



Study of Students' Mistakes While Solving Integration Problems

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ABSTRACT: The aim of the present study is to investigate mathematical mistakes related to integration committed by Yashwantrao Chavan Polytechnic students at First Year Diploma Level in their academic. For this study 60 students from first year diploma classes were chosen randomly. The samples of this study were collected from the test attempted by the participants. The following are the primary difficulties that students face while solving integration problems; Lack of conceptual understanding, Difficulty in identifying the correct technique, memorization, lack of practice, time management.

Index Terms - Integration problems, calculation, algebraic equation, partial fraction

I. INTRODUCTION

Integration is an important concept in mathematics, particularly in calculus. It involves finding the anti-derivative of a function, which is the opposite of finding the derivative of a function. While integration problems can be challenging, they are an essential part of the curriculum for students pursuing math and science fields. However, many students face difficulties while solving integration problems. In this research paper, we will explore the common problems faced by students while solving integration problems and the strategies that can help them to overcome these challenges.

II. OBJECTIVES OF THE STUDY

The present study analyses the mathematical mistakes committed by the First Year Diploma students during solving the problems. It also focuses light on the reasons behind the mistakes. Accordingly, the study attempts to:

- Focus on conceptual understanding.
- Emphasize problem-solving techniques.
- Use mnemonics and memory aids.
- Provide ample practice opportunities.
- Time management

III. SIGNIFICANCE OF THE STUDY

The significance of the study will be of great value to the teachers of Mathematics to give much time to teach basic concepts, more attention and considerable time for solving mathematical problems.

IV. RESEARCH QUESTIONS

- What are the difficulties while solving the integration problems in applied mathematics committed by Yashwantrao Chavan Polytechnic students at First Year Diploma Level in their academic?
- What are the reasons behind these difficulties while solving the problems related to Integration?

V. METHODS, SAMPLES AND PROCEDURES

A) SUBJECTS

The subjects of the present study are the 60 students enrolled in First Year Diploma Programme at Yashwantrao Chavan Polytechnic. The targeted samples are the engineering students who will complete their diploma certification in one of the following streams: Civil Engineering, Computer Science and Engineering, Electrical Engineering, Electronics and Tele-Communication Engineering and Mechanical Engineering. The students attend 4 lecture hours and 2 tutorial hours per week. The students' age ranged from 17 to 18 and they have been learning Concepts of Mathematics for ten years. The participants were chosen from above mentioned stream.

B) INSTRUMENTS

In order to collect reliable and authentic data, the following instruments were employed in this study:

C) STUDENTS' TEST

The Researcher developed 20 marks test. The test consists of the mathematical problems on integration in the following category; simple algebraic rational function, integration by substitution method, integration by-part, In order to answer the first research question of what are the difficulties while solving the integration problems in Applied mathematics committed by students at First Year Diploma Level in their academic?

Following the steps was followed.

1. Collected a sample of student work for each type of Integration problem related to simple algebraic rational function, integration by substitution method, integration by-part.
2. Recorded all student responses in written format.
3. Analyzed the responses and looked for patterns among common problem types.
4. Described the patterns observed in simple language and the possible reasons for the Student's problems

Table 1 provides description of the difficulties while solving the integration problems in applied mathematics and possible causes.

Example	Mistakes	Description Possible cause
Simple algebraic rational function Evaluate $\int \frac{1}{(x+1)} dx$	1. Incorrect application of integration rules 2. Forgetting the constant of integration	1. Students may misapply integration rules such as the power rule, substitution rule, or integration by parts. This can lead to incorrect solutions. 2. Integration involves adding a constant of integration (C) to the solution. Students sometimes forget to include this constant, which is important as it accounts for the multiple antiderivatives of a function.
Substitution method Evaluate $\int \frac{e^x}{(e^{2x}-16)} dx$.	1. Algebraic errors 2. Misunderstanding problem	1. Students may make algebraic mistakes while simplifying expressions or manipulating equations during the integration process. These errors can propagate throughout the solution and result in incorrect answers. 2. Sometimes, students fail to correctly interpret the problem statement or misunderstand the underlying concepts. This can result in using the wrong integration technique or formula, leading to incorrect solutions.
Integration by-part Evaluate $\int xe^x dx$	1. Not checking their work 2. Incorrect application of integration rules	1. Students may neglect to check their final answers or perform back-substitution to verify if their solution satisfies the original problem. This oversight can lead to undetected errors. 2. Students may misapply integration rules such as the power rule, substitution rule, or integration by parts. This can lead to incorrect solutions.

Table 1

VI. RESULTS AND DISCUSSION

The collected written data by the students was examined by the researcher and the results showed that the main mathematical mistakes were in the following categories; Simple algebraic rational function, Simple algebraic rational function, Integration by-part. A total number of 93 mathematical mistakes were found. Table 2 below displayed these mathematical mistakes in number and percentage:

Mistakes Category	Number of Mistakes	Percentage of Mistakes
Simple algebraic rational function	32	34.40 %
Substitution method	21	22.58%
Integration by-part	40	43.01%
Total	93	100 %

Table 2

Table 2 classification of the type of errors generated in the context of the study

❖ Simple algebraic rational function

The number of mistakes in Simple algebraic rational function is 32 basic mistakes that compromises 34.40 % of the total mistakes generated in the data analysis process. These mathematical mistakes were divided into the subcategories in table 3 below:

Type of Mathematical mistake	Number
.Incorrect application of integration rules	15
Forgetting the constant of integration	17

Table 3

❖ Substitution method:

The number of mistakes in Substitution method is 21 basic mistakes that compromises 22.58 % of the total mistakes generated in the data analysis process. These mathematical mistakes were divided into the subcategories in table 4 below:

Type of Mathematical mistake	Number
Algebraic errors	13
Misunderstanding the problem	8

Table 4

❖ Integration by-part

The number of mistakes in Integration by-part is 40 basic mistakes that compromises 40.01 % of the total mistakes generated in the data analysis process. These mathematical mistakes were divided into the subcategories in table 5 below:

Type of Mathematical mistake	Number
Not checking their work	24
.Incorrect application of integration rules	16

Table 5

VII. CONCLUSION

Integration is a crucial concept in calculus, and students face several difficulties while solving integration problems. The problems students face include a lack of conceptual understanding, difficulty identifying the correct technique, memorization, lack of practice, and time management. Teachers can address these difficulties by focusing on conceptual understanding, emphasizing problem-solving techniques, using mnemonics and memory aids, providing ample practice opportunities, and teaching effective time management techniques. By addressing these difficulties, students can develop the necessary skills and confidence to solve integration problems effectively.

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