Diagnostic of Errors Committed By 9th Grade Students in Solving Problems in Geometry

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Abstract:
The aim of this paper is to identify the different types of errors and learning difficulties committed by IX standard students in solving geometrical problem. A standardized mathematics diagnostic cum achievement test constructed by the investigator was used for identifying the common errors and understand the learning difficulties. In the present study descriptive survey research method was mainly adopted. Data was collected from 900 class nine students. Results show that students commit - concept error (82.8%), defective algorithm (78.1%), misused data (71.4%), calculation error (73.3%), and technical error (76.2%) respectively.

Keywords: *Error, Geometrical problem, Mathematics diagnostic*

1. Introduction

Mathematics occupies an important place in the life. Geometry is an important branch of mathematics which not only dominates/influence the learning of the mathematics in schools and higher studies, but also each and every human beings life.

Arithmetic and algebra are dealt with science of numbers but geometry is science of lines and figures. It is concerned with concept of size, shape, relative position of figure and properties of space. Geometry is recognized as a study important for cultural development. It is the key to mathematical thinking. Its importance arises partly from its value in demonstrating the nature and power of pure reason. On the basis of a few axioms or assumptions, the student is able to erect a logical structure of established truth that can be used to discover and prove new facts. It provides content that range from simple to complex. The results are verifiable as correct or incorrect. Technical advancement has placed an increasing importance on geometry not only in engineering, machine shop and construction industries, but also in landscape, architecture, interior decoration etc. Further for a sound foundation in teaching geometry a teacher has to be well versed with all possible errors which can be committed by students in learning geometry. Hence it is necessary that teacher must have the prior knowledge of errors and their remedies (Mukesh Ahlawat& Poonam Bist)

2. Error Analysis and its Scenario – Literature Review

Errors are "springboards for enquiry"- Borasi (1987). According Radatz(1980) "Student's errors in mathematics learning are worldwide phenomenon, and there is a long history for error analysis in mathematics education. But researches in the area have been scarcity. Researches in mathematics education revive only in 1970 - 1980's. The fourth, fifth and sixth survey of research in education gives a comprehensive report about research in mathematics education. The decade wise growth of research in mathematics education show 178 researches had been done for the past 60 years (from 1941-2000). Hackworth (1985) identifies three school mathematics topics seem to be "stumbling blocks" (p. 8): fractions, algebra or geometry, and calculus.

In India, sixty one studies had been conducted to identify the students errors in mathematics, forty studies concentrate in the area arithmetic only, Only eight studies have been done in the Algebra and in the combination of few topics, few studies concentrate on Geometry (Dutta,1990; Guruswamy,1990; Rachana, 2005; Neela,2007; Parekh,2008), and only one study was carried out in the area of Trigonometry (Chatiwala, 2009).

Dutta(1990) has discussed diagnosis and prevention of learning disabilities in the reasoning powers of the students in geometry. Gurusamy(1990), Kasat (1991) found circles arc and area were difficult in geometry. Rachana (2005) studied the learning difficulties in Geometry of 94 grade VIII students of Vadodara city using self-constructed diagnostic test and parallel test. Similarly Parekh Jigisha (2008) diagnose learning difficulties in Geometry of standard IX students and in the same way Chatiwala (2009) studied errors committed by 200 ninth standard students, Yadav(1990) found school environment have significant effect on concept formation in geometry. Xiaodan Wang ,et.al., (2009) conducted a study to assess the individual differences in Distribution Strategy of the Working Memory Resources during Space Geometry on sample of 15 high and low-achieving students from 400 second graders.

The findings of their study revealed that students are not clear about the difference in symbol, do not know how and when to do apply mathematical symbols pairs of angle which formed by the transversal, concept of intersection used for line segment and ray, some of the symbols used in set theory viz {}, null set, belongs and not belongs, intersection, different not understood the concept of exterior angle of triangle and interior angle, not able to identify the types of triangle from the given condition, not know the difference between two different quadrilaterals, not able to interpret geometrical statement and weak in taking L.C.M and doing error in multiplication, applying Pythagoras law and their use in geometry. Majority of students done mistakes in simplification as concept of additive inverse and multiplicative inverse and it was found that concept of right angle was not understood properly. Some students theoretically clear but unable to visualize the given situation and put it on the paper. Students were unable to relate the points given at a particular distance on the line.

From the above literature review it was found studies related to diagnosis in geometry were less and limited compared to other areas. And also samples selected for identifying the common errors in geometry ranges from 30 to 200. Hence this present study was done to have a clear explore with a large sample to understand the common errors committed by ninth class students in geometry.

3. Objectives
1. To identify the types of errors committed by IX standard students in Geometry.
2. To identify the difficulties faced by IX standard students in Geometry.

4. Methodology
The method adopted for the study is as follows:

5. Research Design
In the present study descriptive survey research method was mainly adopted by the researcher. The present study is explorative and normative in nature. The data collected for the study are both nominal and scaled data. Both descriptive and inferential statistics are employed to analyse the data.

6. Samples
A total of 900 selected IX standard students' with mixed ability from 18 English medium coeducation schools were selected for this study.

7. Research Instruments Used

A standardized Mathematics Diagnostic cum Achievement Test (MDAT) constructed, by investigator was used for collecting the data. The test is diagnostic cum achievement in nature. Each item by the test had four distracters and one of them give the correct answer. The other three distracters imply the thinking process and cognitive demand involved. The test had 30 items which could provide 90 opportunities for committing each type of errors. The responses given by all the students for each of the four distracters were analysed.

8. Statistical Techniques Used

The responses of each student were analysed to determine how many times each of the different types of errors are committed. Based on the frequencies of errors committed by students in each type, separate frequency distributions were made for all the 900 students taken together.

9. Findings

- Data analysis shows that 92% of students were not able to answer the question.
- The findings of the different types of error categories shows that concept error 745(82.8%), defective algorithm 703(78.1%), misused data 643(71.4%), calculation error 660(73.3%), technical error 686(76.2%) respectively.
- Students committed different types of error in Angles, Triangles, Quadrilaterals and Circles.
- 59% of students lack in angle related concepts and got confusion between supplementary and complementary angles
- 65% of students cannot able to answer the application related problems in triangle and quadrilateral.
- Students were not able to answer sums involving fractions due to lack of knowledge of simplifying fractions, squaring quadratic surds, complementary angle and supplementary angle.
- The concepts of radius, chord, and diameter their relation was not clear to the students.
- The students could not calculate length of chord or diameter or distance between chords in the circle.
- The students find it difficult to apply Pythagoras theorem to evaluate one side when the other two sides of right angled triangle are given.
- The properties of arc and relation with angles were not clear, so they could not give proper measure of semicircle.
- The students had no clear concept of tangent and properties of chord so they were unable to find length of chord touching inner concentric circle the concept of cyclic quadrilateral and the property opposite angles of a cyclic quadrilateral and supplementary were also not clear. Most of the findings of this study related with the findings of study conducted by Pradeep (2010).

10. Conclusion

Error analysis may also be useful for the teacher, when recognizing a specific error, to point it out to the pupil for, as Borasi (1994, page 166) observed, "Although teachers and researchers have long recognized the value of analysing student errors for diagnosis and remediation, students have not been encouraged to take advantage of errors as learning opportunities in mathematics instruction." The study will help the teachers to understand their students' common errors, strength and weakness in solving geometrical problems. Teachers should make aware of their students errors to them. It will help students to rectify their errors, mistakes, misconceptions in the field of geometry and help for fluent harmony in their life.

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