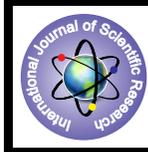


Errors as an Opportunity Tool to Enhance Statistics and Probability Knowledge Among High School Students



Education

KEYWORDS : Errors, Statistics, Probability, Diagnostic, Difficulties, Misconception

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ABSTRACT

Errors are not the incorrect answer they are natural process of students understanding in any learning and a valuable tool for both teachers and students to analyse them. The present study aims to show the different types of common errors and learning difficulties committed by class IX students while solving statistics and probability. 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 to collect data from 900 class nine students from Puducherry. Findings of the research reported the student's errors, difficulties, misconceptions in understanding the concepts and need of the curricular design and statistical training for enhancing the interest in the field statistics and probability.

INTRODUCTION

Statistics is a branch of applied mathematics in the age of planning which plays an important role in all the fields of human activity like actuarial science, astro-statistics, chemometrics, demography, econometrics, epidemiology, geo, bio statistics, operation research, population, ecology, quality control, quantitative psychology, finance, education, industry, unemployment, growth rate etc.. It is more than its own branch because statistical techniques include and uses algebra, differentiation, integration. In the same way, probability (possibility) theories, and statistical methods help make those mathematical theories that much more accurate and leads other fields of life. Statistics and probability provides averages, dispersions, and estimation allows coming with the real scientific solutions by just taking a wild guess. In the technological world what we learned something through our studies and experiences, has its own value only when it is recognized, for that it should be communicated properly outside with professional evidence or authentic proofs. Statistics and probability has been developed recently but in every human sphere they acts as a problem solving field and statisticians providing their hands to working towards a result. As remarked by Ian Hacking "The quiet statisticians have changed our world; not by discovering new facts or technical developments, but by changing the ways that we reason, experiment, and form opinions". Scope and importance of statistics in the technological world cannot be limited in the words.

ERROR ANALYSIS

Error analysis has been a research topic for many decades and researcher also focused uncovering error patterns, directing instruction, categorizing common error with specific functions. In this study error was taken as an opportunity to trace the student's missing link, the basic misconception and misunderstanding. By understanding and utilizing the knowledge about errors and difficulties in learning statistics and probability concepts teacher can properly motivate, equip and enhance their students competence.

NEED AND IMPORTANCE OF THE PRESENT STUDY

In the technologically advanced society need of the knowledge about statistics is increasing substantially and widely gets a recognized place in the education. Many countries USA, London, Spain show effort to design curriculum N.C.T.M standards in USA, mathematics curriculum for England, new Spanish curricular and learning material specifically to increase the effective citizens. To increase the interest among the citizens specific journals, regular international conferences like ICOTS promote by the ISI are taking place and association, news letter, e-journal are publishing regularly. But in country like India, need of statistical awareness was low compared to other countries. Experience of researcher in the field of school education, mathematics teacher's attitudes and the difficulties faced by students in the

statistics and probability provide to contribute research related study by identify difficulties and error which are not known/recognized/aware / reported by the teachers. Studies conducted by Hawkins and Kapadia (1984), Garfield and Alhgerm (1988), Schoi (1991) and Shaughnessy (1992) reported related to the researchers views than teachers and focused on probability than statistics. Batanero et.al (1994) study also inspired researcher and interest to conduct a study of the nature in Puducherry.

OBJECTIVES

- To identify the errors committed by IX standard students in statistics and probability.
- To identify the difficulties faced by IX standard students in statistics and probability.

METHODOLOGY

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.

SAMPLES

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

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 errors. The responses given by all the students for each of the four distracters were analysed.

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

FINDINGS OF THE STUDY

The following errors were identified from the student's responses and presented below with few illustrations of the test items: concept error was the most common error (82.8% of students) among the error doers, next in order was defective algorithm error (78.1% of students), technical error (76.2% of students), and calculation error (73.3% of students) and misused data error

(71.4% of students) respectively

Mean

Mean is seen a simple and a very useful practical concept but students committed (76% of students) error while applying to computational rule. The concept of mean was not understood properly for 21% of students, students while doing computation they made a large number of errors. In the same way while grouping the intervals students ignored the frequency of each one of the intervals when computing mean as found by Li and Shen (1992) in his study. Four general categories students' misconceptions about averages given by Russell and Mokros(1991) the 'most frequent value' or mode; the 'reasonable value'; the 'midpoint'; an 'algorithmic relationship' all found in the student error in high rate.

Median:

- Most of the students (68%) fail to order the data before calculating the median
- 54% of students commit error by taking the mode instead of median
- 49.23% commit error by taking the central value of the absolute frequencies ordered increasingly.

The results of this study has lined with the words of Schuyten (1991) -"the large distance between the conceptual knowledge of the median and the algorithm employed to obtain its value. In going from the definition of the median as 'middle value of the distribution' or as the 'value such that exactly half the data are inferior to it' to its calculation, there are many steps which are not always sufficiently stated or not sufficiently understood".

Mode: Highest Absolute Frequency. (Carvalo,1998)

Item 1: Find the bimodal for the set of values 482,485,483,485,487,487,489

Correct Solution: 485,487

For this test item 576 students respond the correct answer and the remaining 324 out of 900 (36%) students - 292 students (32%) choose 489 incorrectly and 32 students choose 487,489 as the solution. Students may mistakenly or they have misconception that highest number as mode.

Item 2: The marks of ten students in a mathematics talent examination are as follows 75,72,59,62,72,75,71,70,70,70 the mode is

Correct Solution: 70

For this item 542 out of 900(60%) students answered the item correctly and 358 (40%) students choose the incorrect solution.

- Students understanding of measures of central tendency - mean, median, mode are not given more attention by the teachers. Carvalho(2001) observed the same type of computational errors in calculating the mode, median and mean. Cobo and Batnnero (2000) also point out the algorithm of the median is complex one as it is not uniquely defined.
- Students were not clear in the basic concepts like class interval, frequency, mid value and range.
- Students could not find range in basic statistics due to insufficient knowledge of rules of statistics.
- Students could not write cumulative frequency while finding median, due to insufficient knowledge students commit lots of error in statistics.
- Probability and the actual concepts were not understood by them. Memorization related concepts were answered by the students without understanding the concept.
- Students memorize the basic concepts and formulae of probability but they cannot able to apply them in the correct places to find solution. Most of the concepts are not known to them.

CONCLUSION

Analysing of student's errors shows that many statistical concepts are difficult and not understood by them properly and they have the misconceptions and confusions in the concepts. These misconceptions are coming with them to statistical class room and making them more confusion while learning the higher levels concepts and it made them to use inappropriate information in inappropriate place. Findings of the results become the evident that there is a distinction between conceptual knowledge and ability to apply the knowledge in solving problems. The difficulties and errors committed by student's shows that there is a great need to organize a statistical training programme for students to overcome cognitive obstacles and understand meaningful mathematics. In the same way in-service training or awareness campaign should be arranged for teachers to provide deeper understanding of students' reasoning. To conclude researcher use the advise to readers given by Batanero et.al,(1994) necessary to start this exposition by explaining the relevance of this type of research and by defining some related theoretical concepts. Statistics has received, to date, less attention than other mathematical topics; most research has been carried out in experimental situations and very little has been concerned with normal classroom practice; much has been with very young or 18 + college students and rather little with the 11-16 age range; most early research was undertaken by psychologists rather than by statistical educators, although that has begun to change.

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