Chapter Five

Pattern in Achievement : Mathematics - 2013

5.1   Introduction

This chapter presents the patterns in achievement of the students in mathematics.

The patterns in achievement will first be presented at all island level to get an overview of students' achievement in mathematics. As discussed in chapter 2, the explicit stratum in the 2013 study is the province. The implicit strata are the gender, school type and medium of instruction. Thus student achievement will next be presented in relation to province. This would be followed by achievement in relation to gender, school type medium of instruction and location.

5.2   Patterns of achievement at national level

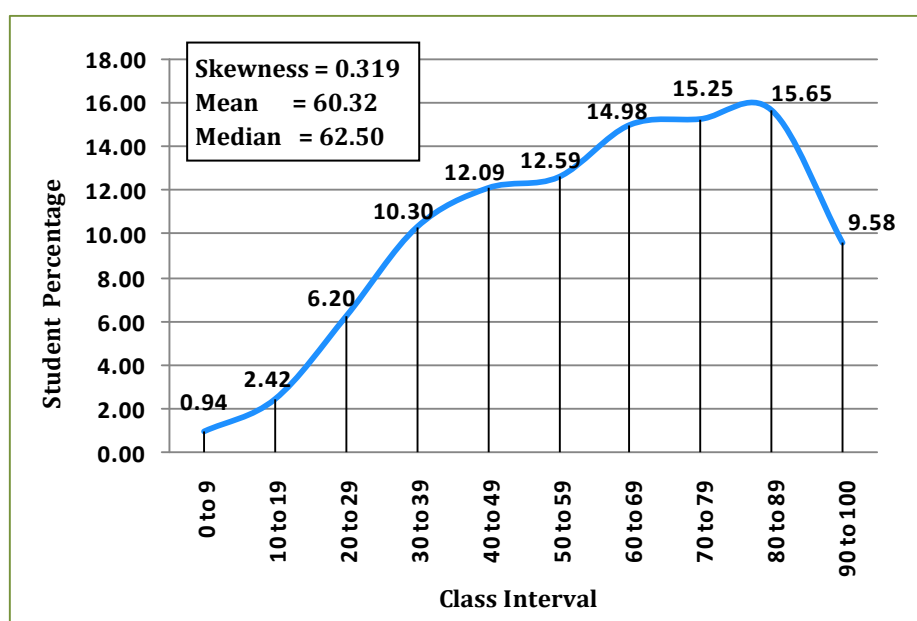National level student achievement will be discussed in relation to student performance pertaining to mathematics.

Fig. 5.1: All island achievement in mathematics 2013 – dispersion of marks

The frequency polygon shown in Fig. 5.1 outlines the total picture of the distribution of marks of grade 04 students in mathematics.

Fig. 5.1 depicts a negatively skewed distribution of marks displaying that majority of the students have scored high marks in mathematics.

Table 5.1: All island achievement in mathematics 2013 – cumulative percentages

Class Interval	Students Percentage	Cumulative Percentage
90 to 100	9.58	100.00
80 to 89	15.65	90.42
70 to 79	15.25	74.77
60 to 69	14.98	59.52
50 to 59	12.59	44.54
40 to 49	12.09	31.95
30 to 39	10.30	19.86
20 to 29	6.20	9.57
10 to 19	2.42	3.36
0 to 09	0.94	0.94

Less than one percent of students has scored less than 10 marks out of 100 for the mathematics paper. Approximately 20% of students has obtained marks below 40 marks out of 100. Forty percent of students has scored 70 and above for the mathematics paper. This shows the diversity of achievement. Above marks intervals are also displayed on the line curve in Fig. 5.1. However, it is significant to note that the highest percentage of students (15.65%) has scored between 80-89 marks.

Fig. 5.2 illustrates student achievement patterns further.

As the boxplot in Fig. 5.2 displays more than 50% of students has scored 62.50 or above. Further 75% of students has scored 42.50 or above for the mathematics achievement. It also reveals that 50% of the marks lie between 42.5 and 80. For the mathematics achievement, there are no outliers which means there are no students who have scored exceptionally high or low marks.
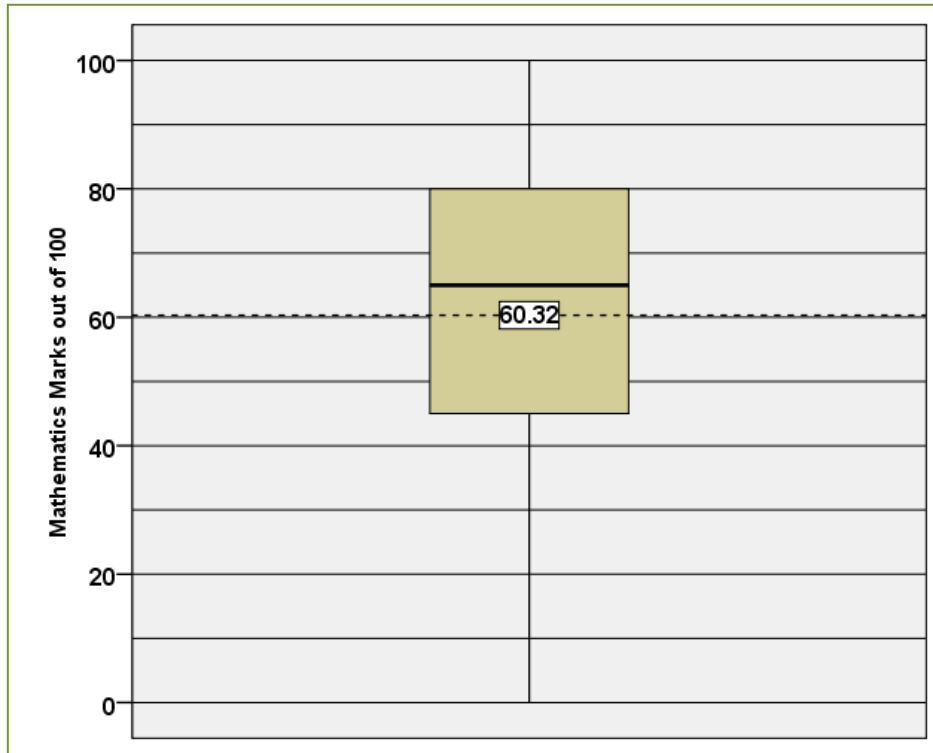
Fig 5.2: Boxplot and whisker chart for mathematics achievement of the Grade 4 in 2013

Summary of national level achievement

- National level mean is 60.32, while the median is 62.50.
- Disparity in achievement prevails with approximately 20% of students scoring below 40 and 40% of students scoring above 70. However, the highest number of students falls within the mark range of 80-89.

Provincial wise student achievement will be discussed next.

5.3 Provincial wise student achievement

The nature of the distribution of scores provincial wise reveals certain patterns. These patterns are discussed in section 5.3.

Table 5.2: Provincial achievement in mathematics 2013 –summary statistics

Province	Mean	Rank	Standard Deviation	Standard Error of Mean	skewness	Percentile (p25)=Q1	Median (p50)=Q2	Percentile (p75)=Q3
Southern	64.65	1	21.384	0.101	-0.511	50.0	67.5	82.5
Sabaragamuwa	64.16	2	21.556	0.121	-0.421	47.5	67.5	82.5
North Western	62.99	3	22.285	0.110	-0.524	47.5	67.5	82.5
Western	62.52	4	21.465	0.077	-0.291	45.0	65.0	80.0
North Central	59.75	5	21.399	0.142	-0.351	45.0	62.5	77.5
Uva	58.13	6	22.541	0.147	-0.317	40.0	60.0	77.5
Central	56.47	7	22.387	0.107	-0.143	37.5	57.5	75.0
Northern	53.95	8	21.762	0.156	-0.043	37.5	52.5	72.5
Eastern	52.66	9	23.302	0.132	-0.089	35.0	52.5	72.5
All Island	**60.32**		**22.311**	**0.038**	**-0.319**	**42.5**	**62.5**	**80.0**

As Table 5.2 indicates, and based on provincial wise mean achievements, Southern province ranks first. However, Sabaragamuwa province is ranked second with only a slightly lower mean value.

Western province is in the fourth place with North Western coming third with a slightly higher mean value.

In terms of achievement the provinces fall into three categories. Southern, Sabaragamuwa, North Western and Western with mean scores above the national mean, fall into the higher category. North Central, Uva and Central provinces cluster in the middle while Northern and Eastern fall into the lowest category. Between the Southern and Eastern provinces there is almost 12 point difference in mean values indicating the disparity in achievement among the provinces.

These disparities are further highlighted through the bar chart given in Fig. 5.3.
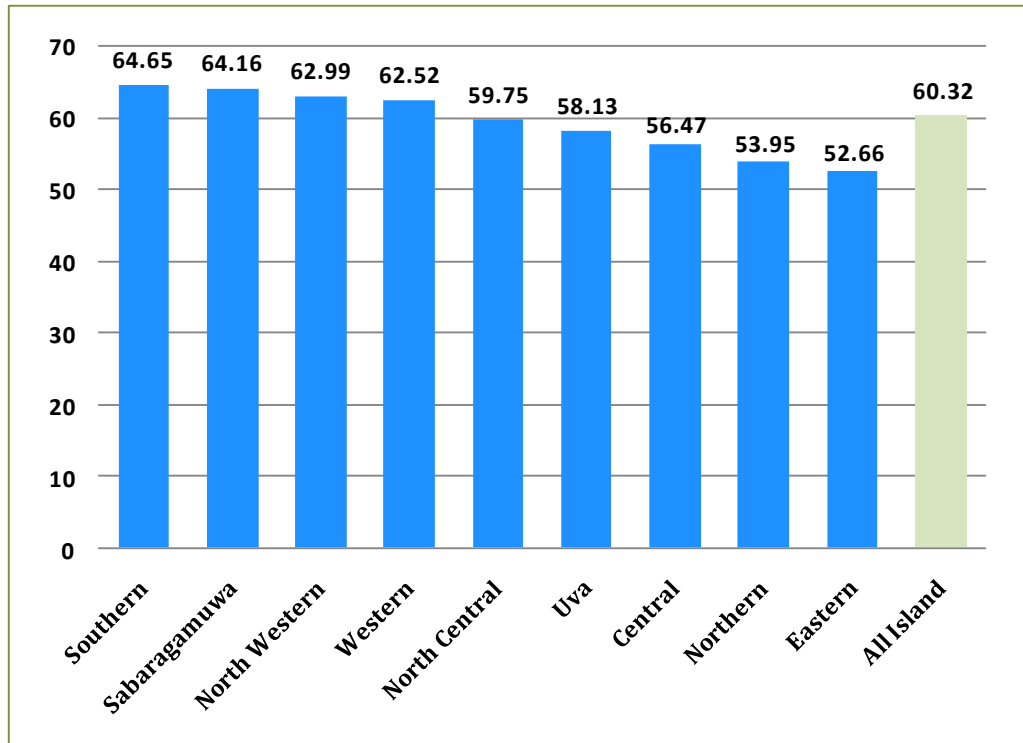
Fig. 5.3: Bar chart to represent mean among the provinces

Disparity in achievement among provinces

Standard Deviation (SD) indicates how marks deviate from the mean. According to Table 5.2, Southern province has the highest mean value but has obtained the lowest SD. There are five provinces that have shown similar SD values even though their mean values are different. Eastern province has the highest SD value indicating that the variation of students' marks is the highest in this province. The SD values of Uva, Central and Eastern provinces are higher than the all island SD value.

All the provinces have obtained negative skewed values. It is a positive sign that higher number of provinces have achieved higher values (closer to the mean or above). North Western province has obtained a higher value than the Southern province. This means that the number of high achievers in the North Western province is higher than in the Southern province. Achievement in all the provinces has contributed to the island wide value. Northern and Eastern provinces have obtained lower skewed values. This indicates that their performances are not good compared with other provinces.

In the Southern province, 25% of students have scored below 50 mark point. Twenty five percent of students have obtained marks between 50 to 67.5 and 25% of students have scored marks between 82.5 to 100. Sabaragamuwa and North Western provinces have shown similar characteristics, but 25th percentile is lower than the Southern province. 25th percentile and 50th percentile of Western and North Central provinces are above or similar to all island value, but only Western province shows similarity in the 75th percentile. Uva, Central, Northern and Eastern provinces are below the all island 25th, 50th and 75th percentile in all marks points.
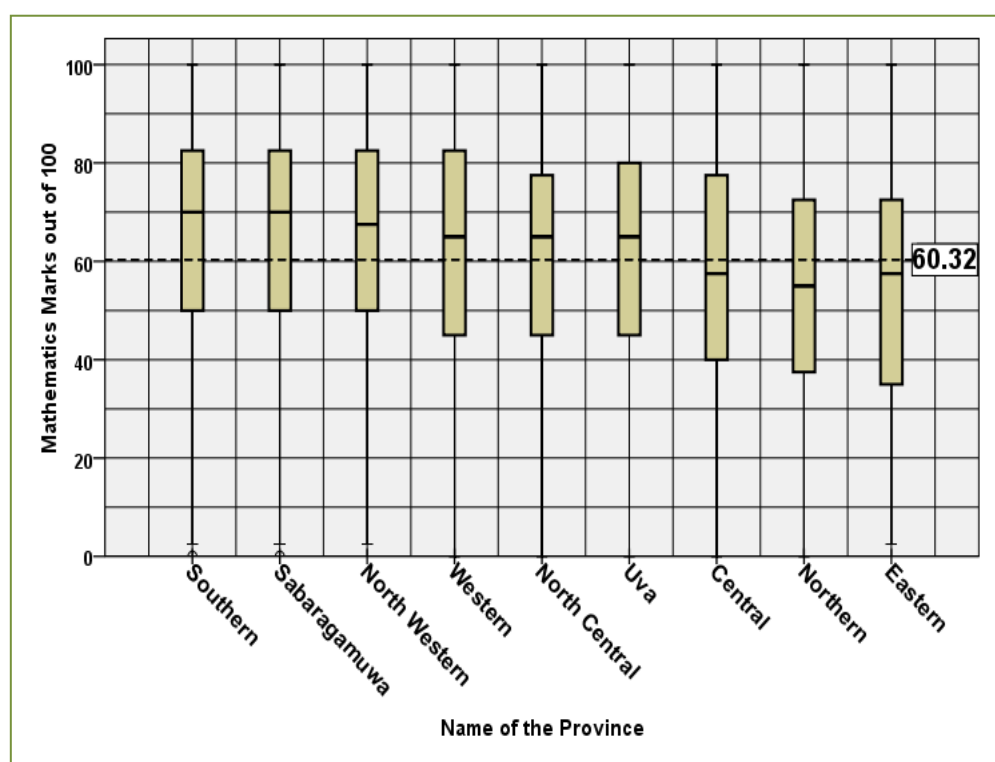

Fig. 5.4: Provincial wise mathematics marks representation using boxplot and whisker plot

According to the above chart, there are three provinces (Southern, Sabaragamuwa, North Western) which show similar characteristics. Marks dispersion of the Western province is higher than the above three provinces. Western, North Central and Uva provinces are similar at the 25th percentile, but differ at the 75th percentile. North central shows a lower mark dispersion than the Western and Uva provinces. Central, Northern and Eastern provinces show a descending order of marks at the 25th percentile. Very high marks dispersion is displayed in the Eastern province compared with the Central and Northern provinces.

Table 5.3 provides the percentage of students scoring 50 or above marks at provincial level.

Table 5.3: Percentage of students scoring 50 or above, and below 50

Province	Above or equal to 50	Below 50
Southern	77.40%	22.60%
North Western	77.10%	22.90%
Sabaragamuwa	77.00%	23.00%
Western	72.00%	28.00%
Uva	71.60%	28.40%
North Central	70.30%	29.70%
Central	62.90%	37.10%
Northern	58.90%	41.10%
Eastern	58.00%	42.00%
All Island	**70.20%**	**29.80%**

The above table confirms that Southern, Sabaragamuwa and North Western are the three highest performing provinces.

Summary of provincial level analysis

- Achievement wise the provinces fall into three categories.
  Category 1 – Southern, Sabaragamuwa , North Western and Western with mean scores above the national mean (60.32)
  Category 2 – North Central, Uva and Central provinces cluster in the middle.
  Category 3 – Northern and Eastern.
- Disparity of marks within a province is highest in the Eastern province.
- In North Central and Uva provinces, the disparity of marks is less, but the marks are low. Therefore, in these provinces achievement is more homogeneous but low.

5.4   Achievement levels by type of school

Table 5.4:   Mathematics marks achievement according to the school type

School Type	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
1AB	62.20	21.129	0.109	-0.328	47.50	65.00	80.00
1C	61.33	21.989	0.079	-0.396	45.00	65.00	80.00
Type 2	59.51	22.610	0.064	-0.262	42.50	62.50	77.50
Type 3	59.83	22.554	0.072	-0.319	42.50	62.50	77.50
All Island	**60.32**	**22.311**	**0.038**	**-0.319**	**42.50**	**62.50**	**80.00**

As Table 5.4 indicates there is not a considerable gap between the mean scores of different school types. However, the mean score of 1AB schools is above that of the other types and also above the national mean. Yet, a significant finding is that the mean score of Type 1C schools is also above the national mean and closer to mean score of 1AB schools. On the other hand, the mean scores of Type 2 and 3 schools, even though below the national mean, are close to it. Therefore, the gap between school types in relation to opportunities of "education for all' seems to be narrowing.

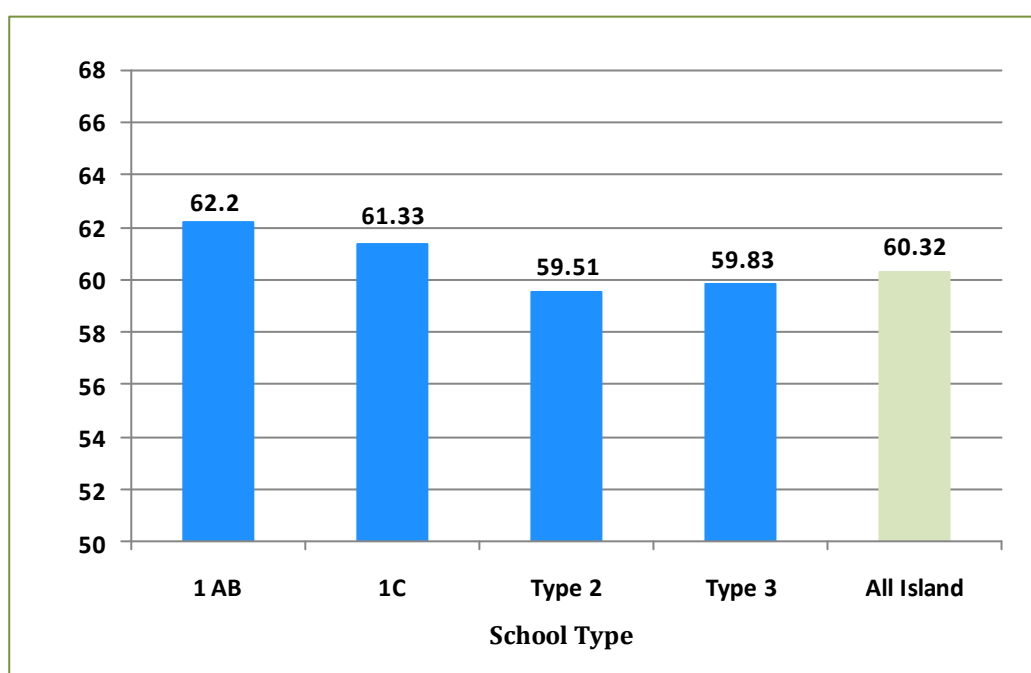The difference in mean scores is graphically shown in Fig. 5.5.

Fig. 5.5: Bar chart representing the mean values according to school types – Mathematics

The performance of the school types is further highlighted when the median scores are considered in Table 5.4. All school types have achieved a high median value for the mathematics achievement. Fifty percent of students in all school types have obtained scores above the mean value. However, the median value of 1AB and 1C schools is even higher (65.00).

Variation among students

Variation in student achievement in 1AB and 1C school types is low. Lower standard deviation values are shown by 1AB schools and 1C schools. Those values are lower than the all island SD value as well. It reveals that higher number of student achievement lies closer to the mean value. The dispersion from the mean value is very low. Standard deviation value of Type 2 schools is the highest among the school types. This indicates that deviation of student achievement from the mean is very high. Type 1AB and 1C schools have SD values less which than the all island SD value, but Type 2 and Type 3 schools have SD values which are above the all island value.

Disparity in achievement

All school types have obtained negative skewed values. It reveals that in all school types higher number of students has achieved high marks while lower marks are obtained by a lower number of students. Highest skewed value has been obtained by 1C schools. Next higher value has been obtained by 1AB schools. Both values are above the all island skewness value. Skewness value of Type 3 schools is equal to the all island value. Lowest negative skewed value has been obtained by Type 2 schools.

The homogeneity of student performance in different types of schools is further highlighted through the frequency distribution graphs.
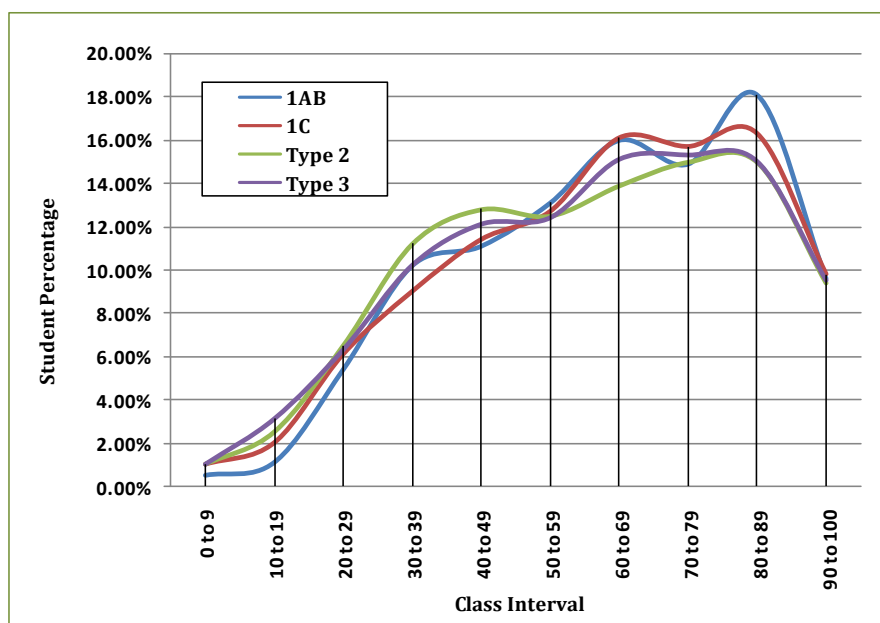
Fig. 5.6: Dispersion of marks by school type – mathematics

Fig. 5.6 displays that the curves of 1AB and 1C school peaked at the 80-89 class interval. While in Type 3 schools, the peak spreads over three mark intervals, in Type 2 schools the peak is at two mark intervals.

The spread of marks at different mark intervals is further illustrated in the cumulative percentage table.

Table 5.5: Cumulative student percentages according to the school type- mathematics

Class Interval	1AB		1C		Type 2		Type 3	
	Student (%)	Cumulative (%)	Student (%)	Cumulative (%)	Student (%)	Cumulative (%)	Student (%)	Cumulative (%)
90 to 100	9.60	100	9.80	100	9.40	100	9.50	100
80 to 89	18.10	90.40	16.20	90.20	15.10	90.60	15.00	90.50
70 to 79	14.90	72.30	15.70	74.00	15.10	75.50	15.30	75.50
60 to 69	14.90	72.30	15.70	74.00	15.10	75.50	15.30	75.50
50 to 59	13.10	41.40	12.70	42.20	12.50	46.50	12.40	45.10
40 to 49	11.10	28.30	11.40	29.50	12.80	34.00	12.10	32.70
30 to 39	10.20	17.20	9.00	18.10	11.20	21.20	10.20	20.60
20 to 29	5.40	7.00	6.10	9.10	6.50	10.00	6.30	10.40
10 to 19	1.10	1.60	2.00	3.00	2.50	3.50	3.10	4.10
0 to 9	0.50	0.50	1.00	1.00	1.00	1.00	1.00	1.00
Total	100		100		100		100	

In 1AB schools the percentage of students who have scored below ten marks is less than one. In other school types this percentage is one. When considering student marks below 40 points, cumulative percentage of 1AB schools is 17.20, but in other school types, this percentage varies from 18.1 in 1C to 21.2 in Type 2 schools.

The analysis of data pertaining to the school types indicates less disparity in achievement. This is further illustrated through the boxplot.
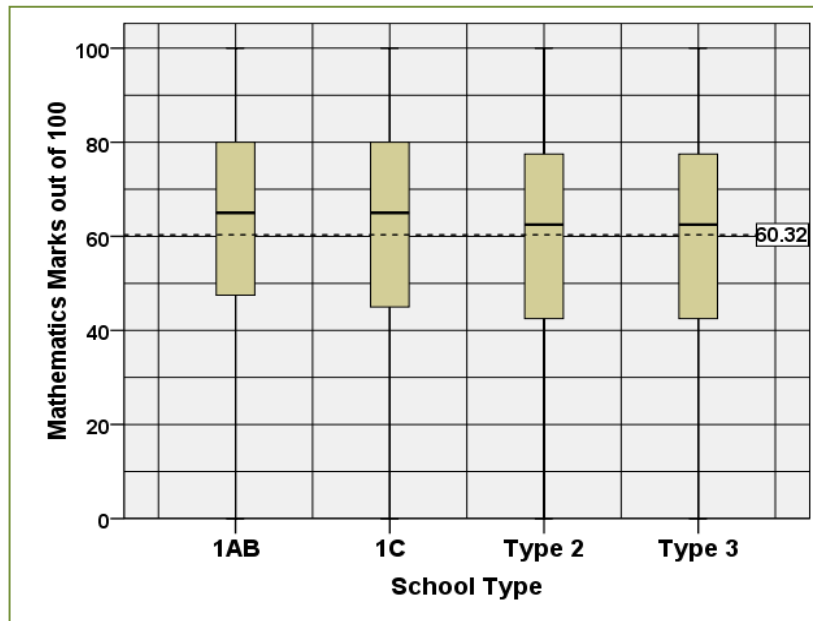

Fig. 5.7: Mathematics marks according to the school types using boxplot and whisker plot

Both 1AB and 1C schools show a similarity in the dispersion of marks. When the 75th percentile is considered, 1AB and 1C schools have obtained similar values (80.00) which is a very high achievement. On the other hand, Type 2, and Type 3 schools are similar with values of 77.50.which is also quite satisfactory.

Summary

- The achievement in mathematics in 1AB and 1C schools are relatively similar. At the same time, the performance of Type 2 and Type 3 schools are also similar.
- The gap in achievement between school types appears to be narrowing.

5.5   Achievement levels by gender

Table 5.6:   Mathematics marks achievement according to the gender

Student Gender	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
Female	62.45	21.206	0.053	-0.433	48	65.00	80
Male	58.34	23.119	0.055	-0.202	40	60.00	78
All Island	**60.32**	**22.311**	**0.038**	**-0.319**	**42**	**62.50**	**80**

There is a difference in the achievement of females over males. As Table 5.6 indicates, male performance is also lower than the all island mean score while female performance is above the all island mean.

These differences could also be seen in Fig. 5.8.
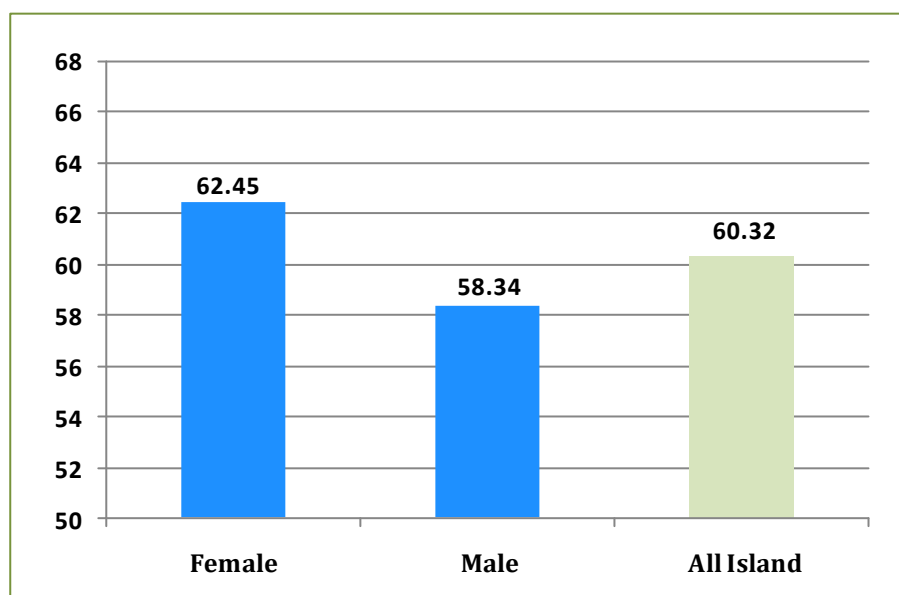

Fig. 5.8: Bar chart representing mean values according to gender

Variation among students

Variation in achievement among males is higher than that of the female students. This is indicated by the male students obtaining a higher SD value than the female students as well as the all island SD (Table 5.6). On the other hand, the female students SD is below the all island SD.

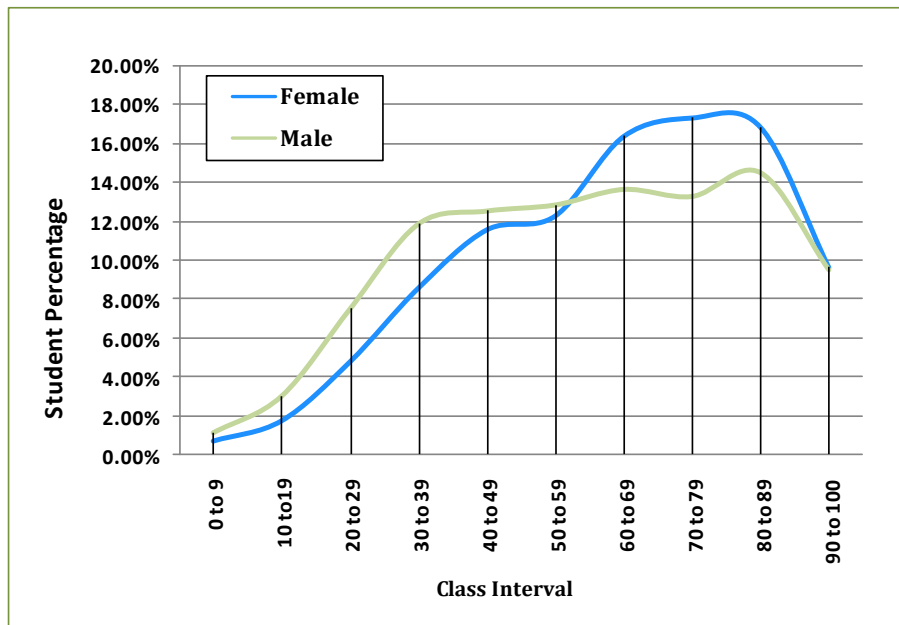Fig. 5.9 graphically illustrates the dispersion of marks according to gender.

Fig. 5.9: Dispersion of marks by gender

Fig. 5.9 displays two curves which are both negatively skewed. As can be seen there are more high achievers than low achievers among both males and females. Pattern of the two curves are almost similar at the beginning, then the curves become different and finally, both curves become similar again.

The disparity in the male students' achievement can be elaborated better through the cumulative percentages.

Table 5.7: Gender wise mathematics analysis cumulative percentages

Class Interval	Female (%)	Cumulative Percentage	Male (%)	Cumulative Percentage
90 to 100	9.64%	100.00%	9.52%	100.00%
80 to 89	16.86%	90.36%	14.52%	90.48%
70 to 79	17.34%	73.50%	13.30%	75.96%
60 to 69	16.39%	56.16%	13.66%	62.66%
50 to 59	12.30%	39.77%	12.86%	48.99%
40 to 49	11.59%	27.47%	12.55%	36.13%
30 to 39	8.59%	15.88%	11.89%	23.58%
20 to 29	4.80%	7.29%	7.52%	11.69%
10 to 19	1.77%	2.49%	3.03%	4.18%
0 to 9	0.72%	0.72%	1.15%	1.15%
Total	100.00%		100.00%	

According to Table 5.7 and Fig. 5.9, it could be concluded that among both females and males, there are high performing students. The highest percentage (17.34%) of female students' marks fall into the class interval 70-79. On the other hand, the highest percentage of male students' marks, even though a lesser percentage (14.52%), falls into the class interval 80-89. This indicates that the high performing boys achievement is higher than that of the high performing girls.

Even though there are only 15.88 cumulative percent of female students who have scored below 40 marks, there are 23.58% of male students who have scored less than 40 marks. Therefore, the heterogeneity in achievement in mathematics of the boys is greater than the girls.

Boxplot and whisker for gender wise mathematics achievement shows similarities that have been discussed already.
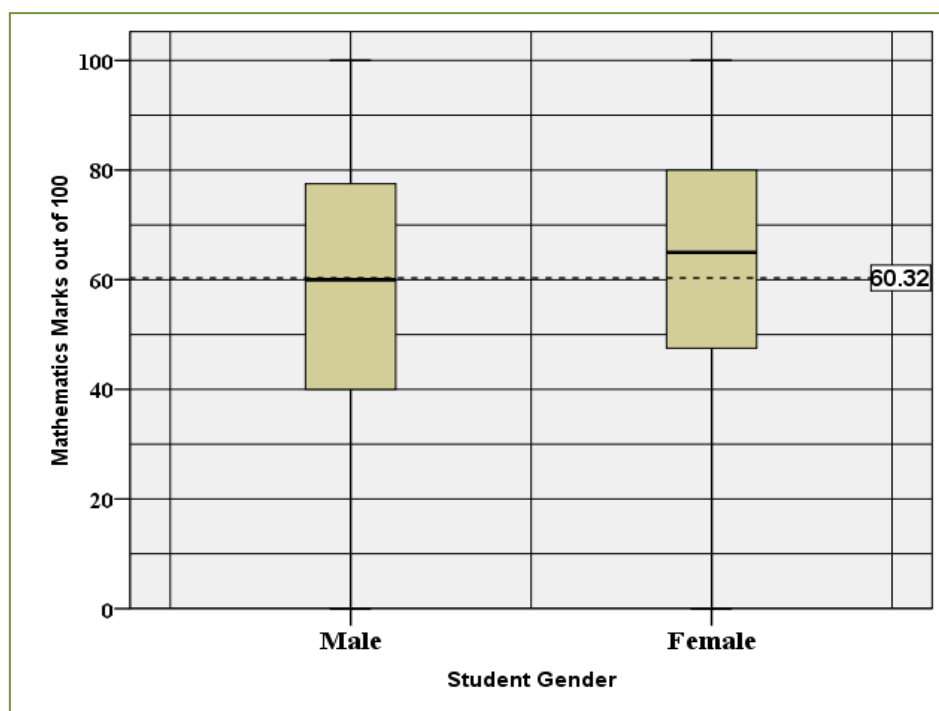

Fig. 5.10: Boxplot and whisker plot representing gender wise mathematics marks

Boxplot and whisker chart shows that male students' marks dispersion is higher than that of the female students. Fifty percent of male students' achievements lie below the female students' achievement. Median of the male students also lie close to the all island

mean value line, where as the female students median is higher than the all island mean. This means that while 50% of male students have scored 60.00, fifty percent of female students have scored 65 or above.

25th, 50th and 75th percentile values of female students are higher than male students percentile values and all island percentile values.

Therefore, it could be concluded that female students is better than that of the male students and their achievement is more homogeneous.

Summary

- Female performance is better than all island and male performance.
- While 15.88% of girls has scored below 40, the percentage of boys is 23.58%.
- Highest percentage of females (17.34%) falls into the mark range 70-79. On the other hand, among the males, the highest percentage belongs to even higher mark range 80-89. However, the percentage that falls into this class interval is less (14.52%) than that of the female percentage (17.34%).

5.6   Achievement levels by medium of instruction

Table 5.8: Achievement level by medium of instruction - Mathematics

Medium of the Student	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
Sinhala	63.32	21.456	0.043	-0.433	48.0	65.0	80
Tamil	50.93	22.335	0.078	0.051	32.0	50.00	70
All Island	**60.32**	**22.311**	**0.038**	**-0.319**	**42.0**	**62.50**	**80**

There is a disparity among the students belonging to the different medium of instruction. While the Sinhala medium students' mean achievement is above the all island mean value, the mean achievement of Tamil medium students is below the national mean average.

These disparities are further highlighted through the bar chart given in Fig. 5.11.
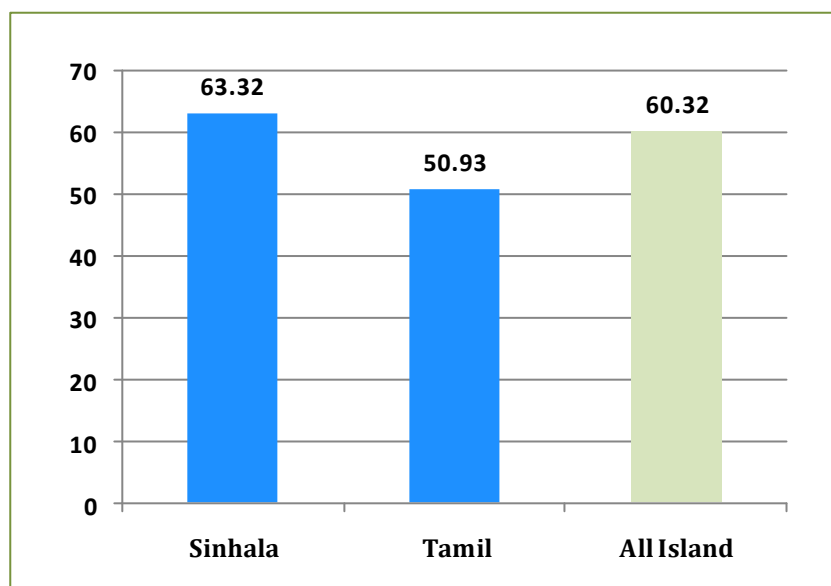
Fig. 5.11: Bar chart representing mean values according to medium of instruction

Performance of the Sinhala medium students is more homogeneous than that of the Tamil medium students. This is evident as the standard deviation of Sinhala medium students of mathematics is lower than the Tamil medium and all island standard deviation. Therefore, the deviation of marks from the mean among the Sinhala medium students is less compared with the Tamil medium students deviation of marks from the mean.

The achievement curve of the Sinhala medium students shows negative skewness value. This means that majority of the students have scored high marks. On the other hand, the achievement curve of Tamil medium students shows that it has skewed in the positive direction. This denotes the fact that majority of the students are low achievers. All island achievement curve is highly affected by the achievement of the Sinhala medium students.

25th percentile value of the Sinhala medium students is 48. It is higher than the Tamil medium students, 25th percentile value as well as the all island value. There is a difference of 16 points between the 25th percentile value of Tamil medium and Sinhala medium. While there is a difference of -10 points between the all island value and Tamil medium value, there is a difference of +6 points between the Sinhala medium and all island value. The difference between Sinhala and Tamil medium has continued to 50th and 75th percentile as well. Finally, the 75th percentile of the Sinhala medium students

and all island marks have become equal. Performance of the Sinhala medium students is above the all island performance with respect to the median value as well. This means that 50% of Sinhala medium students scores equals or above 60. On the other hand, 50% of Tamil medium students have scored less than 50.

The diversity in achievement scores among the students taught through the different medium of instruction, is further highlighted through the frequency distribution graphs.
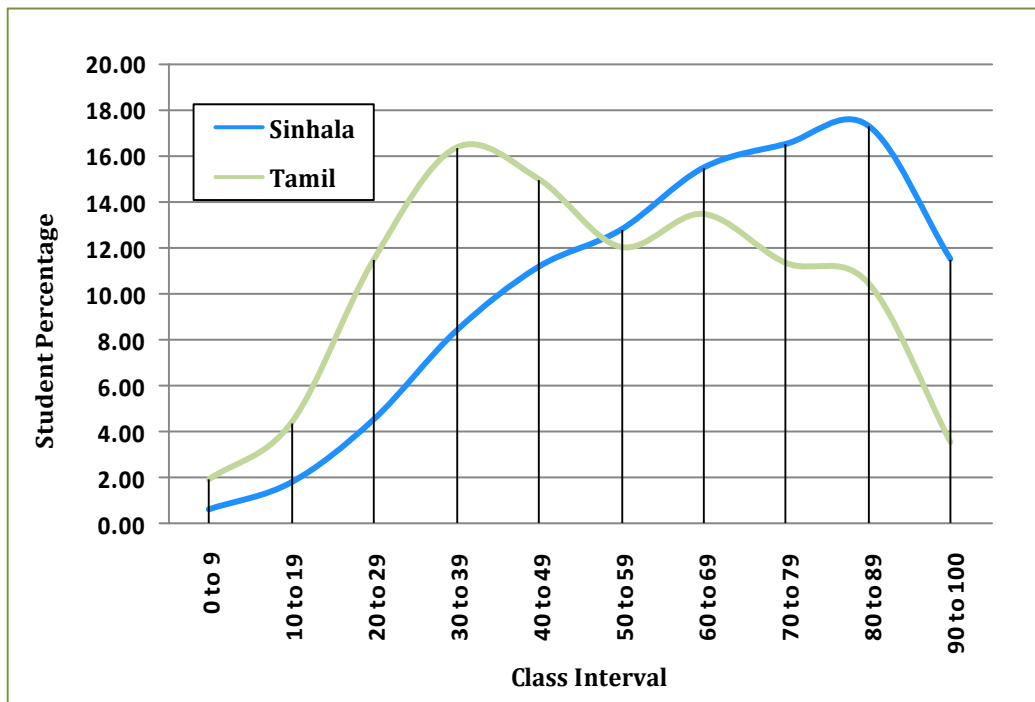
Fig. 5.12: Dispersion of marks by medium of instruction - Mathematics

The disparity discussed using the mean and the median is also visible through the frequency distribution graph. All the curves are positively skewed.

Both curves have peak in opposite directions and skewed to opposite directions. It shows that higher number of Tamil medium students is in the lower marks range while a higher number of Sinhala medium students is in the higher marks range.

This medium wise disparity in students' achievement can be elaborated better through the cumulative percentages.

Table 5.9: Medium wise cumulative percentage – Mathematics

Class Interval	Sinhala	Cumulative Percentage	Tamil	Cumulative Percentage
90 to 100	11.50	100.00	3.55	100.00
80 to 89	17.30	88.50	10.48	96.45
70 to 79	16.49	71.20	11.35	85.97
60 to 69	15.46	54.70	13.47	74.63
50 to 59	12.77	39.24	12.03	61.16
40 to 49	11.16	26.48	15.00	49.13
30 to 39	8.37	15.32	16.35	34.13
20 to 29	4.53	6.95	11.47	17.78
10 to 19	1.80	2.43	4.38	6.30
0 to 9	0.63	0.63	1.93	1.93

Considering the pass mark as 40, only 15.32% of Sinhala medium students have scored below the pass mark. On the other hand 34.13% of Tamil medium students have scored below the pass mark.

Less than one percent of Sinhala medium students belong to less than 10 marks interval, but nearly 2% of Tamil medium students belong to this marks interval. It is significant that 45.3% Sinhala medium students have scored above 70 marks but only 25.37% of Tamil medium students fall into this category.

Box plot for medium wise achievement graphically shows the differences that have been discussed already.
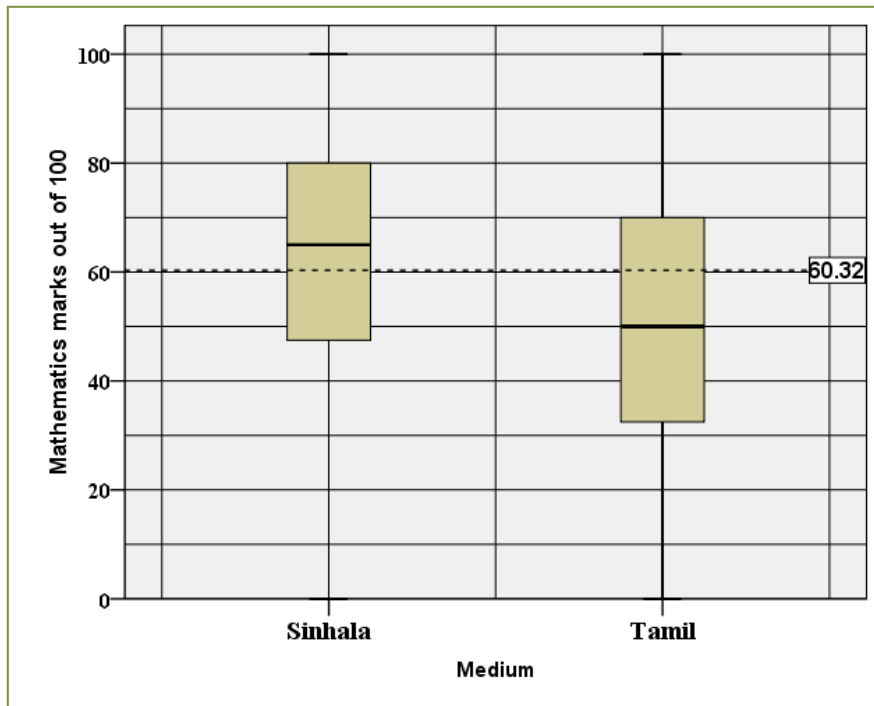
Fig. 5.13: Boxplot for medium wise achievement - Mathematics

Boxplot and whisker plot chart shows high differences among both media. However, Sinhala medium students' dispersion of marks in the boxplot is less than the Tamil medium students' achievement boxplot chart.

While the Sinhala medium students median is close to the all island mean value the mean value is little higher. On the other hand the Tamil medium students' mean and median values are below the national mean and median.

Summary

- There is wide disparity among students belonging to different medium of instruction.
- The mean score of the Sinhala medium students is above the national mean while the mean score of Tamil medium students is lower.

Students achievement in relation to the location of the school would be discussed next.

5.7 Achievement levels by location

Table 5.10: Mathematics marks achievement according to the location

Location	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
Municipal Council	63.03	20.934	0.097	-0.303	47.50	65.00	80.00
Urban Council	64.28	22.218	0.123	-0.532	47.50	67.50	82.50
Pradeshiya saba	59.33	22.468	0.044	-0.290	42.50	62.50	77.50
All Island	**60.32**	**22.311**	**0.038**	**-0.319**	**42.50**	**62.50**	**80.00**

As Table 5.10 indicates, there is variation in achievement among the schools in the different localities. Schools in the urban council area have performed slightly better than the municipal council area schools. On the other hand, the lowest performance is recorded in the pradeshiyasaba area schools. They have performed below the national mean while the other two types of schools have performed above the national mean.

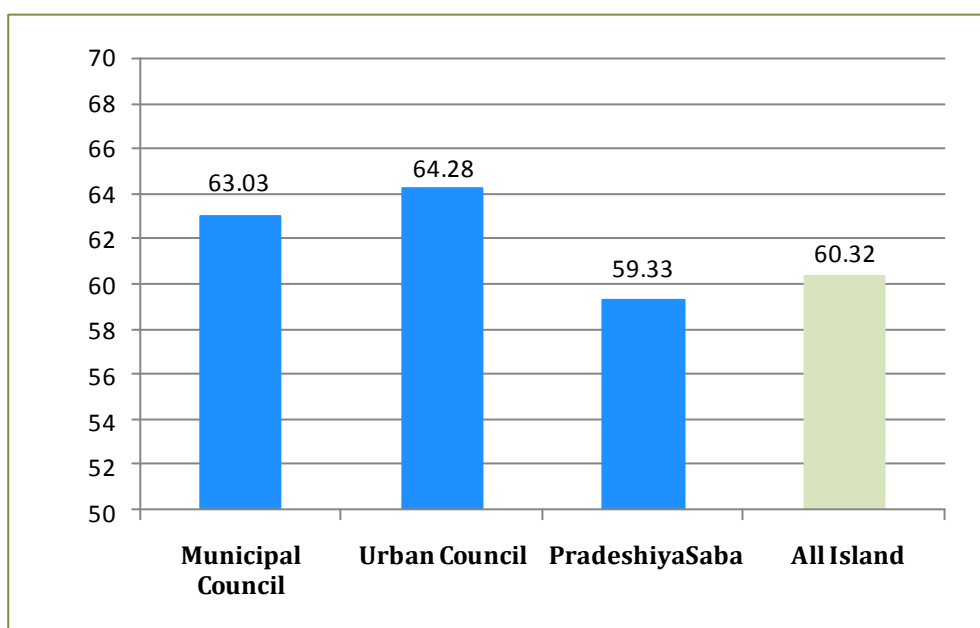The difference in mean values is graphically shown in Fig. 5.14

Fig. 5.14: Bar chart representing mean values according to location - Mathematics

As Fig. 5.14 indicates the mean values in the municipal council area schools are lower than urban council areas. However, these differences are minimal. On the other hand, when the median values given in Table 5.10 are considered, there is a greater difference (65.0 and 67.50). However, in the pradeshiyasaba area schools, the median is equal to the all island median.

Even though there is disparity in achievement, the deviation of the marks from the mean according to Table 5.10 appears to be quite close to each other. However, the SD of the municipal council area schools is less than the schools in the other two localities. This means that the deviation of marks is less in the municipal council area schools.

Students' achievement is further elaborated through the frequency distribution graphs in Fig. 5.15.
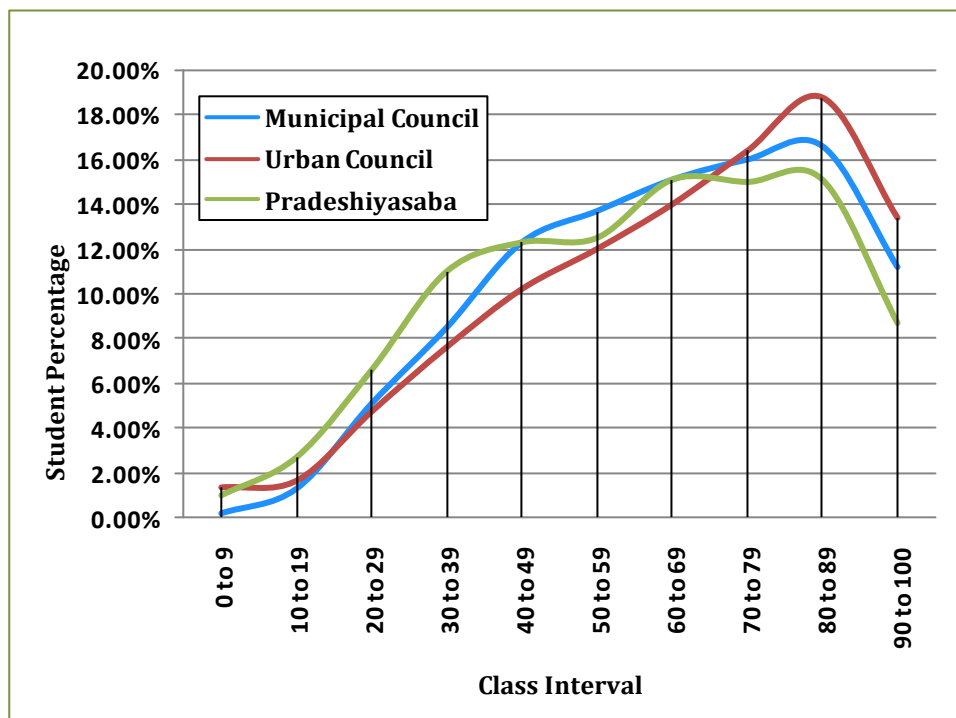
Fig. 5.15: Dispersion of marks by location

Fig. 5.15 displays three negatively skewed graphs. This means that in all three localities the high achievers are greater than the low achievers. While the curves representing the performance of the urban and municipal council area schools are smooth, the shape of the curve representing the performance of the pradeshiyasaba schools is different. This difference can be explained using the cumulative percentage table.

Table 5.11: Cumulative percentage according to location

Class Interval	Municipal Council		Urban Council		Pradesiyasaba	
	Student %	Cumulative %	Student %	Cumulative %	Student %	Cumulative %
90 to 100	11.20%	100.00%	13.40%	100.00%	8.70%	100.00%
80 to 89	16.60%	88.80%	18.80%	86.60%	15.10%	91.30%
70 to 79	16.00%	72.20%	16.40%	67.80%	15.00%	76.20%
60 to 69	15.10%	56.20%	14.00%	51.40%	15.10%	61.20%
50 to 59	13.70%	41.10%	12.00%	37.40%	12.50%	46.10%
40 to 49	12.30%	27.40%	10.20%	25.40%	12.30%	33.60%
30 to 39	8.50%	15.10%	7.60%	15.20%	11.00%	21.30%
20 to 29	5.10%	6.60%	4.70%	7.60%	6.60%	10.30%
10 to19	1.30%	1.50%	1.60%	2.90%	2.70%	3.70%
0 to 9	0.20%	0.20%	1.30%	1.30%	1.00%	1.00%
Total	100.00%		100.00%		100.00%	

According to Table 5.11, the highest percentage of students in municipal council area schools (16.60%) and in urban council area schools (18.80%) falls into the same class interval 80-89. Therefore, the peak of these two curves are at this class interval. On the other hand, in the pradeshiyasaba schools, there are similar percentage of students at the 80-89 as well as 60-69 class intervals. There is another 15.00% of students falling within the class interval 70-79. Therefore, the range of marks of the students in the pradeshiyasaba schools is evenly spread. Further, the number of students who has scored less than 40 marks is high in the pradeshiyasaba schools than in the other two localities.

The spread of marks is further illustrated through the boxplot graph.
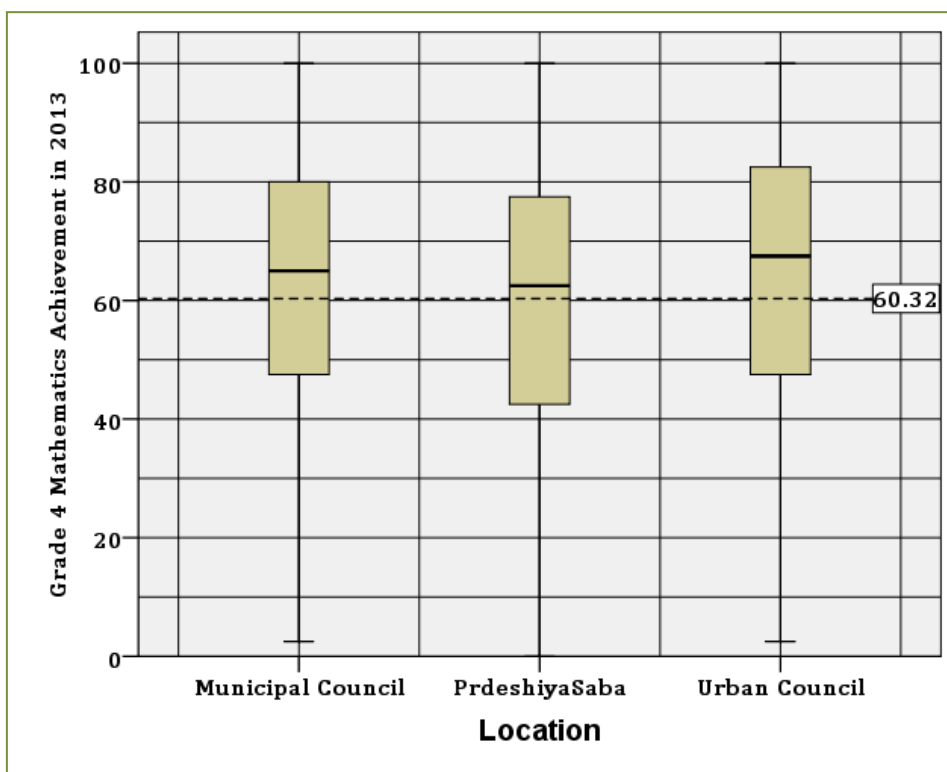
Fig. 5.16: Boxplot for location – Mathematics

At the 25th percentile level, schools in both urban council and municipal council areas are similar. Yet, at the 75th percentile range they differ.

The Table 5.12 indicates the summary statistics considering the locality as urban and rural. In this analysis both urban council and municipal council schools have been considered as urban and pradeshiyasaba schools as rural.

Table 5.12: Mathematics achievement according to urban/rural demarcation

Location	Mean	Std. Deviation	Std. Error of Mean	Skewness	Percentile 25	Median	Percentile 75
Urban	63.54	21.478	0.076	-0.402	47.50	65.00	82.50
Rural	59.33	22.468	0.044	-0.290	42.50	62.50	77.50
All Island	60.32	22.311	0.038	-0.319	42.50	62.50	80.00

According to Table 5.12 there is nearly 4 point difference in the performance of students in the mathematics according to whether the schools are in rural or urban area. However, there is not much difference in the SD values. Therefore, it could be

claimed that mark deviation from the mean is similar in both urban and rural students. Hence, student achievement is heterogeneous in both rural and urban area schools.

The difference in the mean performance is further illustrated in Fig. 5.17
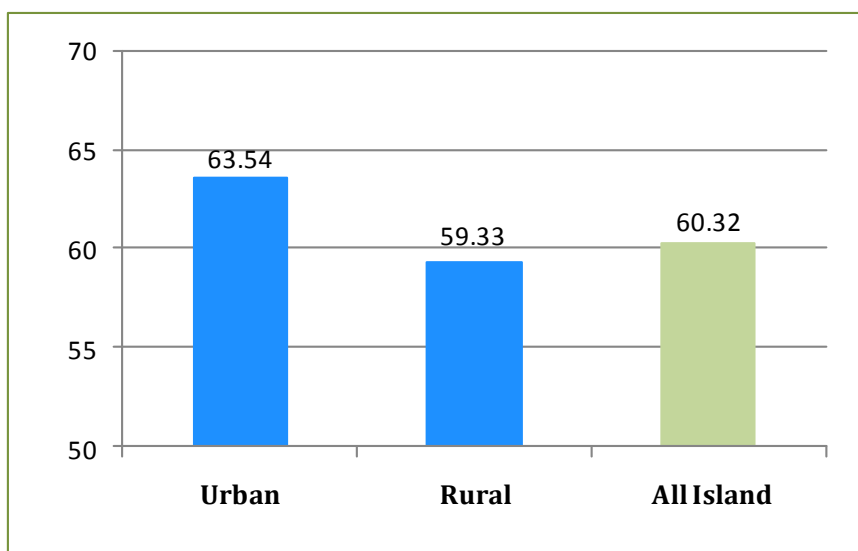
Fig. 5.17: Bar chart representing mean values according to location (Urban/Rural) – Mathematics

Summary

- The performance of the students in the urban council areas is better than in the other two locations.
- The deviation of marks is less in the municipal council area schools.
- Urban area students' performance is higher than the rural area students' performance. However, the deviation of marks appears to be quite similar.

Achievement patterns observed in relation to the achievement in mathematics revealed that there were variations among provinces, school type, gender, medium and location.

Students' achievement in relation to subject content will be discussed next.

5.8   Analysis of achievement by skill levels

In constructing the achievement tests, the test items were designed in relation to the sub skills concepts, procedures and problem solving,

Students' performance according to the sub skills is given in Fig. 5.18
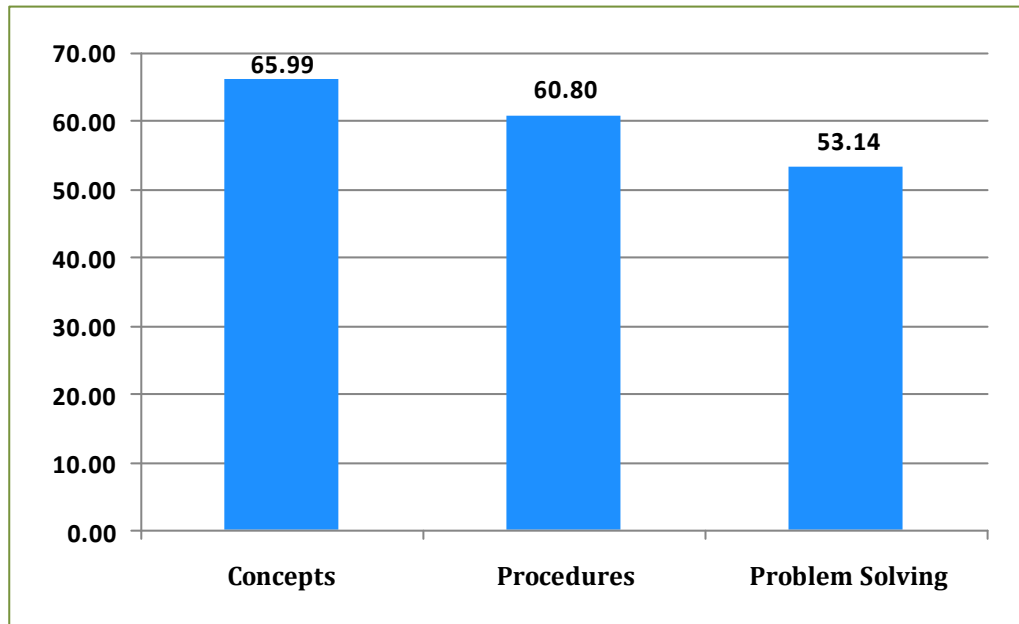
Fig. 5.18: Achievement in sub skills in mathematics

Fig. 5.18 displays the mean values for the different sub skills in mathematics. Accordingly, the lowest mean value is for problem solving.

Student achievement in relation to Essential Learning Competencies (ELCs)

As discussed in chapter 2, in constructing the paper the Essential Learning Competencies (ELCs) identified for Key Stage 2 were also considered.

Table 5.13 indicates student performance in relation to the ELCs

Table 5.13: Student performance in relation to ELCs

ELC	Description	Q. No	Percentage of correct responses
9	Correctly measures a length given using standard units	20	60.7%
10	Calculate the balance of a 100 rupees note after buying a product valued less than that	17	66.5%
		4	82.0%
11	Reads a number with three digits	2	84.1%
		4	82.0%
16	Names objects situated both at left and right sides of one's own position	39	33.0%
18	Reads the time by 5 minutes intervals on 12 hours clock	8	73.6%
19	Multiplies a number with 2 digits by 2 and 3 without carrying forward	10	78.8%
20	Divides a number less than 3 digits by 2 without carrying forward	18	56.9%
21	Adds two numbers with three digits without carrying forward	01	84.9%

As Table 5.13 indicates, student performance in relation ELCs is above 56% except in the competency 16. That is "Names objects situated both at left and right sides of one's own position". The percentage of correct responses to the question pertaining to this competency is 33.0%.

Facility index values for the mathematics paper

The mathematics paper consisted of forty supply type questions.

Fig. 5.19 displays the facility values for questions 1-40.

According to this Figure, the most difficult item had been question 38. Therefore, it confirms that students achievement of the competency related question, as discussed above is not satisfactory.
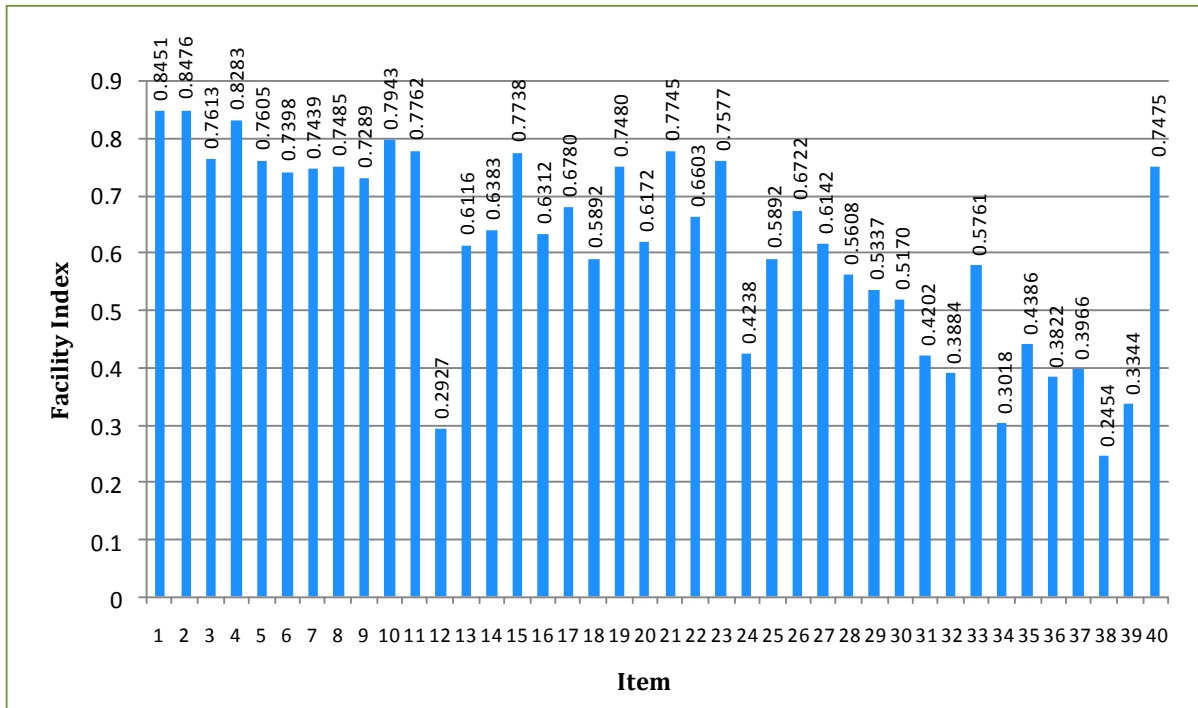
Fig. 5.19: Facility index value for mathematics

According to Fig. 5.19 the facility values ranges from 0.2454 to .8476.

Disparity in achievement seen through item analysis

The Item Person Map (IRT) given on pg. 126 displays the range of difficulty of the test items as well as the range in student ability. According to the map, there are approximately 1702 students whose abilities are higher than the most difficult item. On the other hand there are 451 students whose abilities are lower than the easiest item. Therefore, this analysis confirms the disparity in achievement which has already been discussed.

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°===============================================================================
Mathematics Paper final - 2013                      Wed May 07 14:53 2014
MAP OF WLE ESTIMATES AND RESPONSE MODEL PARAMETER ESTIMATES
===============================================================================
                                                    Terms in the Model (excl Step terms)

                                                           +item
        -----------------------------------------------------------------------
                                            XX|
        
     5                                      XX|
     
     4
                                    XXXXXX|
                                  XXXXXXXXX|
     3                        XXXXXXXXXXXXXX|
                          XXXXXXXXXXXXXXXX|
                        XXXXXXXXXXXXXXXXXXX|38
     2                  XXXXXXXXXXXXXXXXXXX|
                        XXXXXXXXXXXXXXXXXXX|12 34
                      XXXXXXXXXXXXXXXXXXXXX|39
                        XXXXXXXXXXXXXXXXXX|
                        XXXXXXXXXXXXXXXXXX|32 36 37
                          XXXXXXXXXXXXXXXX|24 31
     1   XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX|35
                          XXXXXXXXXXXXXXXX|
                          XXXXXXXXXXXXXX|30
           XXXXXXXXXXXXXXXXXXXXXXXXXXXXX|28 29
                        XXXXXXXXXXXXXXXX|18 25 33
     0       XXXXXXXXXXXXXXXXXXXXXXXXXXXXX|13 20 27
                        XXXXXXXXXXXXXX|14 16
                        XXXXXXXXXXXXXX|17 22 26
               XXXXXXXXXXXXXXXXXXXXXXXX|
                        XXXXXXXXXXXX|6 9
           XXXXXXXXXXXXXXXXXXXXXXXX|3 5 7 8 19 23 40
                        XXXXXXXXXXXX|11 15 21
                        XXXXXXXX|10
                          XXXXXXX|4
                        XXXXXXXXXXXXX|1 2
                          XXXXX|
    -2                      XXX|
                             XX|
                              X|
                              X|
    -3                        X|
                              X|
    -4                        X|
        -----------------------------------------------------------------------
Each 'X' represents  27.9 cases
===============================================================================
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5.9 Conclusion

This chapter discussed students' performance in mathematics both at national and provincial level, according to school type, gender, medium of instruction and location.

Further, test items used to assess students' performance were analyzed to assess how far they have been successful in achieving the sub skills of mathematics in grade 4 students. It could be concluded that there is disparity in achievement of learning outcomes in the learning of mathematics.