of engineering and science. (2) Visualizing images in 2D and 3D, which is used to visualize data in various



types plots and graphs (2D and 3D). Use for optimization, namely making algorithms for solve continuous optimization problems and discrete without constraint and unlimited, [11].

This study aims to familiarize students with using the Scilab application for trigonometry simulations to answer the problem of how to solve problems related to trigonometry material and its development in everyday life.

For this reason, in this study simulation using Scilab software to analyze the justification between theories, formulations, and daily life applications on the basic concepts of trigonometry, pythagoras, triangles, and angle comparisons.

2. Research Methods

Trigonometric ratios are also said to be ratios of the lengths of the saide of the right angles. Divides into the polar coordinates of a point, the relationship between cartesian coordinating and polar coordinates, functions sine, cosine, tangent, propositions in triangles, graphs of trigonometric functions, the sumof two anl es and the difference between two angles, trigonometric equations, and inequalities, and identity division consists of inverse relationship, comparative relationship, pythagorean relationship, [12].

If the position of a point in the X-Y plane can be expressed in Cartesian coordinates. The relationship between Cartesian coordinates and polar coordinates. can be formulated as, [13]:

$$\sin \alpha^0 = \frac{y}{r} \leftrightarrow y = r \sin \alpha^0 \tag{1}$$

$$\cos \alpha^0 = \frac{x}{r} \leftrightarrow x = r \cos \alpha^0 \tag{2}$$

In mapping the function set of angles x^0 the set of real numbers $\sin x^0, \cos x^0, \tan x^0$ can be represented by:

$$F(x^0) = \sin x^0 \text{ atau } fx = \sin x$$

$$F(x^0) = \cos x^0 \text{ atau } fx = \cos x$$

$$F(x^0) = \tan x^0 \text{ atau } fx = \tan x$$

TABLE 1
COMPARISON OF TRIGONOMETRIC FUNCTIONS

No	Function	Ratio
1	Sinus α	y/r
2	Cosinus α	x/r
3	Tangen α	y/x
4	Cotangen α	x/y
5	Secan α	r/x
6	Cosecan α	r/y

Pythagoras Theorem is about a property of all triangles with a right-angle (an angle of 90°): legs a,b; hyp=hIf a triangle has one angle which is a right-angle (i.e. 90°) then there is a special relationship between the lengths of its three sides, if the longest side (called the hypotenuse) is h and the other two sides (next to the right angle), [1].

The research location was carried out at Budi Darma University in the teaching of Trigonometry material in the 2021-2022 academic year. This research was carried out directly by applying scilab learning applications for simulations of the basic concepts of trigonometry, Pythagoras and triangles and the ratio of angles

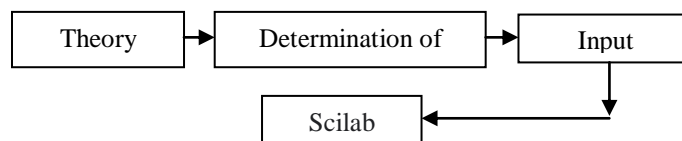


Figure.1. Research Block Diagram



Pythagoras Theorem is about a property of all triangles with a right-angle (an angle of 90°): legs a,b; hyp=h If a triangle has one angle which is a right-angle (i.e. 90°) then there is a special relationship between the lengths of its three sides:

1. If the longest side (called the hypotenuse) is h and the other two sides (next to the right angle) is called a and b, then:

$$a^2 = b^2 + c^2 \quad (3)$$

the square of the longest side is the same as the sum of the squares of the other two sides :

$$c^2 = b^2 + a^2 \quad (4)$$

is only true for right-angled triangles, [14].

2. If all the angles of a triangle are less than 90° then :

$$c^2 < a^2 + b^2 \quad (5)$$

For example, in an equilateral triangle with sides 1 1 1 and all angles 60° $1^2 = 1 < 1^2 + 1^2 = 2$

3. If one the angles of a triangle is greater than 90° then :

$$c^2 > a^2 + b^2$$

The following steps would be useful to find the angles of a triangle from the given ratio.

1. Let the angles of a triangle are in the ratio a : b : c. To get three angles, multiply each term of the ratio by an unknown, say 'x'. Then, the three angles are ax, bx and cx.
2. Since the angles of a triangle add up to 180° ,

$$ax + bx + cx = 180^\circ \quad (6)$$

Solve for x in the above equation and multiply the value of x by a, b and c separately to find the measure of each angle, [15].

Example :

If the angles of a triangle are in the ratio 5 : 4 : 3, then find the measure of each angle.

Solution : From the ratio 5 : 4 : 3, the angles of the triangle are 5x, 4x and 3x

Sum of the angles of a triangle = 180° , $5x + 4x + 3x = 180$

Simplify.

$12x = 180$, Divide each side by 12.

$x = 15$

1st angle = $5(15) = 75^\circ$, 2nd angle = $4(15) = 60^\circ$, 3rd angle = $3(15) = 45^\circ$

Next example :

In a right triangle ABC, angle A is right angle and the ratio between the angles B and C is 2 : 3. Find the measures of angle B and C.

From the ratio 2 : 3, the angle B and C are 2x and 3x.

Sum of the angles of a triangle = 180° , $m\angle A + m\angle B + m\angle C = 180^\circ$

Substitute. $90 + 2x + 3x = 180$, Simplify $90 + 5x = 180$

Subtract 90 from each side, $5x = 90$, Divide each side by 5, $x = 18$

$m\angle B = 2(18) = 36^\circ$

$m\angle C = 3(18) = 54^\circ$

- In a triangle ABC, measure of $\angle A$ is one of the measure of $\angle B$ and the ratio between the measures of $\angle B$ and $\angle C$ is 2 : 3. Find the measure of each angle.

Given : Measure of angle A is one of the measure of angle B.

$$\angle A = (1/2)\angle B$$

$$\angle A/\angle B = 1/2$$

$$\angle A : \angle B = 1 : 2$$

Given : Measures of $\angle B$ and $\angle C$ is 2 : 3. Find the measure of each angle.

$$\angle B : \angle C = 2 : 3$$

From (1) and (2), $\angle A$, $\angle B$ and $\angle C$ are in the ratio 1 : 2 : 3.



From the ratio 1 : 2 : 3, the measures $\angle A$, $\angle B$ and $\angle C$ are x , $2x$ and $3x$

Sum of the angles of a triangle = 180°

$$x + 2x + 3x = 180$$

Simplify.

$$6x = 180$$

Divide each side by 6.

$$x = 30$$

$$\angle A = 30^\circ$$

$$\angle B = 2(30) = 60^\circ$$

$$\angle C = 3(30) = 90^\circ$$

Solving the theory of basic concepts of trigonometry, pythagoras and comparisons in the form of a simulation application using scilab.

3. Results and Discussion

Explanation of simulation teaching materials, installation of the Scilab application, inputting program code to be input in the application of formula forms, sample variables, and analysis of display results on basic trigonometric concepts. The presentation of the material begins with apperception of the similar material to find the concept of the sine angle.

Example of calculating the similarity of a triangle for the formation of angles in the scilab application :

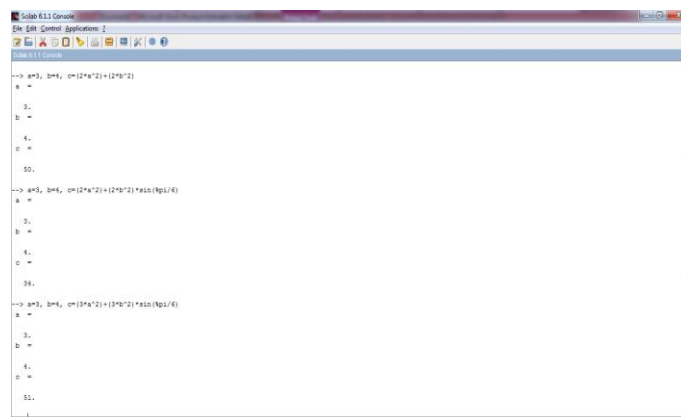


Figure.2. Scilab Simulation on Spatial Congruence

For how to create on $a \leq x \leq b$ function domain, can be done by typing the command in the scilab application :

$X = a:b$, for the values of a and b can be seen from the function domain

Can also be entered into the y function with the equation, for example:

Function $y=4x$, at $0 \leq x \leq 5$, Then we input it into the trigonometric function equation to find out the formation of each angle sine, cosine and tangent, in the following equation :

The function $y=\sin x$, with $0 \leq x \leq 2\pi$, The function $y=\cos x$, with $0 \leq x \leq 2\pi$, The function $y=\tan x$, with $0 \leq x \leq 2\pi$. The display results can be seen in the following image:



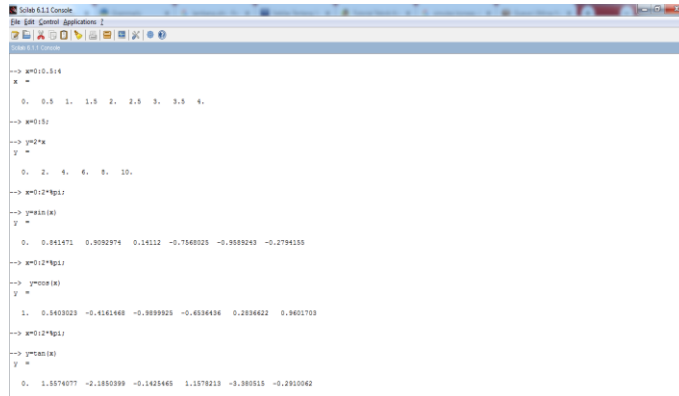


Figure.3. Display of Input Functions and Variables at Angle

Determination of the graph of the trigonometric function, can be seen by plotting the variable x,y, The display on the function graph can be seen in the following image :

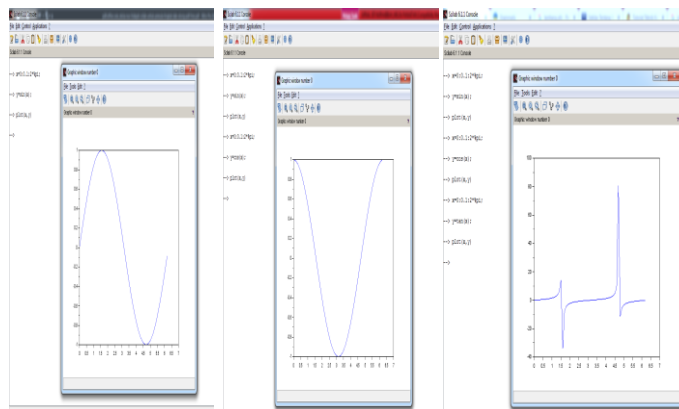


Figure.4. Graphical Display of Sine, Cos and Tangent Functions

For the use of subplots in the Scilab application, it can display 4 graphs in one display on 4 functions y_1, y_2, y_3, y_4 , at values $x=-1:0.1:1$, $y_1=2x$; $y_2=x^2$, $y_3=x^3$, $y_4=x^4$; The input values for the variables x and y in the scilab application are shown in the image below:

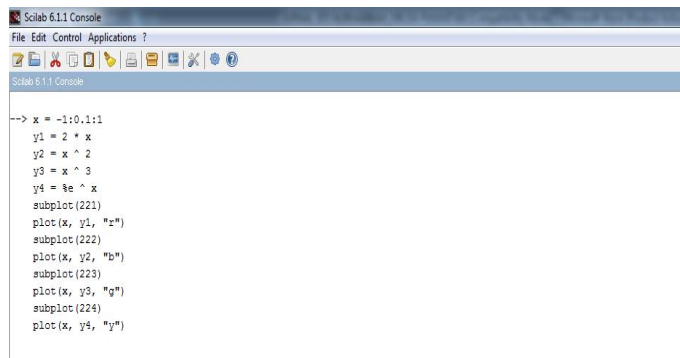


Figure.5. Input Variable Values X and Y For 4 Functions

The output display shows the difference in the following image variable equations:

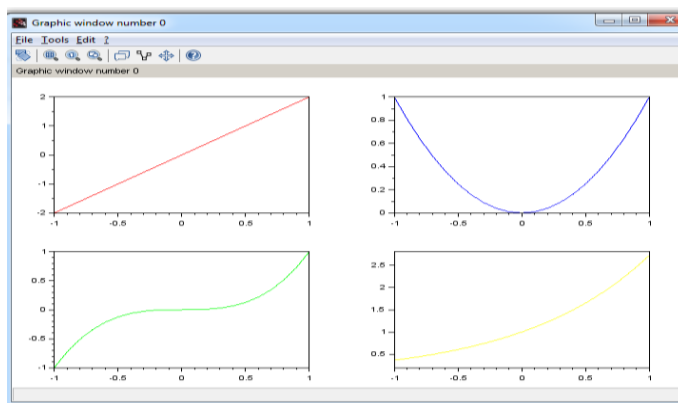


Figure.6. Display of 4 Functions of the Graph of the X and Y Equations

4. Conclusion

Students' understanding in analyzing and translating trigonometry in the form of simulations using the Scilab application can be seen how independence and understanding of using applications, material analysis of trigonometry formulations, program code input and analysis of functions, variables

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