

Manipulative's of Function Translation

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Abstract. Translation of function is important in mathematics. But there are obstacles in learning the Conceptions of function translation. One alternative to overcome this obstacle is to use manipulatives. Through the lecture mathematics learning media, we have designed manipulatives of function translation. This article will present the manipulatives that have been developed and describe how to use this manipulatives of function translation.

1. Introduction

Function is important and fundamental mathematical concept. Therefore, teaching and learning of functions has been an important focus in mathematics education [1,2]. Functions are used in every branch of mathematics as geometry, calculus, algebra, statistics, and analysis. Function as a gateway to advanced mathematics and higher education. Furthermore, function knowledge and skills are relevant in daily and professional life either. Functions are all around us, for example, functions for financial plans to calculate such things as accrued interest and income, to interpretations of local and world demographics and population growth for economic planning and development [3].

But the fact there are obstacles in learning of function. The reports on case study of a 16-year-old student working on transformations of functions in a computer based multi-representational environment [4]. Their study aim to investigate reflections horizontal and vertical lines, horizontal and vertical translations, and horizontal, vertical and stretches of functions. The student try to interpret the horizontal translation of a parabola are presented as "problematic". Zazkis have studied on the difficulty — acknowledged in the aforecited previous study — show by a horizontal of function translation [1]. Their aim as to inquire how teachers and students with that difficulty. The findings, any epistemological obstacles Concept of function translation, learners' experiences with numbers suggest that subtracting 3 (or adding negative 3) results in translation in the negative direction (left), when adding 3 to a variable results in a translation in the positive direction (right). And alike that a view is an over-generalization of previous impression of subtracting and adding numbers on the number line.

Sari recommend that one way to improve mathematics understanding is use manipulatives [5]. Ball [6] suggested manipulatives as crucial to the improvement of mathematics learning. The 3D kit serves as a useful instrument in the teaching of multivariable calculus [7]. Their result, first, for the involved symbolic algebraic manipulation, there were no statistically significant differences between students who used or did not make use the manipulative. Second, geometric orientation of students using the manipulatives did significantly better. Third, the behaviour of students in calculus of multivariable, were extremely positive against the 3D kit as a visualization tool. Heddens [8] shows Research in



Japan, England, China, and the United States endorse the idea that student mathematics understanding and mathematics learning will be more effective if manipulatives are used. Boggan et al report manipulatives is important for children to have a variety of materials to manipulate and explore if students are to develop mathematical knowledge and the opportunity to weed out, pile, classify, scale [9]. Munger shows Children learn and retain math better using manipulatives [10].

The research of [11] invent that on three of four lessons studied manipulative materials use was turned to an end in and of itself, than a tool, and that in the fourth lesson manipulative use hindered till helped student learning. These matter with manipulative use by teachers in the teaching and learning prepare useful guidance for planning of future professional development for mathematics teaching. The conclusion contains suggestion for successful implementation of manipulatives for teachers and professional developers. Next we will present how to use this tool.

2. Results and discussion

This manipulative is made of wood plastered with melamine plywood designed like a chess board, so it can be folded and in it is useful for storing graphs drawn on acrylic. The size of the tool that is (108x52x1) cm in the state of the board is open, while in the folded condition the size becomes (54x52x2) cm. As for the graph drawn on the geogebra software and then printed, then paste on the acrylic with the desired size. In order to stick to the board, paste the magnet with glue on the acrylic. Here is an example of using the tool.

Suppose known function $f(x) = x^2$ is the following picture.



Figure 1

Next we will show the graph $y = (x-2)^2$, so that the graph $f(x) = x^2$ (in figure 1) shift two units to the right is shown by the following figure.



Figure 2

Represent the graph $y = (x+2)^2$, so that the graph $f(x) = x^2$ (in figure 1) change two units to the left is shown by the following figure.

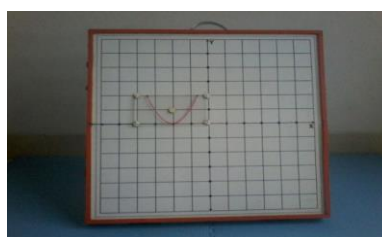


Figure 3

The graph $y = x^2 - 2$ is obtained by means of the graph $f(x) = x^2$ (in figure 1) move two units upward shown by the following figure.

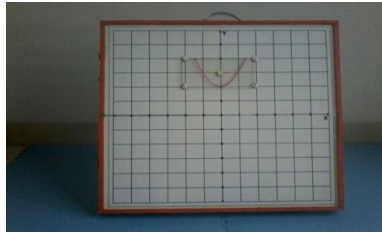


Figure4

The graph $y = x^2 + 2$ is obtained by means of the graph of $f(x) = x^2$ (in figure 1) shifted two units downward shown by the following figure.



Figure 5

The graphs on the manipulatives are as follows:

$f(x) = x^2$	$x=1$	$f(x)=1$	$f(x)=x$	$f(x) = \frac{x}{x-1}$
$f(x) = x^3$	$f(x) = x $	$f(x) = [x]$	$f(x) = 2^x$	$f(x) = {}^2 \log x$

Note: The graph is drawn using geogebra software

The principle of function translation graph is:

	Let $c > 0$, obtained 4 kinds of graphs: • $y = f(x) + c$, move $y = f(x)$ as far as c units up. • $y = f(x) - c$, move $y = f(x)$ as far as c units down. • $y = f(x - c)$, move $y = f(x)$ as far as c units to the right. • $y = f(x + c)$, move $y = f(x)$ as far as c units to the left.
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3. Conclusion

This manipulative can be used as an alternative as a visualization tool in the concept of function translation. So it is advisable to do further research on the effect of using the manipulatives.

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