A Study of Logical Thinking and Academic Achievement in Mathematics of Secondary School Students

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Abstract

The main aim of this study was to assess performance of secondary school students in logical thinking. A test of reasoning was administered to a sample of 1000. The results show differential performance of the students. Item wise performance with background variable as school management shows that performance of unaided schools students was significantly better than students of government schools. Similarly urban students performed well than rural students respectively. Interaction analysis of rural urban divide shows that some items show interaction effect by behaving differently in response to moderator variables.

Introduction

Devlin (2001) defined mathematics as the science of patterns which also emphasizes on order, structure, pattern and logical relationship. Students in mathematics education need to develop their ability to reason and think logically. It is required by students of all discipline in general and of mathematics in particular (Frances, 1995). Mathematics education aims at developing logical thinking among students who generally think in algorithm but that is not logical thinking as there is difference between logical thinking and just thinking. Depending on mere thinking leads to memorization which ultimately does not develop logical thinking. Students without logical thinking in mathematics can handle the similar situation but are unable to do something when confronted with a different situation. Logical learning enables them to understand the situation and find a logincal solution that leads them towards logical thinking (Bako, 2009). Logical thinking moves from known to unknown following certain objectives rules and standards which are grammar of logic (shatnawi, 1982). Logical thinking is linked to the idea that study of mathematics can prove that certain things are true in mathematics and there are certain rules of grammar with which concepts related to mathematics can be organized (Macdonal, 1986). Logical thinking is based on certain premises and if premises have mathematical nature, it can be said that mathematical logic is working.

Study of mathematics provides meaningful understanding when understood through the use of reasoning. Level of logical reasoning increases with its consistent usage in various contexts and when it is learnt at early years. Wille (2009) stated that mathematical thinking developed logical thinking which helped the students understand the realities around them and do sensible actions.

Review of Related Literature

Achievement in mathematics has been associated with reasoning and logical thinking. (Dyke and Frances, 1995). Systematic reasoning is thought to be a prominent feature of mathematics education in which one can explore, identify and justify all content related to mathematics.

Bessoondyal (2005) conducted a research in mathematics to identify gender differences. His findings showed that boys performed significantly better than girls. There were gender differences on TIMSS data as stated by (Gonzales et al 2004) which indicated that girls performed better than boys. Data showed that girls used logical thinking in mathematics more than the boys.

Study conducted by Ma'moon (2005) also found that girls performed better

than boys in the use of logical thinking while solving mathematics sums. In another study on gender comparison by Cox (200), it was found that female students scored higher than the boys in mathematical operations involving logical thinking. Battista (1990) conducted a study to examine gender relationship for use of logical thinking in mathematics. The results indicated that there was no significant relationship between male and female on the use of logical thinking in mathematics at secondary school level. Various research studies (Ginsburg, Cooke, Leinwand, Noell, and Pollock, 2005; Bessoondyl, 2005; Stanley, 1982, Mamoon, 2005) showed that gender differences existed on logical reasoning at secondary level. These studies reveal that boys perform better than girls in logical thinking skills.

The Problem

The present investigation is titled as: "**A Study of Logical Thinking and Academic Achievement in Mathematics of Secondary School Students".**

Objectives of the Study

1. To study the significant difference between type of management (Aided/ Un-aided and Government) of secondary school students with respect to logical thinking in mathematics.
2. To study the significant difference between location (rural and urban) of secondary school students with respect to logical thinking in mathematics.
3. To study the significant difference between gender (male and female) secondary school students with respect to logical thinking in mathematics.
4. To study the significant difference between logical thinking of secondary school students with respect to academic achievement in mathematics.

Variables of the Study

In the present study the following variables were considered:

Independent Variable

- Logical Thinking

Moderator Variable

- Gender (Boys and Girls)
- Type of Management (Aided/Unaided and Government)
- Location (Rural/Urban)

Method of Research

The present study is a Descriptive survey research method.

Research Design

The present study is a descriptive survey research. The research design

specifies the questions to be investigated, the process of sample selection, methods of procedure to be followed, measurements to be obtained and comparison and other analyses to be made. Secondary school students were considered for the study.

Hypotheses of the Study

1. There is no significant difference between type of management (Aided/Un-aided and Government) of secondary school students with respect to logical thinking in mathematics.
2. There is no significant difference between location (rural and urban) of secondary school students with respect to logical thinking in mathematics.
3. There is no significant difference between gender (male and female) secondary school students with respect to logical thinking in mathematics.
4. There is no significant difference between logical thinking of secondary school students with respect to academic achievement in mathematics.

Research Tools Used

The following tool was used for collection of data.

1. Logical Thinking Test –Constructed and Developed by the Investigator

Sample of the Study

The study consists of 1000 samples of students of secondary schools selected from three types of schools (Government, Aided and Un-aided) by using stratified random sampling technique.

Statistical Techniques

In the present study 't' test is used to know the difference between logical thinking in mathematics of the secondary school students

Data Analyses and Interpretation

Table-1: Mean, SD, SE, t-value and p-value Urban and Rural Secondary school students with respect to Academic Achievement

Location	Mean	SD	SE	t-value	P-value	Signi.
Urban	40.15	10.40	0.46	7.2604	0.0001	S
Rural	34.89	12.42	0.56			

From the results of the above table, it can be observed that, the students of urban and rural secondary schools differ significantly with respect to their academic achievement scores (t=7.2604, p=0.0001) at 5 percent level of significance. The chance for the wrong rejection of null hypothesis is zero. Therefore, it may reject H_0. Hence, it is concluded that the students of urban secondary schools have significantly higher academic achievement as compared to students of rural secondary

schools. The mean and SD are also presented in the following figure.

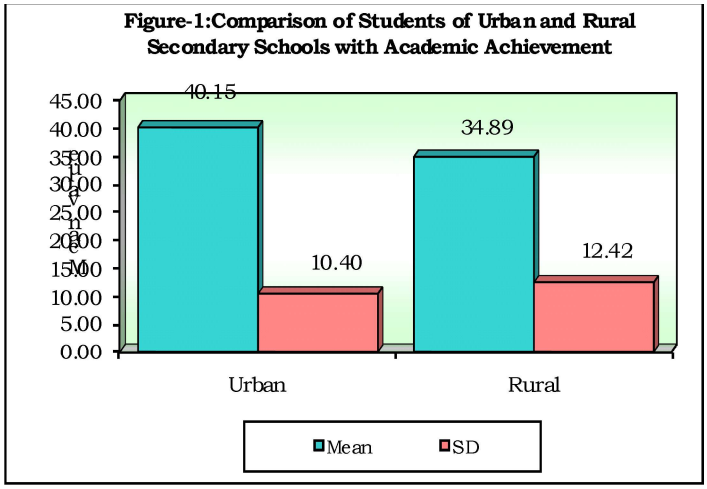

Table-2: Mean, SD, SE, t-value and p-value of Urban and Rural Secondary School Students with respect to Logical Thinking in Mathematics

Variable	Location	Mean	SD	SE	t-value	P-value	Signi.
Logical Thinking	Urban	69.03	15.50	0.69	6.9129	0.0001	S
	Rural	61.30	19.62	0.88			

From the results of the above table, it can be observed that,

Ø The students of urban and rural secondary schools differ significantly with respect to logical thinking scores (t=6.9129, p=0.0001) at 5 percent level of significance. The chance for the wrong rejection of null hypothesis is zero. Therefore, we may reject H_0. Hence, it is concluded that the students of urban secondary schools have significantly higher logical thinking as compared to students of rural secondary schools. The mean and SD are also presented in the following figure.

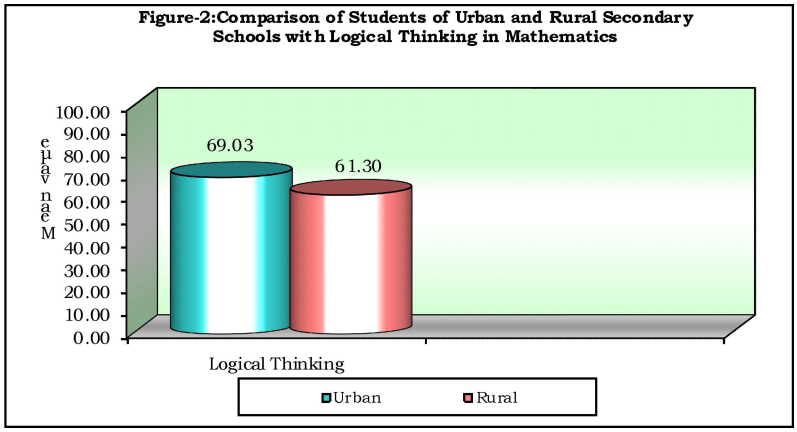

Table-3: Mean, SD, SE, t-value and p-value between Students of Government and Private Secondary Schools with respect to Academic Achievement

Managements	Mean	SD	SE	t-value	P-value	Signi.
Government	35.25	12.19	0.54	-6.2415	0.0001	S
Private	39.80	10.83	0.48			

From the results of the above table, it can be observed that, the students of Government and private secondary schools differ significantly with respect to their academic achievement scores (t=-6.2415, p=0.0001) at 5 percent level of significance. The chance for the wrong rejection of null hypothesis is zero. Therefore, we may reject H_0. Hence, it can be concluded that the students of private secondary schools have significantly higher academic achievement as compared to students of Government secondary schools. The mean and SD are also presented in the following figure.

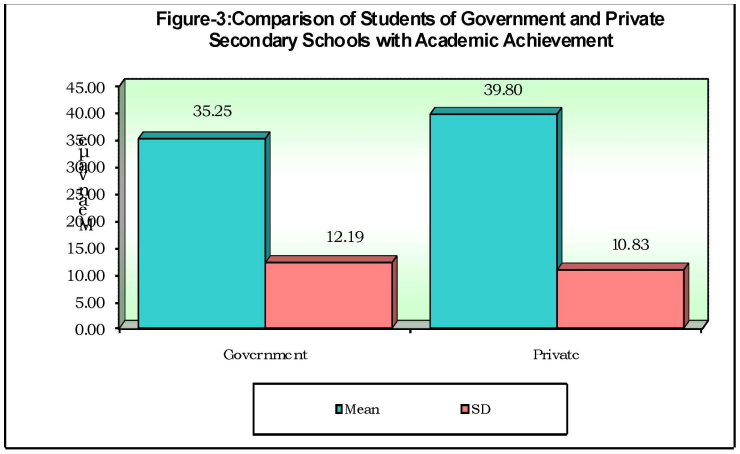

Table-4: Mean, SD, SE, t-value and p-value between Students of Government and Private Secondary Schools with respect to Logical Thinking in Mathematics

Variable	Managements	Mean	SD	SE	t-value	P-value	Signi.
Logical Thinking	Government	62.14	18.12	0.81	-5.3501	0.0001	S
	Private	68.18	17.57	0.79			

From the results of the above table, it can be observed that,

Ø The students of Government and private secondary schools differ significantly with respect to logical thinking scores (t=-5.3501, p=0.0001) at 5 percent level of significance. The chance for the wrong rejection of null hypothesis is zero. Therefore, we may reject H_0. Hence, we conclude that the students of private secondary schools have significantly higher logical thinking as compared to students of Government secondary schools. The mean and SD are also presented in the following figure.

Findings of the Study

2. The students of urban secondary schools have significantly higher academic achievement as compared to students of rural secondary schools.
3. The students of urban secondary schools have significantly higher logical thinking as compared to students of rural secondary schools.
4. The students of private secondary schools have significantly higher academic achievement as compared to students of Government secondary schools.
5. The students of private secondary schools have significantly higher logical thinking as compared to students of Government secondary schools.

Discussion and Conclusion

Government and private secondary schools in the sample follow the same syllabus but change significantly in management autonomy and the quality of input in terms of student's enrolment. This fact is more elaborated by the disparity in private secondary school students and government secondary school students' achievement gap where in the cities the students can have private coaching easily. In the same way private and government secondary school students gap in achievement where private coaching for students of private school, with parents relatively better than parents of government school students, is a fashion and status symbol for them points to this explanation. Students interviews also shows that private secondary school students had better understanding of the questions and expressed mathematical thinking in their solution than rural secondary school students.

In relation to location, there were significant performance differences for Logical thinking. In Logical thinking urban students outperformed rural students indicated by their means scores. Urban areas have often better population in terms of socio-economic status and literacy rate so the students here also have the opportunities to get private coaching which is a popular culture in urban areas. Urban students have frequent interaction with educated people and thus gets motivated for education in contrast to the students of rural areas where they are mostly engaged with parents in farming and other jobs and thus do not get much time for study and lagged behind their urban counter parts. Students of private secondary schools outperformed their government secondary schools counterparts significantly in logical thinking. The result also showed that there was significant interaction effect between urban and rural secondary school sector and logical thinking. On the other hand contrasting results was found in case of private secondary school students where private schools did well in logical thinking.

Students should not be discouraged during question answer process in the classroom and their faulty mathematical reasoning should be utilized for learning. Their poor reasoning should not be rewarded negatively.

References

1 Ai, X. (2002). Gender differences in growth in mathematics achievement: three level longitudinal and multilevel analyses of individual, home, and school influences. *Mathematical thinking and learning,* 4(1).

2 Alasia, A. (2003). *Rural and Small Town Canada Analysis Bulletin Catalogue* No. 21-006-XIE.4(5).

3 Alkhateeb, H.(2001). Gender difference in mathematics achievement among high School students in the United Arab Emirates. *School Science and Mathematics,* 101(1).

4 Armstrong, J. M. (1981). Achievement and participation of women in mathematics: Results of two National Surveys. *Journal for Research in Mathematics Education.* 12.

5 Baker, T.L. (1994), *Doing Social research (2ndEdn.),* New York: McGraw-Hill Inc.

6 Basey S. W., Joshua M.T and Asim A.E. (2008). Gender Differences and Mathematics achievement of Rural Senior Secondary Students in Cross River State, Nigeria.

7 Benbow, C. P. (1982). Consequences in high school and college of sex differences in mathematical Reasoning ability: A longitudinal perspective. *American Educational Research Journal*, 19(4).

8 Bitner-Corvin, Betty L. (1987). *The GALT: A Measure of Logical Thinking Ability of 7th through 12th Grade Students*. Downloaded from ww.eric.ed.gov/ ERICDocs/ data/ ericdocs2sql/ content_ storage_01/ 0000019b/ 80/1d/7d/ 29.pdf

9 Brandon P.R., Barbara J., Newton and Hammond O. W. (1987). Children's Mathematics Achievement in Hawaii: Sex Differences Favoring Girls. *American Educational Research Journal,* 24.