



Teaching Challenges: Addressing Mathematical Errors and Misconceptions among Government and Private School Students

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ABSTRACT

The aim of the study was to look into secondary school students' achievements, errors and misconceptions. 800 grade IX secondary school students (out of which 431 were from Government schools and 369 were from private schools) took the Three Tier Concept Achievement Test (TTCAT) in mathematics. Descriptive statistics yielded the mean and standard deviation. Errors and misconceptions among secondary school students were examined in connection to school type using t-ratio calculations. On the Three Tier Concept Achievement Test, there were notable disparities between the two groups in terms of mathematics achievement and errors. However, there was no discernible variation in secondary school pupils' misconceptions.

Introduction

The subject mathematics makes a man logical or systematic, that's why it is described as methodical appliance of matter. Everybody uses mathematics in their daily lives. Experience has shown that incorporating mathematical games and tricks into the curriculum can make learning the subject more enjoyable and easy.

Despite teachers' best efforts, it is a well-established fact that students do not retain the main ideas that are presented in the classroom. Even some kids provide the correct answer, but they are merely utilizing words that they have learnt. There are many fundamental causes of errors, starting with a thoughtless



error. "Between the thought and the word spoken, between the word spoken and the word heard, between the word heard and the meaning taken, lies a vast gulf." Dunlop (1997).

Barras (1984) wrote about "mistakes," "errors," "misconceptions," and "misleading ideas." He believed that only knowledgeable pupils and teachers could fix conceptual errors. According to research by Eryilmaz and Surmeli (2002), Pesman (2005), and Kutuluay (2005), blunders, ignorance, and misunderstandings are the main causes of errors made by secondary school pupils. They referred to mistakes as the wrong replies when recognizing mistakes and misconceptions among students.

Not all of the mistakes are misinterpretations. Often referred to as students' conceptions, children's knowledge, alternative conceptions or alternative frameworks (Gilbert and Watts, 1983), knowledge (Reiner, Slotta, Chi, and Resnick, 2000), or commonsense beliefs (Hestenes, Well, and Swackmer, 1992), misconceptions are impulsive ideas that students have created for themselves as a result of events with their physical environment. According to Meyer (quoted in Al-Rubayea, 1996), misunderstandings can persist for a long time since they provide people with a variety of benefits and help them understand their issues.

Misconceptions were categorized by Hershey (2004) into five groups: oversimplifications, overgeneralizations, outdated concepts and terminology, misidentifications, and incorrect studies.

Because they are oversimplifications, overgeneralizations, or misidentifications, the researchers have found that some misconceptions are simpler to spot. It was also mentioned in various research that the classroom climate (Schenke et al., 2015) and school environment (Chaturvedi, 2009) both have an impact on academic attainment. Researchers have demonstrated that while mistakes cannot be completely eradicated, they can be used to better understand the nature of concepts (Thelma, 1992; Kumar and Kumar, 2003).

Operational Definitions

- **Three-Tier Concept Achievement Test (TTCAT):** This test, known as the Three-Tier Concept Achievement Test (TTCAT), has forty-five multiple-choice questions. Each question had three different formats: multiple-choice (one right answer and three distractions) (first tier), reasoning (the rationale for the first tier answer), and level of confidence (whether or not both answers were correct) (third tier).
- **Achievement:** Mathematics proficiency is demonstrated by the right answer on the first tier of the three-tier concept achievement test.
- **Errors:** The mistake is shown by the first tier of the three-tier idea attainment test.



➤ **Misconceptions:** Based on prior incorrect responses, a misconception is an incorrect reaction followed by an incorrect justification.

Objectives of the study

1. To examine how pupils perform on a three-tier achievement test according to the type of school.
2. To investigate students' mistakes and misunderstandings regarding school type on achievement tests.

Hypothesis of the study

1. On the three-tier concept achievement test in mathematics, there is no significant difference between the Achievement of secondary school pupils attending government and private schools.
2. There is no significant difference between the errors made by secondary school pupils attending government and private schools.
3. The misconceptions held by pupils in government and private secondary schools do not differ much.

Method and Sample

The universe of the study consisted of secondary school students Punjab state. The study's target population consists of all IX students enrolled in C.B.S.E.-affiliated institutions. Multistage sampling was used to gather a sample of 800 pupils. The Three Tier Concept Achievement Test (TTCAT) is the instrument used to collect data in mathematics. Information was gathered from schools spread across Punjab's several districts. The researcher went to the school in person. 800 grade IX secondary school students (of which 431 were from the government and 369 were from the private sector) made up the sample.

Data Analysis and Statistical Treatment

The data was analysed using the t-test and descriptive statistics.

Achievement, Errors and Misconceptions of Grade IX School Students on Three Tier Concept Achievement Test in Mathematics with Respect to Type of School

Table 1 shows the mean, standard deviation, and t-value of the mathematics achievement, errors, and misconceptions of grade IX students on the Three Tier Concept Achievement Test (TTCAT) by school type, i.e government and private schools.

Table 1**Achievement, Errors and Misconceptions of Grade IX School Students on Three Tier Concept Achievement Test (TTCAT) in Mathematics with Respect to Type of the School (N=800)**

Type of School	Government (N = 431)		Private (N = 369)		t-Value
	Mean	SD	Mean	SD	
Achievement	30.71	5.18	32.03	5.31	3.55*
Errors	13.64	4.99	12.35	5.09	3.61*
Misconceptions	5.10	2.91	5.04	3.30	0.31

*P<0.01

Ho 1: The average achievement scores of IX grade pupils attending government and private schools are 30.71 and 32.03, respectively, with standard deviations of 5.18 and 5.31, as indicated in Table 1. At the 0.01 level of significance, the kind of school's t-value of 3.55 is significant. Therefore, the hypothesis that there is no significant difference in the mathematical achievement of pupils attending government and private schools was rejected.

Ho 2: According to Table 1, the average number of mistakes made by IX grade Government and private school pupils on the Three Tier Concept Achievement Test (TTCAT) is 13.64 and 12.35, respectively, with standard deviations of 4.99 and 5.09. At the 0.01 level of significance, the kind of school's t-value of 3.61 is significant. Therefore, the hypothesis that there is no significant difference between the errors made by pupils in government and private schools on the mathematics achievement test was rejected.

Ho 3: According to Table 1, the average number of misconceptions among IX grade students attending government and private schools is 5.10 and 5.04, with SDs of 2.91 and 3.30. At the 0.05 level of significance, the kind of school's t-value of 0.31 is not significant. Therefore, the hypothesis that there is no significant difference in the mathematical achievement of pupils attending government and private schools was accepted.

Main Findings and Conclusions

1. Students in government and private secondary schools perform significantly differently on the three-tier concept achievement test in mathematics. On the three-tiered concept achievement test in mathematics, private school students perform better than those attending public schools.



2. The errors made by secondary school pupils attending government and private schools varied significantly. Compared to students at private schools, students in government schools made more mistakes.
3. Students attending private secondary schools have similar misconceptions about the government.

Suggestions

1. To improve the performance of pupils in government schools, new methods and approaches had to be implemented.
2. Students should be encouraged to study in order to reduce mistakes.
3. To reduce misunderstandings, concepts should be corrected through a constructive method.

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