"Integral" Concept: Limitations On Application And Perception Of Secondary School Students-Vietnam

Nguyen Phu Loc, Huynh Thanh Liem

Abstract: In grade 12 mathematics program in Vietnamese secondary schools, students have an opportunity to learn the concept "integral" and its applications. Thus, it helps them to know the practical significance of mathematics in general and calculus in particular. In addition, they also recognize that mathematics is a unified whole, the subjects of mathematics are consistent and mutually supportive. For example, thanks to integration one can find the formulas for calculating the area and volume of shapes that students have learned in Geometry, and can calculate the area and volume of shapes that it is very hard to find by geometrical tools. With such an importance of integral concept, the question is that: what are students' restrictions on the application and perception towards concepts "integral" students? This paper presents some results relating to the above two questions.

Index Terms: Integral, teaching calculus, mathematical didactics, mathematics education

1 INTRODUCTION

In Vietnam, students begin to learning the topic "Integral" in Grade 12- the final year of secondary education level. It includes specific contents such as: Anti derivative, Integral, Applying integration to geometry [1] [3]. Through lessons on integral, students learn how to compute the area of plane figures limited by two curves, and also learn how to calculate the volume of solids of revolution. Thus, hopefully after finishing Grade 12 mathematics program, they can realize the practical significance of mathematics in general and calculus in particular; students see more clearly the applications of calculus in reality as well as consistency among the mathematics subjects. In addition, students can learn one more that thanks to the integration which one can prove again the formulas of area and volume of the familiar figures such as the area of a circle…, and can figure out the area and volume of the figures difficult to find by pure geometry tools. However, it is not easy to obtain the above objectives because of concepts of calculus hard for secondary school students to understand (Loc, 2010). The question is that: what are students' restrictions on the application and perception towards concepts "integral"? In order to answer to the question, we addressed two following hypotheses to verify.

2 HYPOTHESIS

Hypothesis H1: In case of integral calculation of a given function, students often used to be familiar with the problems in which the functions were expressions. Thus, in case of a function given by its graph, most of students find it hard to discover the solution.

Hypotheses H2: Because the textbooks only mentioned how to calculate figures limited by two curves, students can not calculate the area of some familiar figures such as parallelogram and rectangle by integration.

- *Nguyen Phu Loc, PhD. Associate Professor in Mathematics EducationCan Tho University, Vietnam, Email: nploc@ctu.edu.vn*
- *Huynh Thanh Liem, Master student in Mathematics Education, Can Tho University, Vietnam*

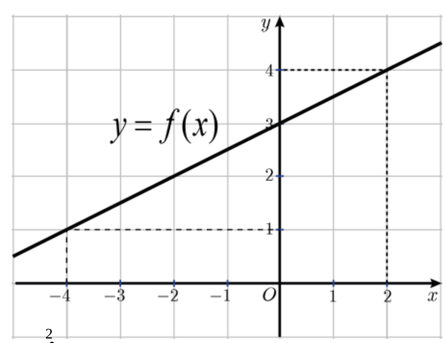
3 PROCEDURE

*** Testing students** from of four classes:

- 12A1 (N = 32) and 12 A2 (N = 36) from The Secondary School Nguyen Trung Truc (An Giang Province, Vietnam).
- 12C5 (N = 33) and 12C6 (N = 34) from The Secondary School Nguyen Huu Canh (An Giang Province, Vietnam).

*__Assignments tested__:

Assignment 1 (Verify the hypothesis H1): Given the function y = f(x) whose graph is shown as below.



Compute: $I = \int_{-4}^{2} f(x)dx$

Assignment 2: According to you, if applying integration, which figures below can we compute their areas?

A. The figure is limited by (C): $y=x^2$, Ox and two vertical lines: x=1, x=2.
B. A parallelogram which is given in coordinate system Oxy
C. A rectangle which is given in coordinate system Oxy
D. Both A, B and C.

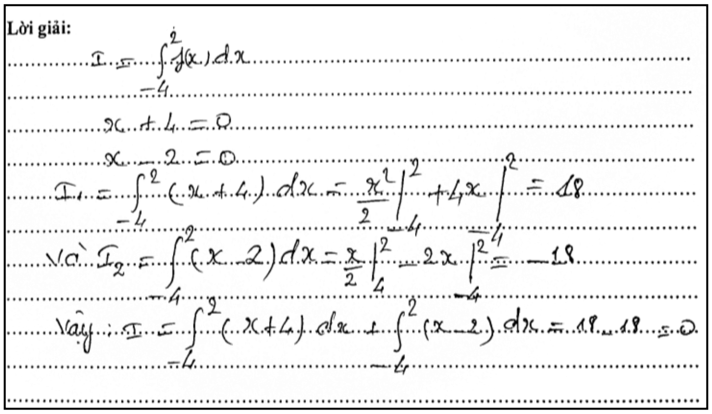
4 RESULTS

For assignment 1:

Table 1: Results of students for Assignment 1

Answer	No right strategy to solve	No answer	Sum
N	104	31	135
%	77%	23%	100%

Table 1 showed that no any students gave the right solutions to the assignment. Figure 1 was an example of a wrong strategy of a student.



Lời giải:

$I = \int_{-4}^{2} f(x)dx$

$x + 4 = 0$

$x - 2 = 0$

$I_1 = \int_{-4}^{2}(x+4)dx = \frac{x^2}{2}\Big|_{-4}^{2} + 4x\Big|_{-4}^{2} = 18$

Và $I_2 = \int_{-4}^{2}(x-2)dx = \frac{x}{2}\Big|_{-4}^{2} - 2x\Big|_{-4}^{2} = -18$

Vậy $I = \int_{-4}^{2}(x+4)dx + \int_{-4}^{2}(x-2)dx = 18 - 18 = 0$

***Figure 1**: The wrong solution of a student*

This means the first hypothesis H1 can be accepted. To know more about why students could not solve the problem, we conducted interviews with two students as follows:

Ask (for student 1): Have the type of the first assignment been familiar to you?

Answer: It is strange to me, I've never met before. I could not solve the problem because of the function not defined.

Ask (for student 2): The problem was too hard for you to solve, wasn't it?

Answer: I think I was not too hard, but because the function y= f(x) was not given, so I couldn't solve.

For assignment 2:

All of student investigated (100%) chose A. To know more about why students chose A, we conducted interviews with more three students as follows:

Ask: Why did you choose A?

Answer (student 3): Because according to the book we have learned, we only have calculated the area of figures limited by two curves. The books did not show how to calculate the area of a parallelogram and a rectangle.

Answer (student 4): I chose A because in case of B and C, all were straight lines

Ask: According to you, could we calculate the area of a parallelogram and a rectangle by integration?

Answer (students 5): No, we couldn't.

The results obtained for the second assignment showed that the hypothesis H2 was true.

5 DISCUSSION AND CONCLUSION

From the results obtained of the study, we can state that the students' understanding on integration has depended very much on the calculus textbooks. In unfamiliar situations although it was not difficult to find out the solutions, students didn't make the right solutions or didn't resolve. Thus, one thing to note is that in the process of teaching teachers should indicate the meaning of mathematical objects as well as the relationship among them. Just like that, the students can identify the nature of mathematics objects, and apply them to different situations in a flexible way.

REFERENCES

[1] Trần Văn Hạo (editor), 2012. Giải tích 12. Hanoi: Education publishing house

[2] Nguyễn Phú Lộc, 2010. Nâng cao hiệu quả dạy học môn Giải tích trong trường phổ thông. Hanoi: Education publishing house

[3] Đoàn Quỳnh (editor), 2012. Giải tích 12 - nâng cao. Hanoi: Education publishing house