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Mathematical Ability Of Secondary Students And Its Impact On Achievement In Mathematics

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Abstract: This study investigated the relationship between secondary school students' mathematical ability and achievement in mathematics in West Bengal. This study adopted multi-stage sampling technique. Data were collected rom a sample of 100 female students from rural and 100 male students' rom urban school which were randomly selected using the simple random sampling method at local govt added school. Two research questions and instruments were used for the study. Mathematical Ability test and Mathematical achievement test were used for this investigation. 't' test and simple correlation was used for analysis the data at 0.05 level. Result shows that there was a positive significant relationship between mathematical Ability and achievement in mathematics This study revealed that the boys' and girls' mathematical ability is not significantly difference whereas the no difference between boys and girls in mathematical ability. When we consider there is significant difference between mathematical ability and mathematical achievement then it has been found that achievement in mathematics is significantly better than mathematical ability. But when we consider H03 there is significant difference between mathematical ability of rural and urban areas. We found that urban areas are better mathematical ability than rural areas. Based on these finding, it was recommended that government should provide schools with facilities that will develop and sustain students' mathematical Ability as it is a good predictor of students' achievement in mathematics.

Index Terms **-** Mathematical Ability; Achievement in Mathematics; Gender; Locality; Secondary students.

I. INTRODUCTION

Mathematics is one of the important subjects of education system. It is a subject which is associated with daily human life. It is a science that related logic, number, quantity, time, space, and arrangement. Mathematics has made student more logical.

Science and mathematics are closely related with each other. Special emphasized is relied upon physics, chemistry, biology, astronomy, anthropology etc. Student achievement and educational exploration is depending upon mathematics at large. Hence mathematics is included as compulsory subject to secondary level school education. Thereby mathematics is an essential subject of the school curriculum.

Science and Mathematics are closely connected. Especially in the field of physics, chemistry, Biology, Astronomy, Anthropology etc. A student who is poor in Mathematics cannot be strong in science. Every student should know Mathematics. Mathematics is a compulsory subject to secondary level of school education. Hence Mathematics is an essential subject of the school curriculum. Mathematics is fundamental to know every science. Mathematics helps to students for intellectual development. Many students want to choose Mathematics for further career. For development of problem solving and reasoning ability, student knows Mathematics.

Mathematics is a one of challenging subject to our world. From past times to till date. It is called as a "QUEEN OF SCIENCE". In our daily work we must use different Mathematical concepts. It conveys a period in human life because it relates to numbers. Without number we cannot do our job. So, we use Mathematics from the morning to the finish the day.

Mathematics is a valuable subject which makes major role in achieving the aims of education. The major aim of education is to improve the individual. In different respect, Mathematics is very important to individual.

Mathematics plays a major role at the secondary stage of education among the boy and girl students. Socio-economic and socio-cultural factors also influence mathematical achievement as well as educational upliftment of the students at large.

1.1 Mathematical Ability

Mathematical abilities are studied by psychologists, pedagogues, mathematicians, methodologists, and others, from various aspects. Mostly, the subjects they are dealing with refer to studying of thinking processes manifested at solving different mathematical problems and existence of general (group) or specific mathematical abilities. Generally, the researches into mathematical abilities can be classified in two groups: introspective and factorial. Singling out mathematical abilities' components (parameters) is set as a final aim of the researches. The purpose of our work was to define briefly mathematical abilities, explore experimentally the connection between the level of mathematical abilities development and gender of the students, their general intellectual capacities, success in mathematics and educational status of their parents, and point to the possibilities of developing mathematical abilities in children. Presentation of the research results is a target subject, and other issues will be worked out to the extent necessary for better understanding of these results. In our research, when mathematical abilities are in question, we bear in mind, above all, the pupils who can be classified into a category of gifted ones, thus, the ones with high mathematical abilities.

One of the initiators of researching mathematical abilities was Henri Poincare, (1854-1912), a prominent French mathematician. He found out the existence of special mathematical abilities and pointed out to their important component – mathematical intuition. Depending on the level of possessing mathematical intuition, Poincare singled out three levels of mathematical abilities.

1.2 Achievement in Mathematics

Student learning which is directly related to mathematics achievement is categorized into three major factors: family, institutional, and personal factors. Family factors relate to socio-economic status including parents' qualifications and occupation, family size, income and social standing in society and home environment. Institutional factors include educational environment, curriculum, extent of physical amenities and teachers' competencies and behaviour with students. Students' personal factors may include intelligence, attitude, motivation, interests, and aptitude and study habits. Out of the above-mentioned factors, the effect of socio-economic status, school climate and study habits need to be researched thoroughly to investigate their impact upon student learning and mathematics achievement.

Mathematical achievement is the competency shown by the student in mathematics. It is the result of acquired knowledge or information, understanding, skills and techniques developed in the subject of mathematics in a particular stage. Its measure is the score on the achievement test in mathematics.

Mathematics is just not only the subject to study at schools but it is a life line for future India as it their study that "participation in the co-curricular activities, sports and athletics improve the performance of students in their studies." Marsh & Kleitman (2002) stated in their study that "most of the co-curricular activities have found to be good in constructing and enhancing academic performance of the students although they do not have direct relationship with their academic subjects".

II. REVIEW OF THE RELATED LITERATURE

The investigator presents her acquaintance with some of the related studies as review:

1. **Nizoloman O.N. (2013)** in his work on relationship between mathematical ability and achievement in mathematics among female secondary school students showed that mathematical ability is a stronger predictor on students achievement in mathematics.
2. Kaur (2017) discovered that girls' mathematics performance surpassed that of boys' in general, yet this gender difference was not observed in private schools.

3. Dandagal & Yarriswam (2017) investigated the intelligence levels of secondary-level boys and girls, revealing almost equal intelligence test scores between the genders. They suggested no significant mean difference between boys and girls concerning academic achievement.
4. Bharadwa et al. (2016) explored a substantial gender gap in mathematics, notably increasing with age and impacting mathematics achievement.
5. Mallik; Farook & Tabassum (2016) observed that girls achieved higher scores in mathematics compared to boys, attributing this to the influence of experienced teachers.
6. Anjum (2015) highlighted disparities between boys and girls in upper primary mathematics achievement and reading comprehension. Additionally, they found a positive correlation (r=0.47) between reading comprehension and mathematics achievement.
7. Asante (2010) revealed that boys outperformed girls in mathematics achievement on standardized tests.
8. Fernandez (2011) established a positive correlation between intelligence and specific areas of mathematics achievement.
9. Abiam & Odok (2006) found no significant relationship between gender and mathematics achievement. They also suggested a low relationship specifically in geometry and trigonometry.
10. Das (1986), Patel (1997), Kasat (1991), and Abdual Majeed (1992) all discovered a positive correlation between mathematics achievement and intelligence.

III. Need and Significance of the study

Upon reviewing the related literature, it is evident that there is a lack of research examining the relationship between mathematical ability and Achievement in Mathematics specifically in the context of West Bengal (W.B). Furthermore, there is a dearth of foreign research data available on this subject within this particular region. Consequently, considering this gap, the researcher has chosen to undertake the present study.

The study is focused on nine-grade secondary students at the district level, with Mathematical ability as the independent variable and gender as a factor of interest. The dependent variable of the study is mathematics achievement. This research aims to explore and analyze the relationship between these variables within this specific context.

IV. STATEMENT OF THE PROBLEM

The title of the study stated as: -- "**Mathematical Ability of secondary students and its impact on Achievement in Mathematics.**"

V. OBJECTIVE OF THE STUDY

The objectives of the present study were to assess the relationship between mathematical ability and achievement in mathematics.

The present study has under taken to achieve the following objectives:

1. To study the mathematical ability among secondary school students.
2. To study the mathematical achievement among secondary school students.
3. To study the difference in mathematical ability with respect to Gender and Locality.
4. To study the difference in mathematical achievement with respect to Gender and Locality.
5. To find out the relationship between mathematical ability and achievement in mathematics among secondary school students.

VI. HYPOTHESIS OF THE STUDY

In keeping with the problem formulated and objectives tested with following hypothesis were proposed to be tested:

H_o1: There is no significant difference between boys and girl's secondary student in Mathematical Ability.
H_02: There is no significant difference between boys' and girls' secondary students in Achievement in Mathematics.
H_03: There is no significant difference between rural and urban areas of secondary students in Mathematical ability.
H_04: There is no significant difference between rural and urban areas of secondary student in Achievement in Mathematics.
H_05: There is significant relationship between Mathematical Ability and Achievement in Mathematics.

VII. METHODOLOGY

The current research adopts a Descriptive survey method to collect and analyze data.

7.1 POPULATION

For this study the target population growth is all secondary level students under the West Bengal Board of Secondary Education. The students belong to the age group of 14-16. The investigation was limited within Purba Medinipur district.

7.2 SAMPLE

From the above population the representative group has been selected as sample for the study. The sample comprises of 25 boys and 25girls; 25 rural areas and 25 urban areas across four schools of Purba Medinipur district for the present study. Multistage Sampling technique has been adopted for the selection of sample.

- The sample will be selected randomly from Purba Medinipur District.
- The sample will comprise students of secondary schools only.

The sample considered 100 pupils of class X taken from different schools of Purba Medinipur district.

7.3 VARIABLES

The following variables are considered for the present study:

Independent variable – Mathematical Ability
Dependent variable –Mathematical Achievement
Categorical variables –gender, locality

7.4 TOOLS

The present research used two different tools namely:

1. Mathematical ability questionnaire.
2. Mathematical Achievement data collect from school record.

7.5 STATISTICAL TECHNIQUES USED

Data were analysed by the methods of mean, standard deviation, and t-test.

VIII. ANALYSIS OF DATA

Mean (M) and Standard Deviation (S.D.) of total sample and each group of students for dependent and independent and categorical variables are given below in the following tables:

Table 8.1: Showing mean and SD of mathematical ability with respect to sex

Sex	N	Total score	Mean	S.D.
BOYS	25	450	18	2.59
GIRLS	25	425	17	2.47

Table 8.2: Showing mean and S.D. of achievement in mathematics with respect to sex

Sex	N	Total score	Mean	S.D.
BOYS	25	2050	82	10.27
GIRLS	25	1975	79	7.89

Table 8.3: Showing mean and SD of mathematical ability with respect to locality

Locality	N	Total score	Mean	S.D.
Rural areas	25	400	16	2.49
Urban areas	25	525	21	1.7

Table 8.4: Showing mean and S.D. of achievement in mathematics with respect to locality

Locality	N	Total score	Mean	S.D.
Rural areas	25	2100	84	10.14
Urban areas	25	2225	89	7.53

Table 8.5: Showing mean and S.D. of mathematical ability and mathematical achievement

variables	N	Total score	Mean	S.D.
Mathematical ability	100	1800	18	3.098
Mathematical achievement	100	6500	65	8.062

IX. Hypothesis testing and Discussion

Analysis of data pertaining to H_01 ($H_0$1: there is no significant difference between Boys and Girls secondary student in mathematical ability)

Table 9.1: Showing the distribution of 't' of Mathematical Ability with respect to sex of class X students.

	Sex	N	Mean	S.D.	SED	df	t	Level of significance
Mathematical ability	Boys	25	18	2.59	0.72	48	1.36	NS
	Girls	25	17	2.47				

From the above table 9.1 the 't' value is 1.36 that is not significant at 0.05 level. Hence $H_0$1 is accepted. So, we conclude that there is no significant difference of mathematical ability between boys and girls.

- **Analysis of data pertaining to H_02(**$H_0$2: there is no significant difference between Boys and Girls secondary student in Achievement in Mathematics)

Table 9.2: Showing the distribution of the 't' of mathematical achievement with respect to sex of class X student.

	Sex	N	Mean	S.D.	SED	df	t	Level of significance
Mathematical achievement	Boys	25	82	10.27	2.59	48	1.14	NS
	Girls	25	79	7.89				

From the above table 9.2 the 't' value is 1.14 that is not significant at 0.05 level. Hence, $H_0$2 is accepted. So, we conclude that there is no significant difference of mathematical achievement between boys and girls.

- **Analysis of data pertaining to H_03(**$H_0$3: there is no significant difference between rural and urban areas of secondary student in mathematical ability)

Table 9.3: Showing the distribution of the 't' of mathematical ability with respect to sex of class X student.

	Locality	N	Mean	S.D.	SED	df	t	Level of significance
Mathematical ability	Rural areas	25	16	2.49	0.60	48	8.06	S
	Urban areas	25	21	1.7				

It is seen from the above table 9.3 that the value of 't' is 8.06 that is significant at 0.05 level. So, we conclude that mathematical ability of urban areas is better than that of rural areas.

- **Analysis of data pertaining to H_04 (**H_04: there is no significant difference between rural and urban areas of secondary student in achievement in mathematics)

Table 9.4: Showing the distribution of the "t" of mathematical ability with respect to sex of secondary student.

	Locality	N	Mean	S.D.	SED	df	t	Level of significance
Mathematical achievement	Rural areas	25	84	10.14	2.53	48	1.94	NS
	Urban areas	25	89	7.53				

It is seen from the above table 9.4 that value of 't' is 1.94 that is not significant at 0.05 level. Hence H_04 is accepted. So, we conclude that there is no significant difference of mathematical achievement between rural and urban areas.

- **Analysis of data pertaining to H_05 (**H_05: there is significant relationship between mathematical abilities and achievement in mathematics of secondary student)

Table 9.5: Showing product moment correlation ('r') between mathematical ability and achievement in mathematics among class x students.

Variable	N	df	r	Level of significance
Mathematical ability	100	98	0.22	S
Achievement in mathematics	100			

From the above table 9.5, the obtained value of 'r' is 0.22 which is significant at 0.05 levels. Hence H_05 is rejected at 0.05 levels. So, we conclude that there is significant co-relation between mathematical ability and achievement in mathematics of class X students at 0.05 level.

X. CONCLUSION

The present study has attempted to find out the relationship among mathematical ability and mathematical achievement. A summary of the important findings given:

i. Analysis of data, pertaining to $H_0$1 revealed that there is no significance effect of sex on mathematical ability of the secondary level students. It can be concluded from the result that there is no significance relation between sex and mathematical ability.

ii. Analysis of data, pertaining to $H_0$2 revealed that there is no significance effect of sex and mathematical achievement of the secondary level students. It can be concluded from the result that there is no significance relation between sex and mathematical achievement.

iii. Analysis of data, pertaining to $H_0$3 revealed that there is no significance effect of locality and mathematical ability of secondary level students. It can be concluded from the result that there is significant relation between locality and mathematical ability. It may be concluded that mathematical ability of urban areas is better than mathematical ability of rural areas.

iv. Analysis of data, pertaining to $H_0$4 revealed that there is no significance effect of locality and achievement in mathematics of secondary level school students. It can be concluded from the result that there is no significance relation between locality and achievement in mathematics.

v. Analysis of data, pertaining to $H_0$5 revealed that there is significance effect of mathematical ability and mathematical achievement. It can be concluded from the result that there is significance relation between mathematical ability and achievement in mathematics. It may be concluded that mathematical achievement is better than mathematical ability.

The findings of this study based on the sample and data collected revealed:

- That there is a positive and significant relationship between students' mathematical ability and achievement in mathematics.
- That students' mathematical ability can predict achievement in mathematics.

The study highlights an important result that provider's further information the links between students' mathematical ability and achievement in mathematics. However, the results of this study also showed that mathematical ability is a strong predictor on students' achievement in mathematic.

XI. DISCUSSIONS:

The study has been conducted to find out the relation between mathematical ability and mathematical achievement among secondary school students. In these connection four schools was selected to complete the study within in a very little time. Although the issue of the study was very important but due to different constraint the study was restricted with the one class.

The result of this study revealed that the boys' and girls' mathematical ability is not significantly difference whereas the no difference between boys and girls in mathematical ability. When we consider there is significant difference between mathematical ability and mathematical achievement then it has been found that achievement in mathematics is significantly better than mathematical ability. But when we consider $H_0$3 there is significant difference between mathematical ability of rural and urban areas. We found that urban areas are better mathematical ability than rural areas.

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