An Analytical Study of Gender Difference in Achievement in Geometry at School

Abstract: ***Mathematics is the foundation for success in a variety of content areas, during a child's educational experience. Basically the goal of teaching mathematics, especially at the elementary level is to prepare pupils to develop critical and creative outlook as they confront the challenges of daily life (Meremikwu 2008). The objectives of the study are to examine the gender difference in students' achievement in Geometry and to find out the relationship between the achievement of male and female in matured and active delta areas. A Survey was conducted among 400 students in 19 schools of South 24 Parganas, West Bengal by random sampling technique. A standardized achievement test in mathematics prepared by the author was exercised as a tool. Data was analyzed by mean, standard deviation, t-test and graphical presentation. 83% students have given correct answer and in the component construction and in the component namely axioms and theorems on straight lines, angles, triangles etc. they had shown least achievements, only 44.5 % students have given correct answer only. In the component fundamental geometrical concept, achievement of boys was 52.38% and that of girls was 56.32% and that of boys was 52.38%. It was noticeable that in that component, the achievement of girls was higher than that of boys. It is important to accelerate the process of eradicating gender gap with special emphasis on girls students. Girls students should be informed the importance of mathematics and it is the basic tool for further education. Mathematics teaching and evaluation strategies should be bias-free. This way, males and females will tend to see themselves as equals, capable of competing and collaborating in classroom activities.***

Keywords: Gender differences, Geometry, Elementary Education, Matured Delta Area, and Active Delta Area.

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1. Introduction

Mathematics has always maintained a core position in curriculum and education as one of the "3Rs" reading, writing and arithmetic. It is considered as a critical filter in the social, economic, and professional development of individuals. It is viewed as a male domain and there are large gender differences favouring males in mathematics achievement. Males are generally considered to have a more positive attitude than females toward mathematics. Boys and girls are treated differently by parents and teachers at home and school. Some teachers believe that the most important gender difference is concerned with working. Several external and internal factors have been stated in the literature for female's limited interest in mathematics.

The nature of gender inequalities in education has changed profoundly over recent decades and, with regard to attainment in particular, has become more complex. Apart from the injustice inherent in all gender stereotyping, gender differences in education can also negatively affect economic growth and social inclusion. For example, women remain a minority in the fields of maths, science and technology, but on the other hand evidence shows that boys are more likely to be amongst the poorest performers in reading ability. These two examples illustrate that gender differences in education must be taken into account when developing policies and strategies to improve educational outcomes.

If primary school enrolment and completion rates are high, but the quality of education is low, then "education has not conferred the skills and knowledge that are the source of the hoped-for greater earnings, better health, and more engaged citizenship" (Levine et al. 2003). Access, duration, and quality are all critical variables in realizing educational benefits.

The relationship between gender and educational inputs, such as curricula, textbooks, pedagogy, and teacher training, are rarely made explicit. Similarly, the links among gender inequities, inputs, and outcomes are not sufficiently acknowledged. To close this gap, governments and donor agencies must more effectively address the systemic barriers to girls' educational success as an essential education strategy.

2. **Significance of the Study**

The present investigation will help in making the any type of educational policy, because such type of efforts to restructure the mathematical science to see the level of gender mind setup in future. The Key thought behind this schoolwork is to develop relevancy and appropriate of the discipline to the existing students approach and the educational policy maker's. Students have a different competency level to understand the science like mathematics, so from this study scheme to assess the vision and thinking approach of gender in studying the knowledge of mathematical science. Thus now it is the responsibility of those people, who involve in the arranging of curriculum of the relative subjects to make a bridge between the student's interest, parents thinking and the policy of the matter.

3. Objectives of the Study

The objectives of the study were:

- To examine the gender difference in students' achievement in Geometry.
- To compare the achievement of males and females in matured delta area.
- To compare the achievements between males and females students of active delta area.
- To find out the relationship between the achievement of male and female in matured and active delta areas.

4. Methodology

4.1 Sample and Sampling Technique

Stratified random techniques were adopted for the study. 400 students were taken from nineteen schools. Out of these 160 students were taken from schools in active delta area and 240 students from 12 schools were taken in mature delta area randomly. Details of sample size are given in Table

Table 1: Details of sample size

Area	Male	Female	Total
Mature Delta area	130	110	240
Active Delta area	80	80	160
Total	210	190	400

***4.2.* Tools**

An Achievement test in mathematics for class VIII was made and standardized. The test was comprised of 14 items and the researcher found the reliability by Split Half method . Value of reliability was 0.91. The researcher has gone through the syllabus of Mathematics upto class VIII of prescribed books of West Bengal Board of Secondary Education (WBBSE), Central Board Secondary Education (C.B.S.E) and Indian Council of Secondary Education (I.C.S.E.). After analyzing the content the researcher has broken the whole content into five components viz.

Component 1 Fundamental geometrical concept
Component 2 Axioms on straight lines , triangles , polygons etc.
Component 3 Geometrical transformation
Component 4 Similarity and congruence
Component 5 Construction

5. FINDINGS AND RESULTS

The answer of students in the achievement test was divided into four categories- No response, Wrong response, Partially Correct response and Correct Response. The researcher adopted the Grading System of West Bengal Board of Secondary Education which is shown below in a table

Table 2 **Grading System according to West Bengal Board of Secondary Education**

% of marks	Grade	Interpretation
90-100	AA	Outstanding
80-89	A+	Excellent
60-79	A	Very Good
45-59	B+	Good
35-44	B+	Satisfactory
25-34	C	Marginal
Below 12.5	D	Disqualified

Then the analysis was done.

5.1 Component Fundamental Geometrical Concept

There are three items in that component. Total achievement on this component was 54.25% .That of boys was 52.38% and that of girls was 56.32% i.e., level of achievement was good for all. It was noticeable that the achievement of girls was higher than that of boys.

Table 3: Gender wise achievement of component Fundamental Geometrical Concept

Students	No response	Wrong response	Correct response
Boys	7.77%	39.84%	52.38%
Girls	5.79%	37.89%	56.32%
Total	6.83%	38.92%	54.25%

5.2 Component Axioms and Theorems

There are seven items in that component. Among the seven items, the highest achievement was of item 7, total achievement on which was 78.5%, that of boys was 77.4% and that of girls was 80%. It was noticeable that the achievement of girls was higher than that of boys in this item. The item was about the relation between the exterior angle and interior angles of a triangle in which ability of knowledge was measured. The lowest achievement was of the item number 10, total achievement on which was 19.25%, that of boys was 24.76% and that of girls was 13.15% i.e., achievement level was below marginal or disqualified for promotion. The item was on the properties of triangle which was an application-based question.

Table 4: Gender wise achievement of component Axioms and Theorems on Straight Lines, Angles and Triangles

Students	No response	Wrong response	Partially correct response	Correct response
Boys	13.46%	39.65%	0.0	46.87%
Girls	17.52%	40.60%	0.0	41.88%
Total	15.39%	40.11%	0.0	44.50%

5.3 Component Geometrical Transformation

There are two items in that component. Total achievement of this component was 65.75% .That of boys was 65.95% and that of girls was 66.05% i.e., level of achievement was very good for all.

Table 5 : Gender wise achievement of component Geometrical Transformation

Students	No response	Wrong response	Partially correct response	Correct response
Boys	14.28%	13.09%	6.66%	65.95%
Girls	23.68%	6.84%	3.42%	66.05%
Total	18.75%	10.13%	5.12%	65.75%

5.4 Component Similarity and Congruence

There was only one item. The total achievement was 62.25%, that of boys was 67.61% and of girls was 56.31% i.e. , the total achievement was at very good level .

Table 6: Gender wise achievement of component Similarity and Congruence

Students	No response	Wrong response	Correct response
Boys	2.38%	30.00%	67.61%
Girls	3.68%	40.00%	56.31%
Total	3.00%	34.75%	62.25%

5.5 Component Construction

There is only one item. The total achievement is 83% that of boys is 86.19% and of girls is 76.47% i.e., the total achievement is at very good level.

Table 7: Gender wise achievement of component Construction

Students	No response	Wrong response	Correct response	Total
Boys	4.28%	8.57%	95.00%	86.19%
Girls	2.63%	17.37%	52.00%	76.47%
Total	3.50%	12.75%	75.00%	83.00%

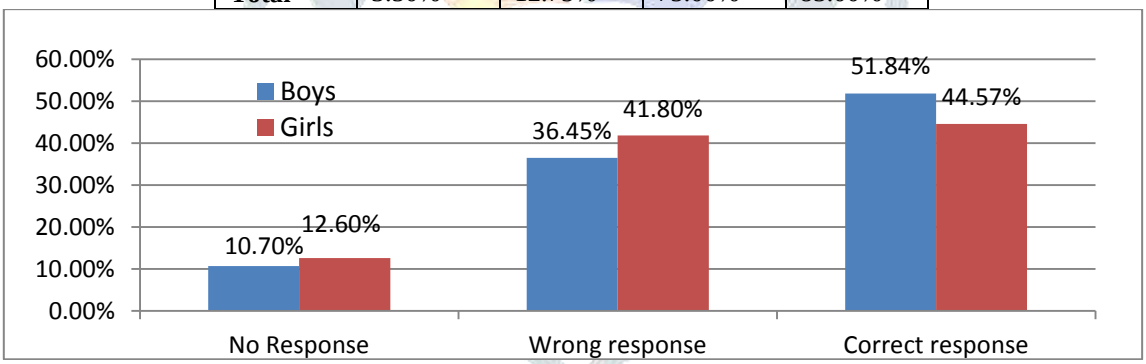

Figure 1 Comparison between Total Boys and Total Girls Students in all components

This figure gives a clear picture of comparison between the response of boys and girls students in different categories. It was clear that boys were in a better position than girls.

Table 8: Componentwise Achievement of students of Active Delta Area and Matured Delta Area w.r.t. Gender

Area / Components	Matured Delta Area		Active Delta Area	
Components	Girls	Boys	Boys	Girls
Component 1- Fundamental geometrical concept	41.02	45.75	70.83	70.23
Component 2- Axioms on straight lines , angles, triangles etc.	34.06	31.68	67.67	55.89
Component 3- Geometrical transformation	60	52.27	75.63	85
Component 4- Similarity and Congruence	54.61	46.36	88.75	70
Component 5- Construction	79.23	68.18	97.5	95

Table 9: Grade wise achievement of two areas w.r.t Gender

Area	Active Delta Area		Matured Delta Area	
Grade(%)	Boys (%)	Girls (%)	Boys (%)	Girls (%)
AA(90-100)	2.38	1.578	0.769	0
A+(80-89)	8.095	3.157	0	0
A(60-79)	22.85	15.26	10.769	2.72
B+(45-59)	18.57	25.789	20.76	19.09
B(35-44)	27.14	23.68	36.92	27.27
C(25-34)	15.71	15.789	23.076	25.45
D(Below 12.5)	5.233	14.736	7.692	25.45

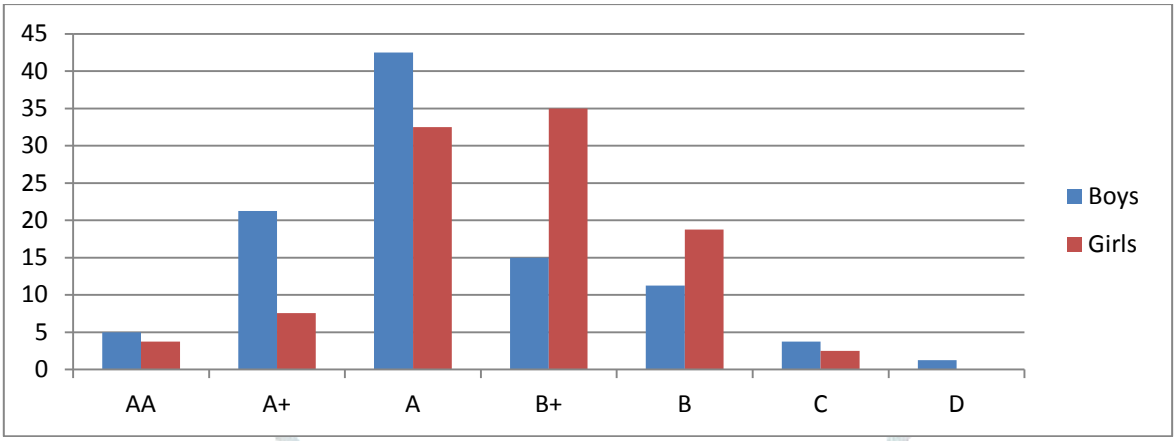

Figure 2: Grade wise achievement of Active Delta Area w.r.t Gender

From figure 4.22 it can be observed that maximum boys students of Active Delta Area had achieved A grade (60 %-80 %) whereas maximum girls students had achieved B+ grade (45 %-59 %). Outstanding grade (90 %-100 %) was gained by 5 % of the boys students and 3.75 % of the girls students. But it was noticeable to observe that no girls students of that area had obtained grade D (i.e. below 25 %) whereas 1.25 % of boys students had obtained grade D.

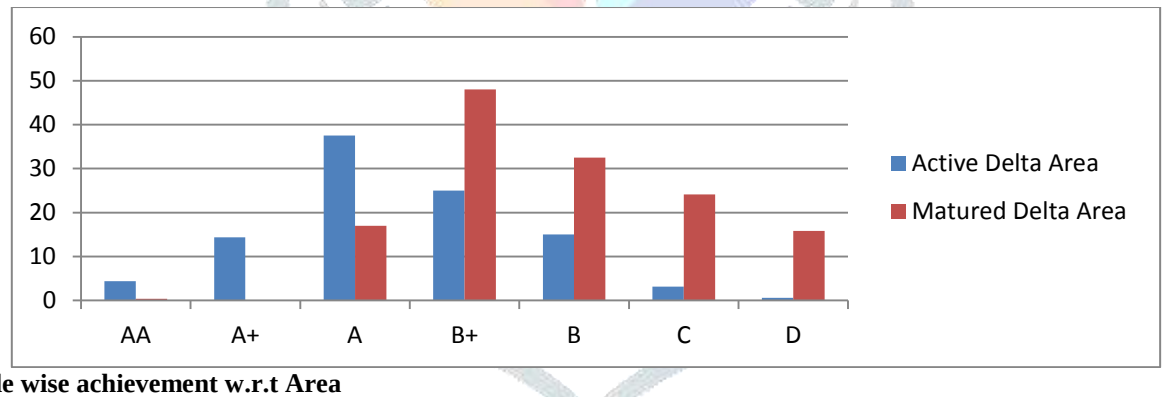

Figure 3: Grade wise achievement w.r.t Area

From figure 4.23 it can be said that no students of Matured Delta Area had obtained the grade A+, whereas 4.375 % and 14.375 % of the students of Active Delta Area had obtained the grade AA and A+ respectively. Again, most of the students of Active Delta Area had obtained the grade A whereas most of the students of Matured Delta Area had achieved the grade B+. Also it was noticeable that 15.83 % of students of Matured Delta Area were at disqualified level of grade and only 0.625 % students of Active Delta Area were at disqualified grade.

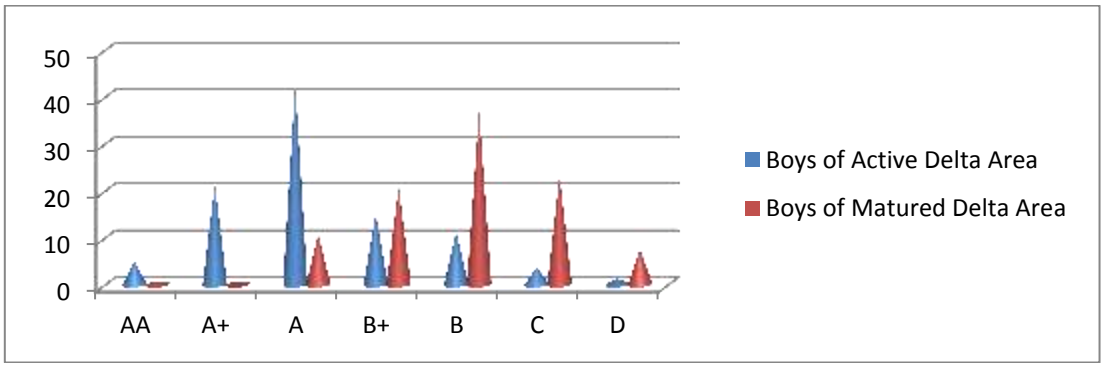

Figure 4: Grade wise achievement of Boys w.r.t Area

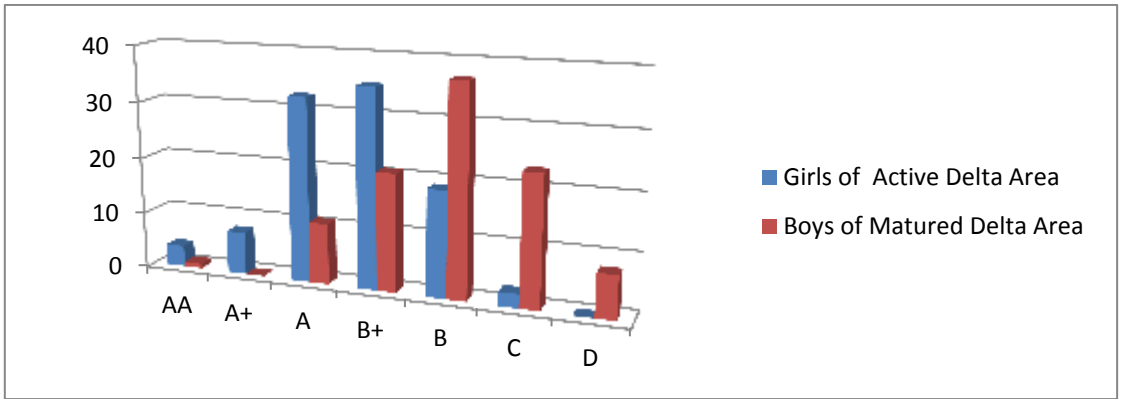

Figure 5: A Significant Comparison between Boys students of matured delta area and Girls students of active delta area

6. Discussion and Analysis

In this study also boys had done better performances than girls in most of the components among the specified five components. That little difference was found because of the fact that girls students are neglected in homes as well as in schools for encouraging of doing mathematics. Conversation with girls students had directed to the decision that most of them are engaged in household work to help her mother. They got hardly time to prepare their homework and mathematics being a subject of practice at elementary level, girls students became backward in mathematics.

The researcher had administered the achievement test in the schools of rural area of South 24 Parganas in West Bengal. The total area was divided into two parts, one adjacent to the city tagged as matured delta are and another nonstop created area nearby to the ocean and far from the city, labelled as active delta area. Students' achievement in mathematics for those two areas was shown elaborately in the previous chapter. It can be said that there stands very significant difference between the achievements of students of Active Delta Area and students of Matured Delta Area signifying that students of Active Delta Area have very much better achievements than the students of Matured Delta Area in mathematics.

Discussion with students, teachers, parents revealed the hidden causes behind success which focused the criteria: geographical location of their area, struggling in daily life, inconvenience in communication, lesser availability of information technology, agricultural dependence, good relationship between students and teacher, cooperative attitude of parents towards teachers , nature friendly mind-set, strong bonding of peer feelings, more acquaintances with calculation, more practical knowledge in weight, unit, volume, area, parental occupation namely fishermen etc. The students of active delta area learn informally many mathematical fundamentals like area, perimeter, concept of unit, weight through their daily life activities. While collecting data the investigator informally discuss with some students about their daily life. The researcher talked with Anshu (student completing of class VIII) helps his father in agriculture every day. He is 15 years old. At the time of ploughing he has to measure the area for dividing the whole area into different parts for growing different types of crops. Then he assists in watering the field. After growing is completed, he helps in weighing the crops to store it in jute bag. Then at the time of selling he has to estimate the price and reckoning the approximate result of the total value of the crops . Another student named Halim goes with his farther for fishing in the sea. He helps to keep the direction and speed of the boat. At the age of 14 he get hold of risky practice of crossing the sea. After catching fish he gives a hand to assess and balance in weighing for selling. In this way, like Anshu and Halim many students of that are bountiful to great effort to their families. As a result they become skilled in calculation, computation, weighing, measuring the land, maintaining speed and direction. These activities facilitate to breed their cognitive domain as well as affective and psychomotor domain also. This work value allows them to work on their own and make decision, also to service to others and work with co- workers in a friendly non-competitive environment. Again the researcher observed that they have to come school by walking or cycling. These help them to keep an eye on the distance, time and speed also. In this manner they perceive the functional ideas of mathematical principles and formulae which guide the way to go ahead in mathematics learning and achievement. Skuy et al., (1996) who expressed the belief that the extent to which students take responsibility for their own learning is a good predictor of academic success. The present study has drawn attention to the reality that academic achievement in mathematics is influenced by the physical and educational environment of the home. That result was carried by the findings of the study in India and outside India in addition in twenty years back and in recent studies also. As for example, it can be said that in India *Rajput (1984), Singh (1986), Deshmukh(1988), Prabha Rashmi (1992), Setia (1992), Mustafa (2009), Nuri & Hulya (2010)* have focused the positive contribution of the home environment to the Achievement in Mathematics and outside India *Pruett (1997), Jacobbi (1997) and Chen (2001)* found that the Achievement in Mathematics is significantly influenced by Home physical and educational Environment. In this context recommendation on Proposed New Education Policy 2016 by National Commission for Protection of Child Rights (NCPCR) can be included here: " Children, especially in rural areas, demonstrate great learning skills through their curiosity, exploration, experiments, and innovations with locally available material. However, their activity based learning is severely challenged in the classrooms which centre on textbooks, information and examinations. The worst sufferer in this situation is science, the subject of explorations, discoveries and innovations."

It is found also that the girls students of active delta area had done better than the boys students of matured delta area. If component wise result is considered then it can be observed that in all components the girls students of active delta area had done very much better than the boys students of matured delta area. Girls students of active delta area had given response 15% to 20 % better than the boys students of matured delta area in the achievement test in mathematics. In the country outside India some previous studies also support the present study's results as Sinnes (2005), is agree that females in principle will produce exactly the same scientific knowledge as males provided that sufficient rigour is undertaken in scientific inquiry. Also, Abiam and Odok (2006) found no significant relationship between gender and achievement in number and numeration, algebraic and statistics. Fifty years ago, in India too ***Kulkarni, Lal and Naidu*** in their survey found that girls belonged to Delhi and Mysore get more marks in comparison to boys. Vermeer et al. (2000) as well had further shown that the gender differences in self confidence were more marked for application problems than computation problems, with girls showing significantly lower confidence for application problem. Again in 2000, Boaler showed that the girls' confidence in mathematics improved greatly in classes which actively involved girls in the learning of mathematics. In the recent(2014) findings by NCERT through NAS for

class VIII there is no significant difference in the performance of boys and girls as well as students from rural schools than urban schools in general. However, students of General and OBC category outperformed than that of SC category students. Therefore, the findings of the present study are departing similar indication with the result found fifty years ago in India and outside India as well and same that of the recent works in mathematics.

7. Conclusion

- Among five components the students had shown best performance in the component geometrical construction. 83% students have given correct answer and in the component construction and in the component namely axioms and theorems on straight lines, angles, triangles etc. they had shown least achievements, only 44.5 % students have given correct answer only.
- In the component fundamental geometrical concept, achievement of boys was 52.38% and that of girls was 56.32%. It was noticeable that the achievement of girls was higher than that of boys.
- It was noticeable that in the component construction girls students of matured delta area had done better than boys students of that area.
- Also, in the component geometrical transformation girls students of active delta area had done better than boys students of that area.
- Boys had done better performances than the girls students in the achievement test in mathematics.
- Students of Active Delta Area had done very much better than the students of Matured Delta Area. Mean value of scores obtained by students of Active Delta Area was 12.46 whereas that of Matured Delta Area was only 7.26.
- A significant observation that revealed the fact that girl student of Active Delta Area had achieved by more than 15 % in mean value scores than that of boys students of Matured Delta Area. While 7.6 % girl students had scored above 80 %, no boy students of the mentioned area had achieved such percentage of marks.
- Quality, retention, and achievement are essential elements of an education strategy designed to ensure that boys and girls maximize their full potential. In sum, additional collaborative efforts – institutional, financial and analytical – are needed in order to supplement the lessons learned from this study and add a new dynamic to on-going national efforts to improve the quality of learning for all elementary school-age children in mathematics.

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