An Analysis of Students' Mistakes in Mathematics While Using Scilab

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ABSTRACT:

This research paper aims to analyze and identify common mistakes made by B.Sc.II year students in mathematics while using Scilab, powerful open-source numerical computing software. Scilab is widely used in educational and scientific communities for mathematical modeling, simulation, and data analysis. Understanding the errors students commonly encounter will help educators in designing more effective teaching strategies and resources to enhance students' learning experiences. The study utilizes a qualitative research methodology involving surveys and interviews with students from diverse academic backgrounds. The findings will provide insights into students' challenges and trends in using Scilab, enabling the development of targeted interventions to improve their proficiency.

Index Terms **- Scilab, mathematical computations, B.Sc.II year students, mistakes, syntax.**

I. INTRODUCTION

Mathematics plays a vital role in various scientific disciplines, and the integration of programming in mathematics education can enhance students' understanding and application of mathematical concepts. Scilab is a widely used software tool in the field of mathematics and provides a platform for performing numerical computations, simulations, and data analysis. However, it is observed that students often make mistakes while using Scilab for mathematical tasks, which can hinder their learning progress and overall performance. This research paper aims to identify these common mistakes and propose strategies to overcome them.

II. OBJECTIVES OF THE STUDY

The present study analyses the mathematical mistakes committed by the Second Year B.Sc. students during solving the problems using Scilab. It also focuses light on the reasons behind the mistakes. Accordingly, the study attempts to:

1. To identify common mistakes made by students while using Scilab for mathematical calculations.
2. To analyze the reasons behind these mistakes and understand the underlying misconceptions in mathematics.
3. To explore the impact of these mistakes on students' understanding and performance in mathematics.
4. To assess the effectiveness of Scilab as a tool for learning and practicing mathematical concepts.
5. To develop strategies and interventions to help students overcome these mistakes and improve their mathematical skills.

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 concept, more attention and considerable time for solving mathematical problems.

IV. RESEARCH QUESTIONS

1. What are the mathematical mistakes committed by Balwant College Vita students at B.Sc. II year in their academic?

2. What are the reasons behind these mathematical mistakes while using the Scilab?

V. METHODS, SAMPLES AND PROCEDURES

A) SUBJECTS

The subjects of the present study are the 30 students enrolled in Second Year B.Sc. Programme at Balwant College Vita. The targeted samples are the B.Sc. II year students who will complete their B.Sc.certification in one of the following subject: Mathematics, Statistics Physics, Chemistry and Electronics. The students attend 1 Practical of 4 hours per week. The students' age ranged from 19 to 20 and they have been learning Basic Concepts of Mathematics for 12 years. The participants were chosen randomly.

B) INSTRUMENTS

The following tools were used in this study to acquire trustworthy and genuine data:

C) STUDENTS' TEST

The Researcher developed 15 marks test. The test consists of the mathematical problems related to B.Sc. II year practical in the following category; Matrices, Function, Polynomial and scilab programming. In order to answer the first research question of what are the mathematical mistakes committed by the B.Sc. II year student's in their academic? Following the steps was followed.

1. Collected a sample of student work for each type of problems related to B.Sc. II year practical.
2. Recorded all student responses in written format.
3. Analyzed the responses and looked for patterns among common problem types.
4. Simple explanations of the patterns seen and potential causes of the student's issues were provided.

Table 1 provides description of the mathematical mistake patterns and possible causes for each mistake.

Example	Mistake Pattern	Description Possible Cause
I. Careless Errors Example: `--> 2+3/4*5`	1. Incorrect syntax	1. This can occur due to a lack of understanding of the scilab syntax or not properly following the rules of scilab coding.
	2. Incorrect data entry	2. Students may make mistakes while entering numerical or symbolic data into the scilab program, leading to incorrect results.
	3. Incorrect use of loops or conditional statements	3. If students are using loops or conditional statements in their scilab code, they may make mistakes in the logic or conditions, leading to incorrect calculations or incorrect execution of the code.
II.Computational Errors Example: 1. The complex number $3 + 2i$ is input in Scilab as: `3 + 2 * % i`	1. Improper use of functions	1. Students may not fully understand the functionality of certain scilab functions or may use them incorrectly, resulting in incorrect calculations.
	2. Misinterpreting output	2. Students may misinterpret the output of scilab calculations, leading to incorrect conclusions or answers.
	3. Algebraic mistakes	3. Students may make algebraic errors such as incorrect simplifications, sign

		errors, or incorrect expansion of expressions, leading to incorrect results in scilab.
III Conceptual Errors Example: Scilab thinks sin and Sin are different and of course misspellings will also cause errors	1. Lack of understanding of mathematical concepts 2 Failure to check for errors 3.Failure to solve for variables	1. Students may have a weak understanding of the underlying mathematics behind the scilab calculations, causing them to make mistakes in applying the appropriate formulas or algorithms. 2. Students may not check for errors or warnings generated by scilab, leading to the propagation of errors throughout their calculations. 3. Students may forget to solve for unknown variables or fail to consider all possible cases, resulting in incomplete or incorrect solutions. 4. Lack of practice and interest.

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 in the following categories; Careless errors, Computational errors, Conceptual errors. A total number of 62 mistakes were found. Table 2 below displayed these mathematical mistakes in number and percentage:

Mistake Category	Number of Mistakes	Percentage of Mistakes
Careless Errors	17	27.42%
Computational Errors	24	38.70%
Conceptual Errors	21	33.87%
Total	**62**	**100%**

Table 2

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

- **Careless Errors**

The number of mistake in Careless Errors is 17 basic mistakes that compromises 27.42% of the total mistakes generated in data analysis process. These mathematical mistakes were divided into the subcategories in table 3 below:

Type of Mathematical Mistake	Number
Incorrect syntax	7
Incorrect data entry	4
Incorrect use of loops or conditional statements	6

Table 3

- **Computational Errors**

The number of mistake in Careless Errors is 24 basic mistakes that compromises 38.70% of the total mistakes generated in data analysis process. These mathematical mistakes were divided into the subcategories in table 4 below:

Type of Mathematical Mistake	Number
Improper use of functions	9
Misinterpreting output	7
Algebraic mistakes	8

Table 4

- **Conceptual Errors**

The number of mistake in Careless Errors is 21 basic mistakes that compromises 33.87% of the total mistakes generated in data analysis process. These mathematical mistakes were divided into the subcategories in table 5 below:

Type of Mathematical Mistake	Number
Lack of understanding of mathematical concepts	7
Failure to check for errors	9
Failure to solve for variables	5

Table 5

VII. CONCLUSION

Identifying and addressing students' mistakes while using Scilab for mathematical tasks is crucial for effective mathematics education. This research paper will contribute to the understanding of the common errors made by students and provide recommendations for instructors to improve their teaching approaches. By minimizing mistakes and enhancing students' understanding, educators can promote better learning outcomes and application of mathematics in various scientific fields.

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