

Patterns and Trends in Achievement: Mathematics 2016

3.1 Introduction

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

The patterns of achievement in 2016 will be presented in part I and the trends will be presented in part II.

Part I - Patterns in achievement in mathematics

First, national level student achievement would be discussed in relation to student performance pertaining to mathematics.

3.2 Patterns of achievement at national level

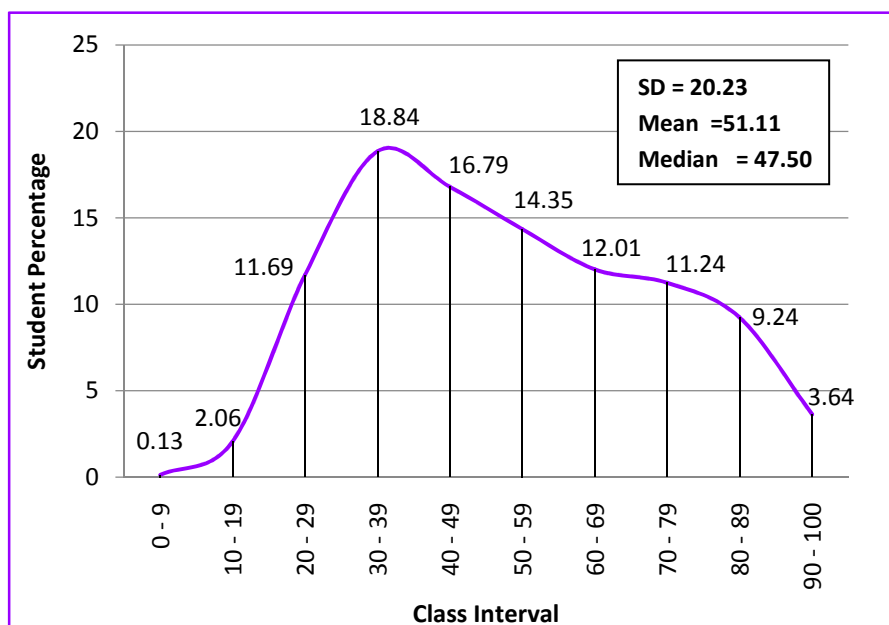


Fig. 3.1: All island achievement in mathematics 2016 – dispersion of marks

The frequency polygon shown in Fig. 3.1 outlines the total picture of the distribution of marks of grade 08 students in mathematics.

Fig. 3.1 depicts a positively skewed distribution of marks displaying that majority of the students has scored low marks in mathematics. The distribution of marks is further clarified in Table 3.1.

Table 3.1: All island achievement in mathematics 2016- cumulative percentages

Class Interval	Student %	Cumulative %
0 - 9	0.13	0.13
10 - 19	2.06	2.19
20 - 29	11.69	13.88
30 - 39	18.84	32.72
40 - 49	16.79	49.51
50 - 59	14.35	63.86
60 - 69	12.02	75.88
70 - 79	11.24	87.12
80 - 89	9.24	96.36
90 - 100	3.64	100.00
Total	100.00	

According to this table the highest percent of students (19%) has scored between 30-39 marks. Further, 32.72% of students has scored below 40 marks. On the other hand, approximately 25% of students has scored above 70. This shows the disparity in achievement in mathematics. Even though, the mean value is 51.11 the median is 47.50 indicating that 50% of the students has scored above 47.50.

Fig. 3.2 illustrates student achievement patterns further.

As Fig. 3.2, the box plot displays average marks (mean) is 51.11. On the other hand the median of the achievement is 47.50. As the average value is above the median, 50% of the students has scored above the average marks.

While 25% of the students (25th percentile) has scored below the 35 marks, another 25% of the students has scored above the 67.50 marks. Therefore, students' marks range between 35 and 67.50.

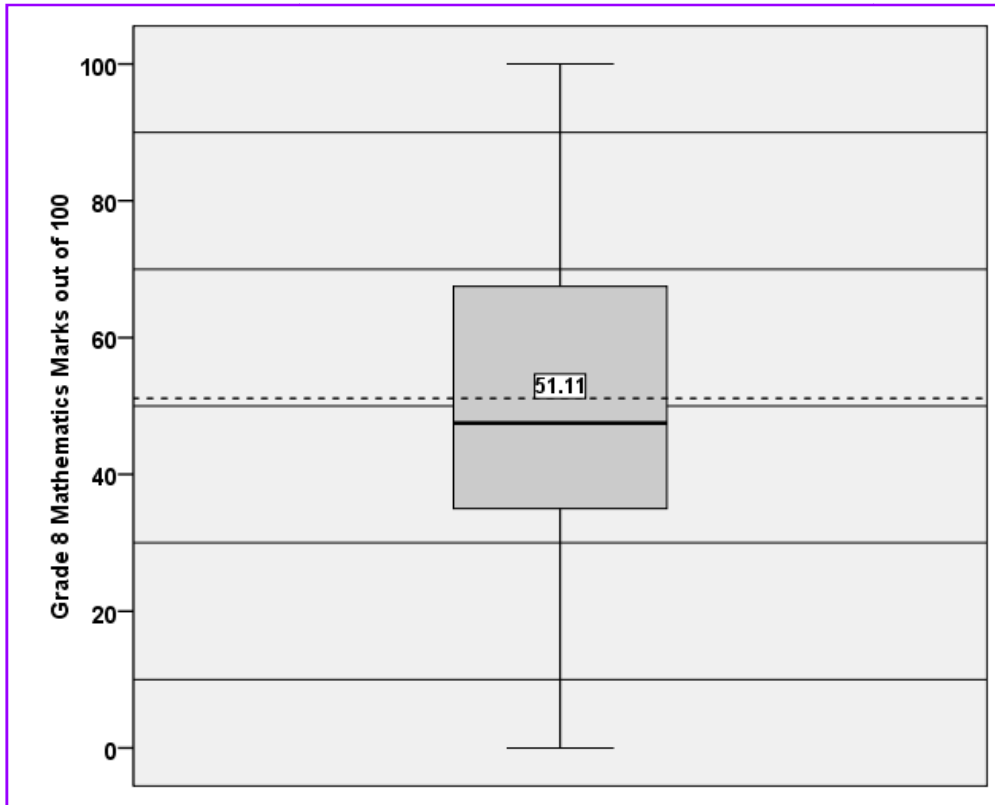


Fig. 3.2: Box plot and whisker chart representing all island mathematics achievement

Summary of national level achievement

- National level mean is 51.11, while the median is 47.50.
- Disparity in achievement prevails with approximately 32.72% of students scoring below 40 and 25% of students scoring above 70. However, the highest number of students falls within the marks range of 30-39.

Provincial wise student achievement will be discussed next.

3.3 Provincial wise student achievement

The nature of the distribution of scores provincial wise reveals certain patterns. These patterns are discussed based on Table 3.2.

Table 3.2: Provincial achievement in mathematics 2016 – Summary statistics

Province	Mean	Rank	Std. Error of Mean	Std. Deviation	Skewness	Percentile 25	Median	Percentile 75
Southern	55.63	1	0.10	21.31	0.03	37.50	55.00	75.00
Western	54.80	2	0.07	20.30	0.11	37.50	52.50	72.50
Sabaragamuwa	51.91	3	0.12	20.49	0.29	35.00	50.00	67.50
North Central	50.90	4	0.13	18.99	0.30	35.00	47.50	65.00
North Western	50.11	5	0.10	19.98	0.29	32.50	47.50	65.00
Central	48.89	6	0.09	19.20	0.44	35.00	45.00	62.50
Northern	47.02	7	0.14	20.24	0.54	30.00	42.50	62.50
Eastern	46.23	8	0.11	19.18	0.56	32.50	42.50	60.00
Uva	46.18	9	0.12	18.48	0.54	32.50	42.50	60.00
All Island	51.11		0.03	20.23	0.30	35.00	47.50	67.50

As Table 3.2 indicates based on provincial wise mean achievement Southern Province ranks first. However, Western Province is ranked second with only a slightly lower mean value.

Achievement wise the provinces fall into three categories. Southern, Western and Sabaragamuwa, with mean scores above the national mean, fall into the higher category. Central, North Central and North Western Provinces cluster in the middle while the rest of the provinces fall into the lowest category. Between the Southern and Eastern Provinces there is almost nine point difference in mean values indicating the disparity in achievement among the provinces.

These disparities are further highlighted in Fig. 3.3.

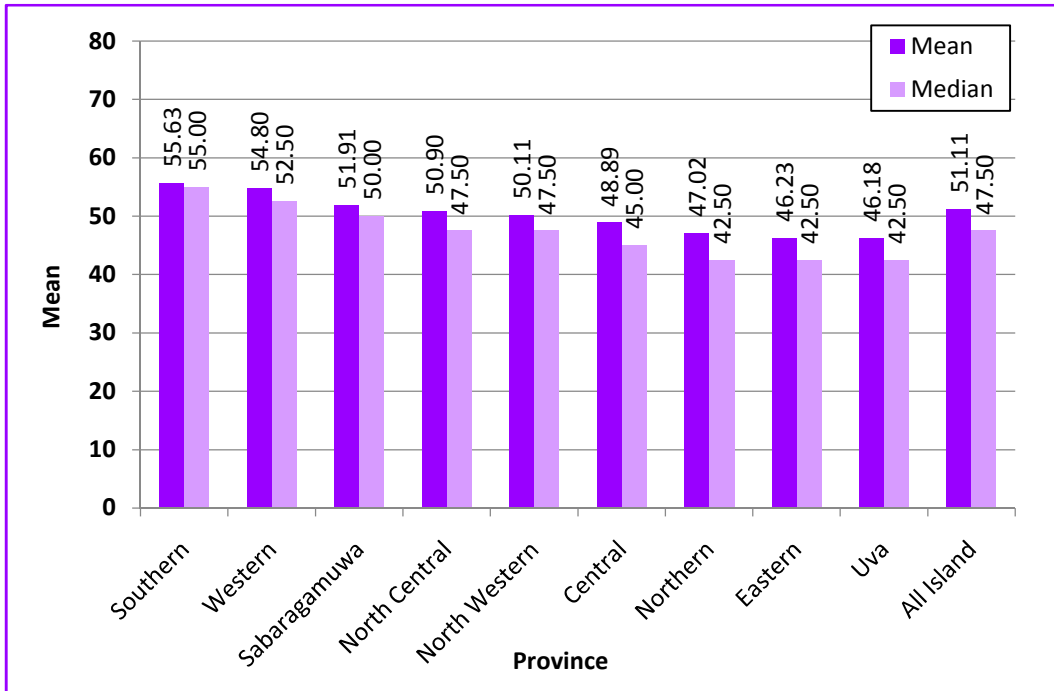


Fig. 3.3: Bar chart to represent mean and median among the provinces - Mathematics

As Fig. 3.3 displays the median values in all provinces are below the mean values. Since the median value represent 50% it could be concluded that in all provinces 50% of students has reached the average (mean) mark.

Disparity in achievement among provinces

According to Table 3.2, Southern Province has the highest mean value but its SD is higher than Western Province which has the next highest mean value. This means that student performance is more homogeneous in the Western Province. Southern Province has the highest SD value indicating that the variation of students’ marks is the highest in this province. The SD values of Southern, Western, Sabaragamuwa and the Northern Provinces are higher than the all island SD value indicating that there is variation in achievement in these provinces. There are five provinces that have SD values lower than the all island SD. All the provinces have obtained positive skewed values. This indicates that student performance is low.

These disparities are further highlighted through the line curves for each province given in Fig. 3.4. Only Southern and Western indicate low skewness values and their curves are bimodal compared to other provinces. The two curves being bimodal suggest that there are both high achievers and low achievers in these provinces.

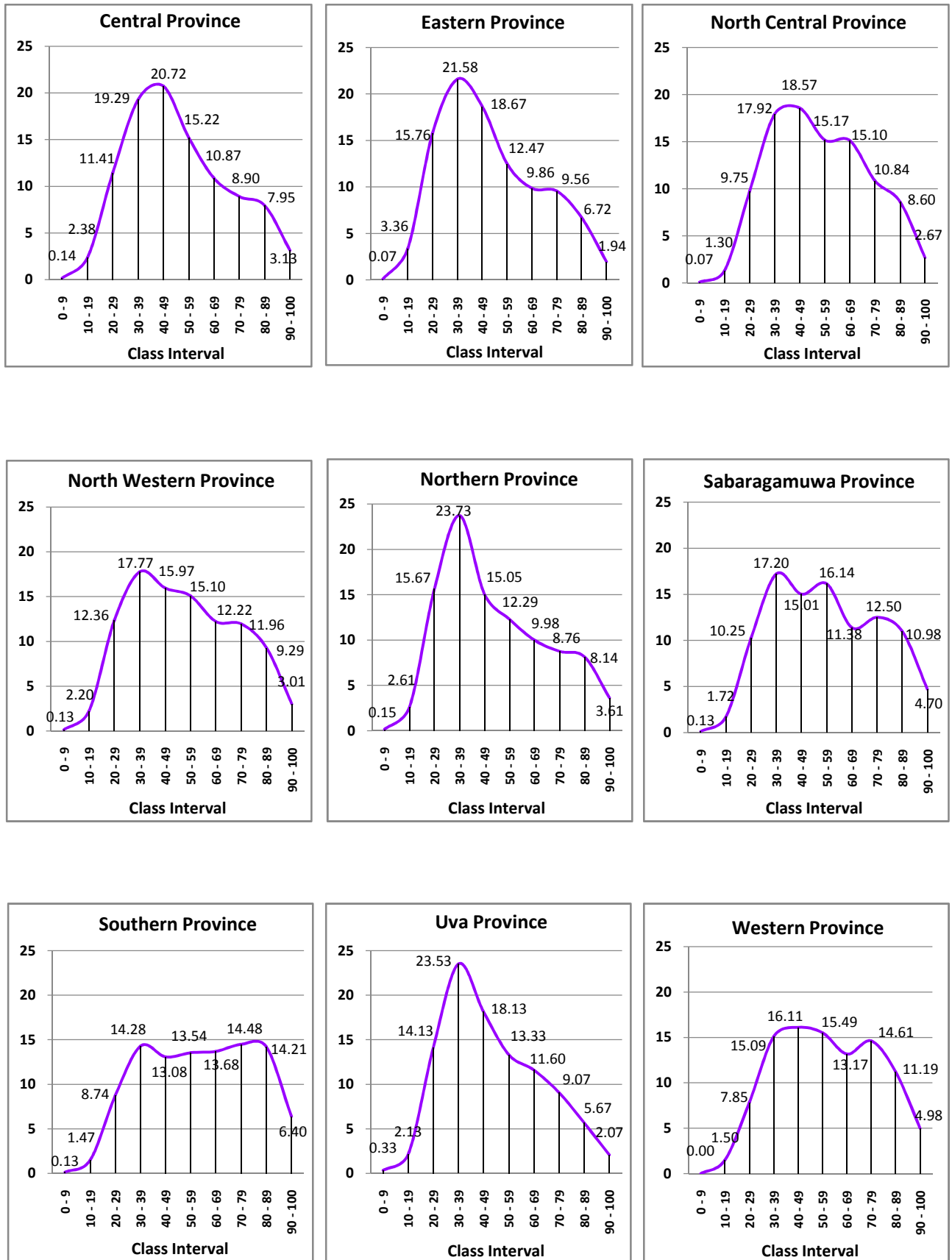


Fig. 3.4: Provincial wise distribution of marks -mathematics

Patterns of achievement in the different provinces are further elaborated through the box plot chart.

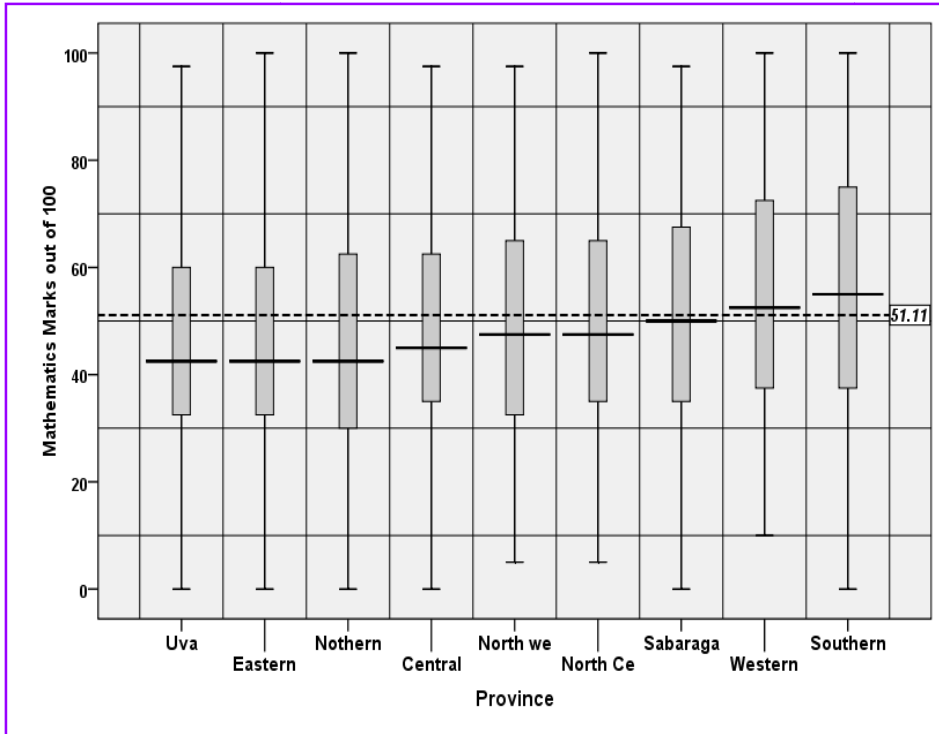


Fig. 3.5: Box plot and whisker chart representing provincial wise mathematics achievement

According to the above chart there are two provinces (Uva and Eastern) which show similar characteristics. Similarly, even though Western Province and Southern Provinces performance are very similar the 75th percentile is higher in the Southern Province. Therefore there is greater disparity of marks in the Southern Province. However, there are no outliers in any of the provinces.

Table 3.3: Percentage of student scoring 50 or above, and below 50 – Mathematics

Province	Greater than or Equal to 50	Less than 50
Central	46.06	53.94
Eastern	40.55	59.45
North Central	52.38	47.62
North western	51.57	48.43
Northern	42.78	57.22
Sabaragamuwa	55.69	44.31
Southern	62.31	37.69
Uva	41.73	58.27
Western	59.45	40.55
All Island	50.49	49.51

Summary of provincial level analysis

- Achievement wise the provinces fall into three categories.
 Category 1 – Southern, Western and Sabaragamuwa, with mean scores above the national mean (51.11).
 Category 2 –North Central and North Western Provinces cluster in the middle.
 Category 3 –Uva, Eastern, Central and Northern Provinces

3.4 Achievement levels by type of school

Table 3.4: Mathematics achievement according to school type

School Type	Mean	Std. Error of Mean	Std. Deviation	Skewness	Percentile 25	Median	Percentile 75	F	Sig.
1AB	58.14	0.05	20.55	-0.07	40.00	57.50	75.00	23756.83	0.000
1C	44.97	0.05	17.45	0.52	32.50	42.50	55.00		
Type 2	42.32	0.07	16.65	0.67	30.00	40.00	52.50		
All Island	51.11	0.03	20.23	0.30	35.00	47.50	67.50		

As Table 3.4 indicates there is a considerable gap between the mean scores of different school types. However, 1AB schools’ mean score is above that of the other types and also above the national mean. On the other hand, the mean scores of Type 2 and 1C schools, are below the national mean. Therefore, the gap between school types exists.

The difference in mean and median scores is graphically shown in Fig. 3.6

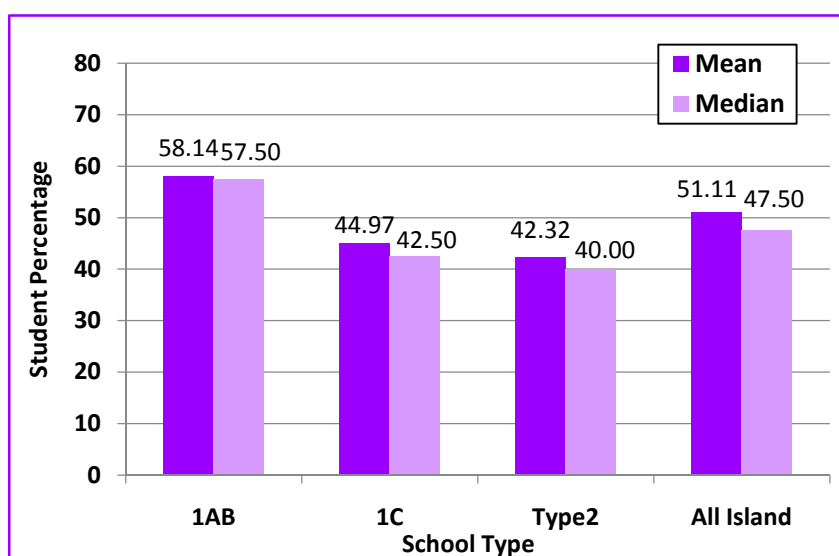


Fig. 3.6: Bar chart representing the mean and median among the school types- Mathematics

The performance of the school types is further highlighted when the median scores are considered in Table 3.4 and Fig. 3.6. All school types have achieved median values below the mean value for the mathematics achievement. This means that fifty percent of students in all school types have obtained scores above the mean value.

Variation among students

Variation in student achievement in 1C and Type 2 schools is low. Lower standard deviation values are shown by 1C schools and Type 2 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. 1AB schools standard deviation value is the highest among the school types. This indicates that student achievement deviation from the mean is very high.

Disparity in achievement

Both 1C and Type 2 schools have obtained positive skewed values. It reveals that in these types higher number of students has achieved low marks while higher marks are obtained by a lower number of students. Highest skewed value has been obtained by Type 2 schools. Next higher value has been obtained by 1C schools. Both values are above the all island skewness value. On the other hand 1AB schools skewness value is lower than the all island value, indicating that there is lesser variation in achievement in these schools. Further, it is negative indicating that there are more high achievers.

The variation in student performance in different types of schools is further highlighted through the frequency distribution graphs.

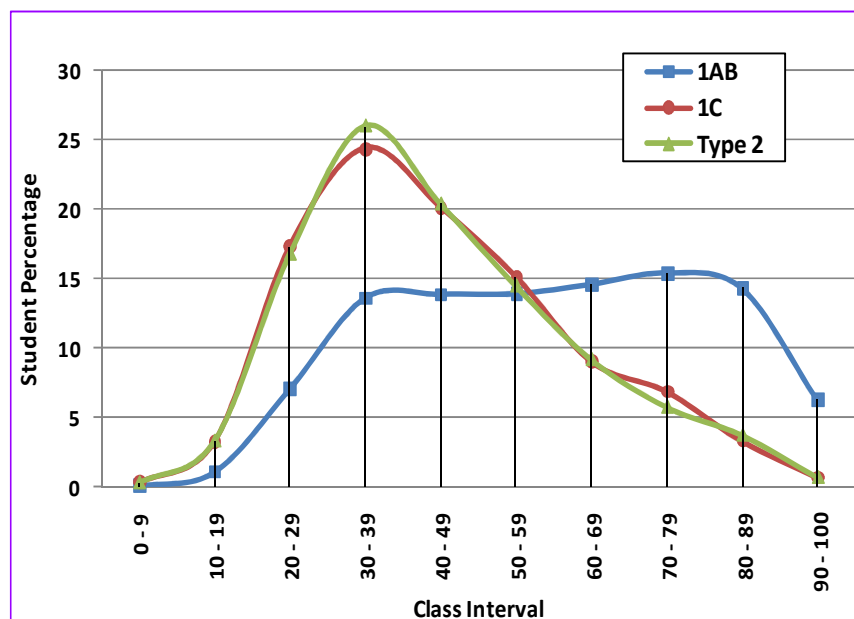


Fig. 3.7: Dispersion of marks by school type-Mathematics

Fig. 3.7 displays that 1C and Type 2 school curves peaked at the 30-39 class interval. While in 1AB schools the peak spreads over different class intervals. It is a bimodal curve with both high and low achiever groups. However, the high achiever group is more.

The spread of marks at different class intervals is further illustrated in the cumulative percentage Table 3.5.

Table 3.5: Cumulative student percentages according to school type- Mathematics

Class Interval	1AB		1C		Type 2	
	Student %	Cumulative %	Student %	Cumulative %	Student %	Cumulative %
0 - 9	0.03	0.03	0.26	0.26	0.23	0.23
10 - 19	1.05	1.08	3.23	3.48	3.25	3.48
20 - 29	7.03	8.11	17.29	20.77	16.72	20.20
30 - 39	13.59	21.71	24.36	45.14	25.97	46.17
40 - 49	13.87	35.57	20.10	65.24	20.34	66.51
50 - 59	13.91	49.48	15.10	80.34	14.42	80.93
60 - 69	14.59	64.07	8.98	89.32	9.11	90.04
70 - 79	15.40	79.47	6.81	96.13	5.69	95.73
80 - 89	14.29	93.76	3.25	99.38	3.66	99.39
90 - 100	6.24	100.00	0.62	100.00	0.61	100.00
Total	100.00		100.00		100.00	

In the 1AB school type high percentage of students has scored between 70-79. On the other hand in both Type 2 and 1C schools the highest percentage of students falls between the class interval 30-39.

The analysis of data pertaining to the school types indicates disparity in achievement.

This is further illustrated through the box plot.

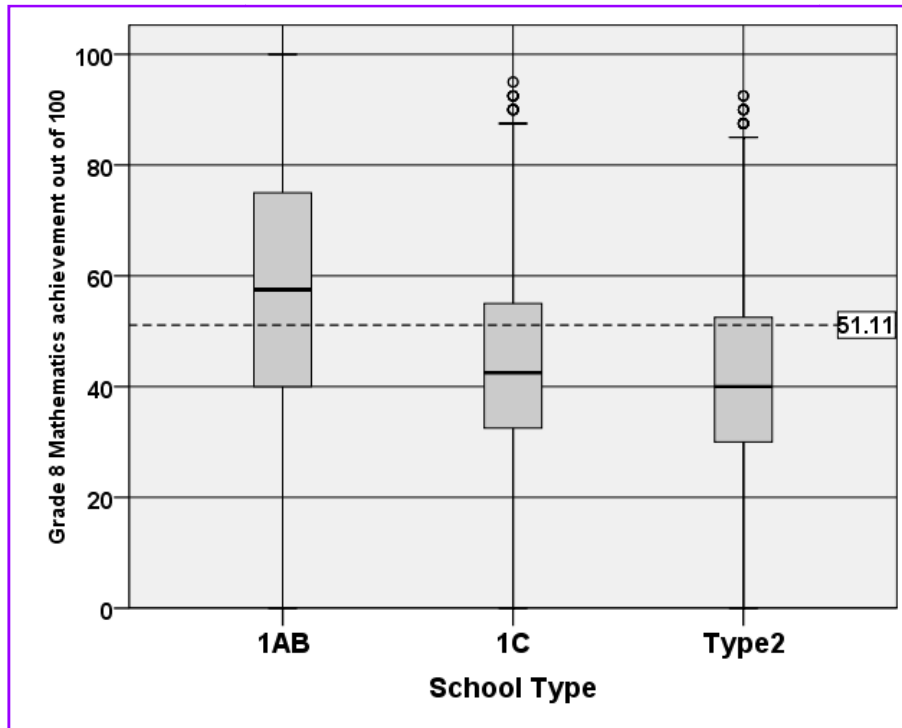


Fig. 3.8: Mathematics marks according to school types using box plot and whisker plot

The box plots of the 1C and Type 2 schools are quite similar. This indicates that their performances are similar. In both school types there are also outliers who's performance is higher than the other students. On the other hand, the 1AB schools performance is different. Their 25th as well as the 75th percentiles are higher than that of the Type 2 and 1C schools. It also indicates that their performance is high.

Summary

- The achievement in mathematics in 1C and Type 2 schools are relatively similar.
- 1AB schools' performance is quite different and higher than the other two school types.
- The gap in achievement between school types continues.

3.5 Achievement levels by gender

Table 3.6: Mathematics achievement according to gender

Gender	Mean	Std. Error of Mean	Std. Deviation	Skewness	Percentile 25	Median	Percentile 75	F	Sig.
Male	49.40	0.05	20.61	0.39	32.50	45.00	65.00	2251.12	0.000
Female	52.70	0.05	19.74	0.22	37.50	50.00	67.50		
All Island	51.11	0.03	20.23	0.30	35.00	47.50	67.50		

There is a difference in the achievement of females over males. As Table 3.6 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. 3.9

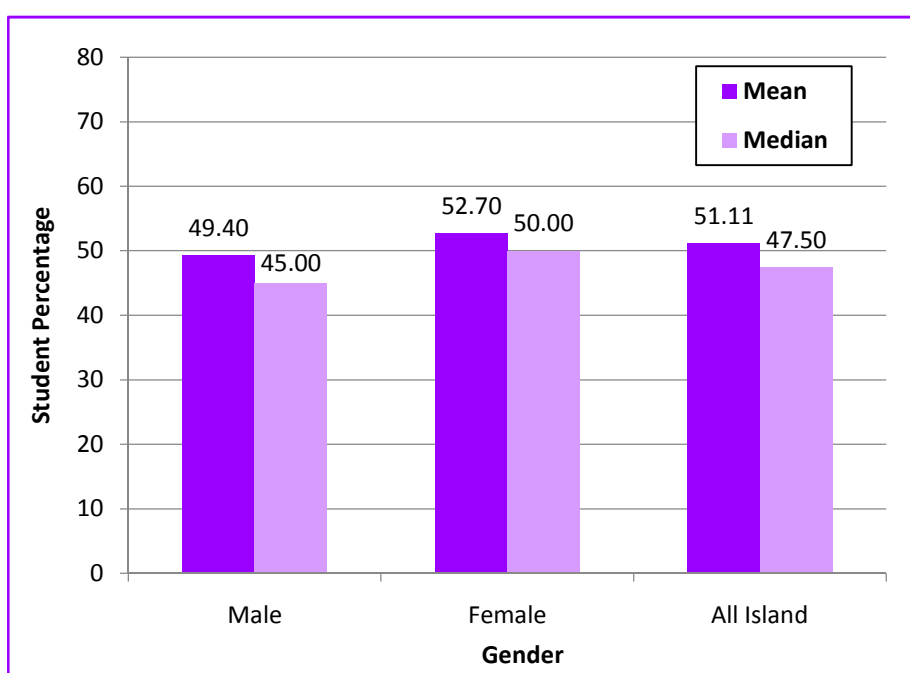


Fig. 3.9: Bar chart representing mean and median values according to gender –Mathematics

Variation among students

Variation in achievement among male students 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 3.5). On the other hand, the female students SD is below the all island SD. Further, the female skewness value is higher than the all island as well as the male value. This indicates that there are more high achievers

among the females. Fig. 3.9 also indicates that both among males and females the median value is below the mean. This indicates that more than 50% of the students have scored above the average mark.

Fig. 3.10 graphically illustrates the dispersion of marks according to gender.

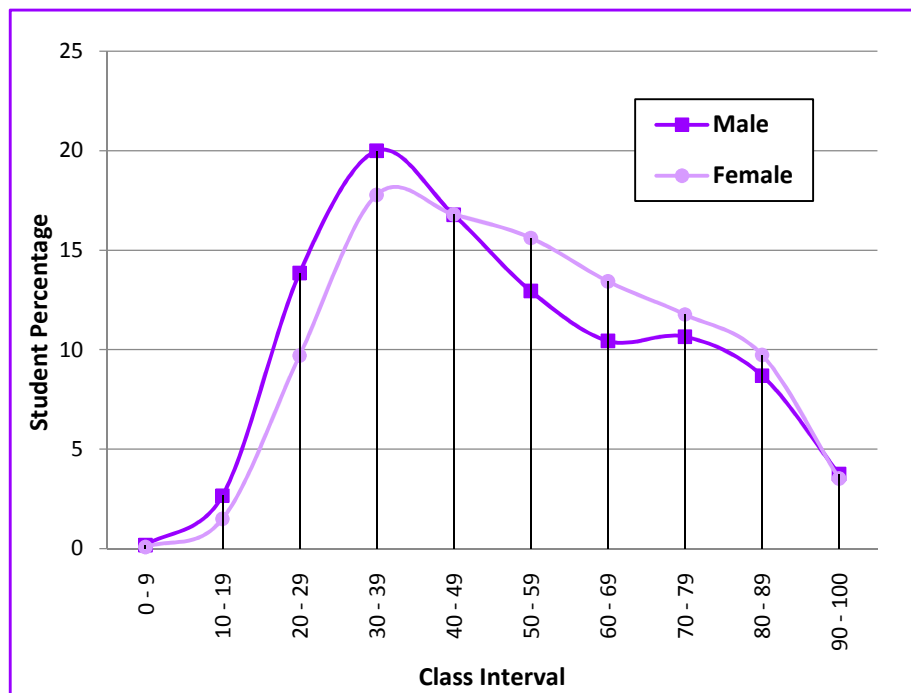


Fig. 3.10: Dispersion of marks by gender – Mathematics

Fig. 3.10 displays two curves which are both positively skewed. As can be seen there are more low achievers than high achievers among both males and females. However the pattern of the two curves are slightly different. At the beginning the curves are similar, then the curves become different and at the 40-49 class interval they cut across. But the female curve then rises above the male curve and finally, both curves become similar again.

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

Table 3.7: Cumulative student percentages according to gender –Mathematics

Class Interval	Male		Female	
	Student %	Cumulative %	Student %	Cumulative %
0 – 9	0.14	0.14	0.08	0.08
10 – 19	2.83	2.97	1.48	1.56
20 – 29	14.28	17.25	9.70	11.26
30 – 39	20.26	37.51	17.78	29.04
40 - 49	17.36	54.87	17.43	46.47
50 - 59	13.23	68.10	15.83	62.30
60 - 69	10.05	78.15	13.30	75.60
70 - 79	10.21	88.36	11.74	87.34
80 - 89	8.19	96.55	9.32	96.66
90 - 100	3.45	100.00	3.34	100.00
Total	100.00		100.00	

According to Table 3.7 and Fig. 3.10 it could be concluded that among both females and males, there are low performing students. The highest percentage (17.78%) of female students' marks fall into the class interval 30-39. The highest percentage of male students' marks, even a higher percentage (20.25%) falls into the same class interval. This indicates that the low performing boys achievement is higher than that of the low performing girls.

At the 40-49 class interval percentage of male and female students is almost similar (17.36% and 17.43%).

Even though there are only 29.04 cumulative percent of female students who has scored below 40 marks, there are 37.51% of male students who has scored less than 40 marks. Therefore, the heterogeneity in achievement in mathematics of the boys is greater than the girls.

Box plot and whisker for gender wise mathematics achievement shows similarities that has been discussed already.

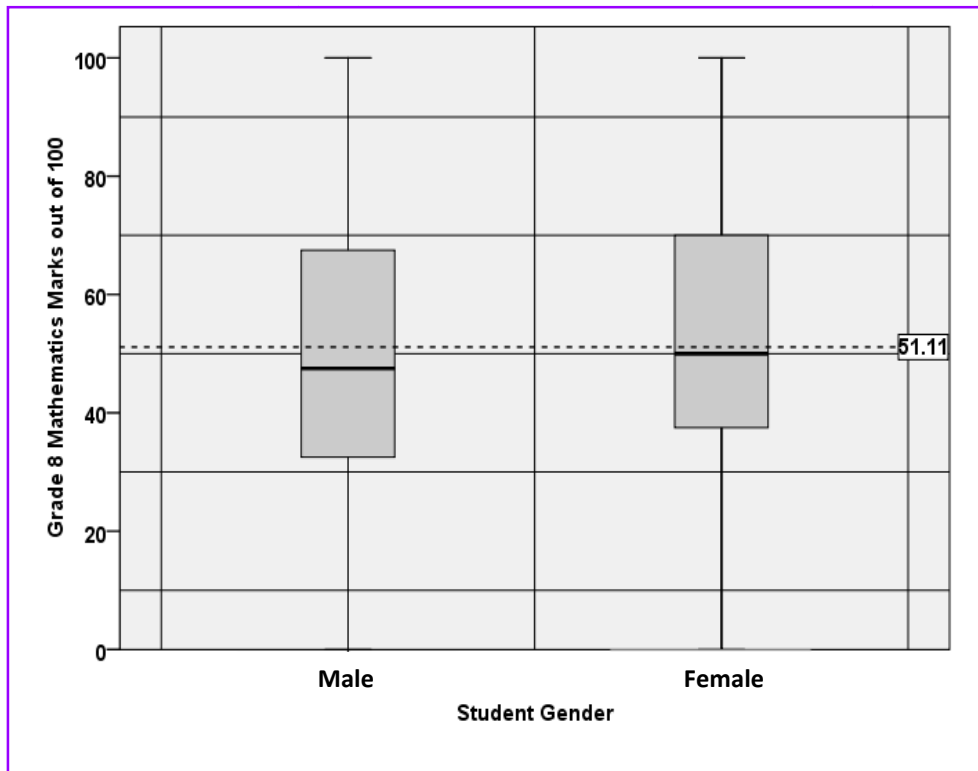


Fig. 3.11: Box plot and whisker plot representing gender wise mathematics marks

Box plot and whisker chart shows that male students' 25th and 50th percentiles are lower than the female mark range as well as the all island range. Therefore, fifty percent of male students' achievement lie below the female students' achievement.

Summary

- Female performance is better than all island and male performance.
- While 29.04% of girls has scored below 40, the male percentage is 37.51.
- Highest percentage of females, 17.78% as well as 20.26% of males fall into the mark range 30-39.

3.6 Achievement levels by medium of instruction

Table 3.8: Mathematics achievement according to medium of instruction

Medium of Instruction	Mean	Std. Error of Mean	Std. Deviation	Skewness	Percentile 25	Median	Percentile 75	F	Sig.
Sinhala	53.28	0.04	20.33	0.19	37.50	52.50	70.00	11234.80	0.000
Tamil	45.01	0.06	18.66	0.60	30.00	40.00	57.50		
All Island	51.11	0.03	20.23	0.30	35.00	47.50	67.50		

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

These disparities are further highlighted through the bar chart given in Fig. 3.12.

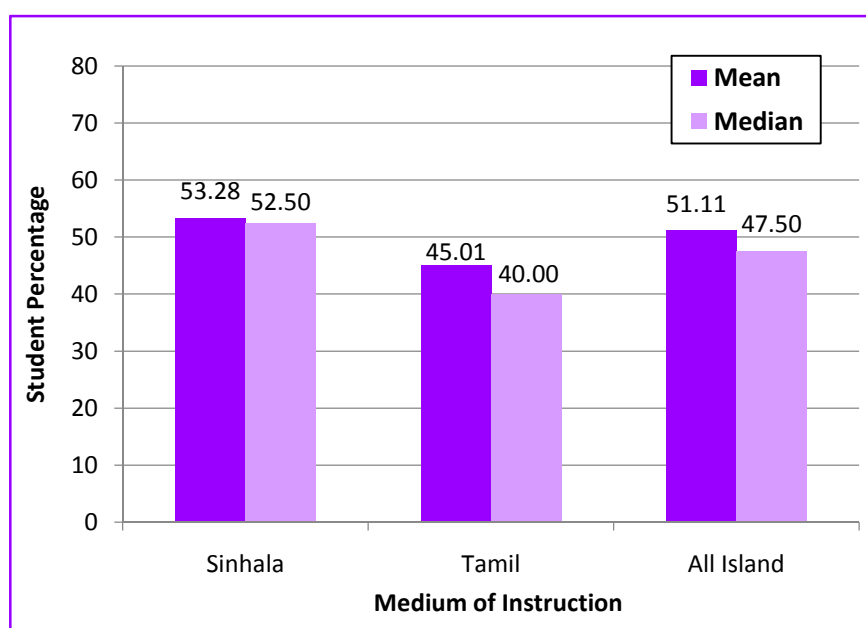


Fig. 3.12: Bar chart representing mean and median values according to medium of instruction - Mathematics

As Table 3.8 indicates Tamil medium students SD is lower than the Sinhala medium students and is lower than the national SD. Thus there is less variation in their performance.

The diversity in achievement among the students taught through the different medium of instruction, is further highlighted through the frequency distribution graphs.

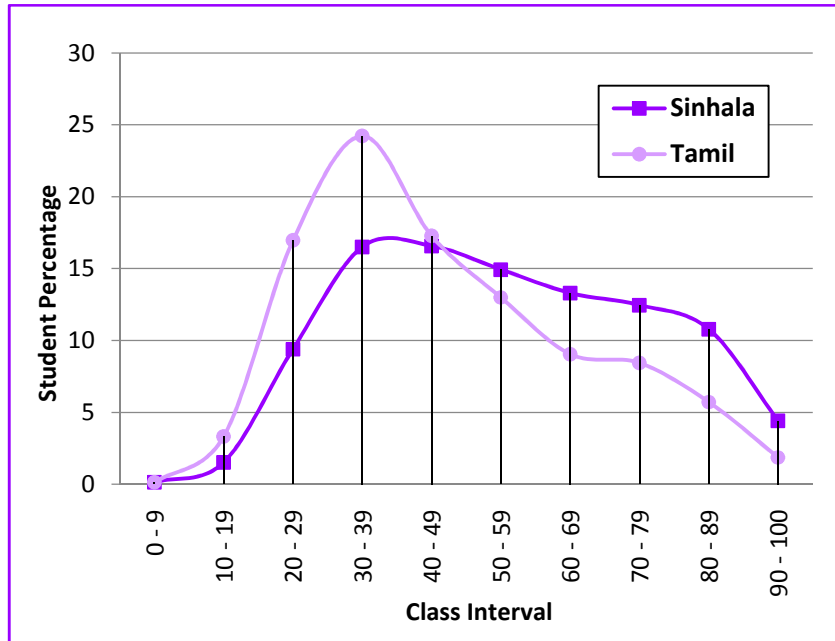


Fig. 3.13: Dispersion of marks by medium of instruction - Mathematics

The two curves on Fig. 3.13 show two different patterns. While both curves are positively skewed with more students scoring low marks the Sinhala medium students marks are spread. There are low achievers as well as high achievers. However, the low achievers are slightly more. This pattern can be explained through Table 3.9.

Table 3.9: Cumulative student percentages according to medium of instruction -Mathematics

Class Interval	Sinhala		Tamil	
	Student %	Cumulative %	Student %	Cumulative %
0 - 9	0.13	0.13	0.13	0.13
10 - 19	1.52	1.65	3.31	3.44
20 - 29	9.40	11.05	16.98	20.42
30 - 39	16.50	27.55	24.24	44.66
40 - 49	16.58	44.13	17.28	61.94
50 - 59	14.93	59.06	13.00	74.94
60 - 69	13.30	72.36	9.05	83.99
70 - 79	12.46	84.81	8.44	92.43
80 - 89	10.78	95.59	5.71	98.14
90 - 100	4.40	100.00	1.86	100.00
Total	100.00		100.00	

As Table 3.9 indicates the highest percentage of the Sinhala medium students' marks is in the range of 40-49. This amounts to more than 44%. On the other hand, the highest percentage of Tamil medium students marks are between 30-39.

Considering the pass mark as 40, only 27.55% of Sinhala medium students has scored below the pass mark. On the other hand 44.66% of Tamil medium students has scored below the pass mark.

Box plot for medium wise achievement graphically shows the differences that have been discussed already.

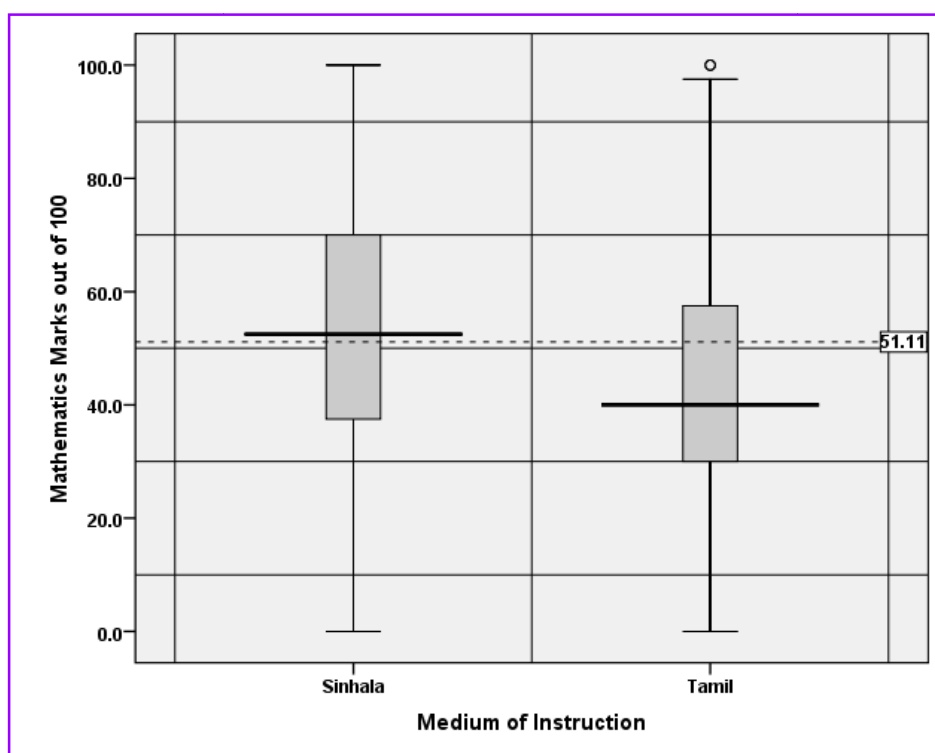


Fig. 3.14: Mathematics marks according to medium of instruction using box plot and whisker plot

Box plot and whisker plot chart shows differences among both media. However, Sinhala medium dispersion of marks in the box plot is less than the Tamil medium students' dispersion of marks. There are no outliers among both media.

Sinhala medium student's 25th, 50th and 75th percentile values are higher than that of the Tamil medium students. Therefore, this confirms that there is disparity between the performance in mathematics of Tamil and Sinhala medium students.

Summary

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

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

3.7 Achievement levels by location

Table 3.10: Mathematics achievement according to location

Location	Mean	Std. Error of Mean	Std. Deviation	Skewness	Percentile 25	Median	Percentile 75	F	Sig.
Rural	48.75	0.04	19.27	0.38	32.50	45.00	62.50	12610.73	0.000
Urban	57.38	0.07	21.36	-0.01	40.00	57.50	77.50		
All Island	51.11	0.03	20.23	0.30	35.00	47.50	67.50		

As Table 3.10 indicates, there is variation in achievement among the schools in the different localities. The urban area schools have performed better than the rural area schools. Rural area schools have performed below the national mean while the urban schools have performed above the national mean.

According to Table 3.10 the SD also differs in the two localities even though not to a great extent. However, while the SD of the rural schools is closer to the all island SD, the urban schools SD is higher than the all island SD denoting more variation among the student achievement.

The difference in mean and median values is graphically shown in Fig. 3.15.

As Fig. 3.15 indicates the median value in the rural area schools is lower than mean value.

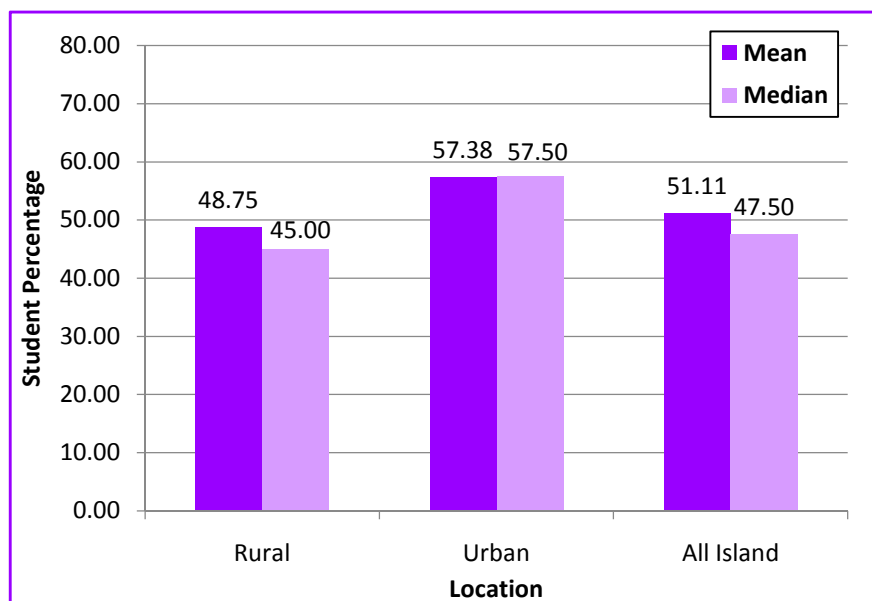


Fig. 3.15: Bar chart representing mean and median values according to location- Mathematics

Students' achievement is further elaborated through the frequency distribution graphs in Fig. 3.16.

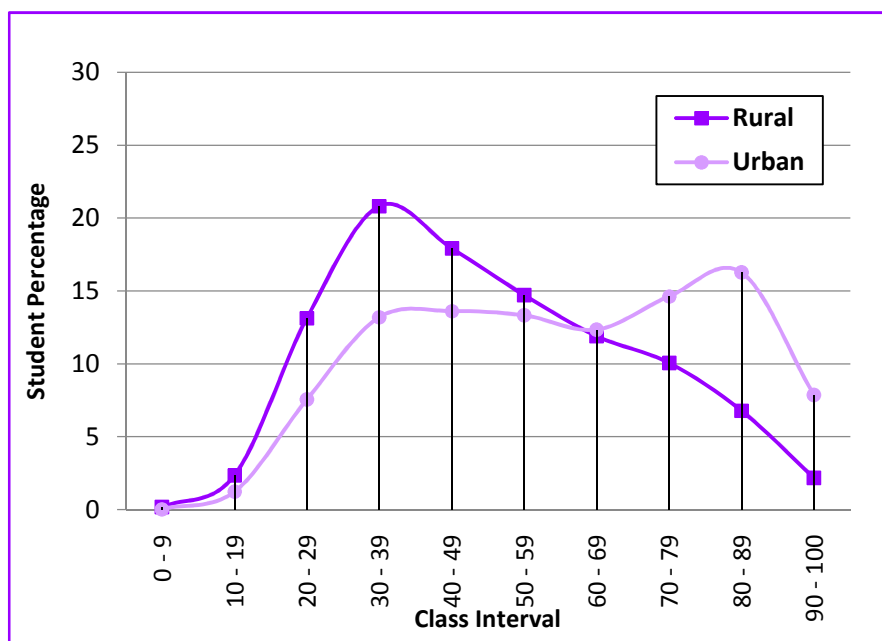


Fig. 3.16: Dispersion of marks by location - Mathematics

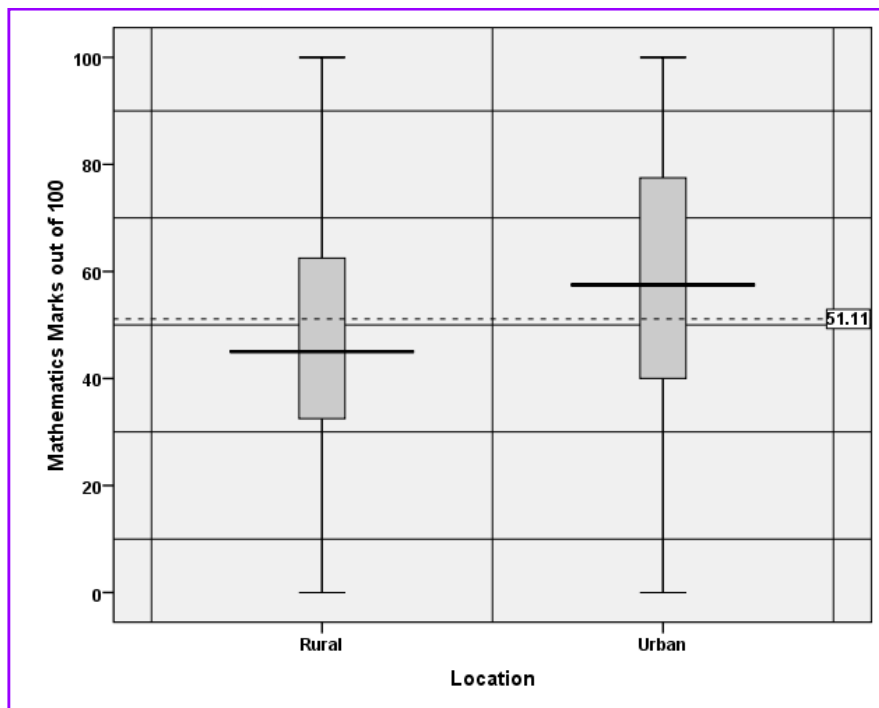
Fig. 3.16 displays two differently skewed graphs. While the curve representing the rural areas is positive the shape of the curve representing the performance of urban schools is negative. This difference can be explained using the cumulative percentage Table 3.11.

Table 3.11: Cumulative student percentages according to the location –Mathematics

Class Interval	Rural		Urban	
	Student %	Cumulative %	Student %	Cumulative %
0 – 9	0.17	0.17	0.03	0.03
10 – 19	2.35	2.52	1.22	1.25
20 – 29	13.14	15.66	7.55	8.80
30 – 39	20.82	36.48	13.20	22.00
40 - 49	17.90	54.38	13.61	35.61
50 - 59	14.71	69.09	13.32	48.93
60 - 69	11.90	80.99	12.34	61.27
70 - 79	10.06	91.05	14.62	75.89
80 - 89	6.78	97.83	16.26	92.15
90 - 100	2.17	100.00	7.85	100.00
Total	100.00		100.00	

According to Table 3.11 the highest percentage of students in urban area schools (16.26%) fall into the class interval 80-89. This is the peak of the urban area school curve. On the other hand, in the rural area schools the highest percentage of students falls in to the class interval 30-39 and the percentage is 20.82. Thus while the urban area curve is negatively skewed the rural area curve is positively skewed.

The spread of marks is further illustrated through the box plot graph.

**Fig. 3.17: Box plot and whisker plot representing location wise mathematics marks**

According to the box plot the urban area schools' performance differ from the rural area schools at the 25th, 50th and 75th percentile. Further their performance is above the all island performance. The box plot confirms the variation that exists between the performance of the two localities.

Summary

- The performance of the students in the urban areas is better than in the rural areas.
- The deviation of marks is less in the rural area schools.

Patterns observed in relation to the achievement in mathematics, revealed that there are variations among provinces, school type, gender and medium wise.

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

3.8 Analysis of achievement by sub skills

In constructing the achievement tests, the test items were designed in relation to the competencies and competency levels identified for grade eight. As discussed in chapter 2, the construct assessed in these studies were the competency levels. Based on the competencies and competency levels, table of specification was prepared.

The mathematics paper was based on five main process standards– knowledge and skills, communications, relationships, reasoning and problem solving.

Achievement of competencies related to knowledge and skills

The percentage of students who has answered correctly the questions related to each competency level under knowledge and skills is given in Table 3.12.

Table 3.12: Achievement of competency levels related to knowledge and skills

Competency Level	Question numbers	Percentage
1.1 Inquires into the relationships between the whole numbers.	2	55.70
1.2 Manipulates directed numbers under the basic mathematical operations	1	37.90
2.1 Builds relationships between the terms of number patterns by investigating various properties	7	43.50
3.1 Manipulates units and parts under multiplication	3	66.10
5.1 Develops the relationship between fractions, ratios and percentages	8	35.60
7.1 Satisfies various requirements by investigating the perimeter of rectilinear plane figures	20	42.30
9.1 Facilitates daily work by investigating large masses	18	54.10
10.1 Determines for daily needs, the space that is taken up by various solids	15	61.00
11.1 Facilitates daily work by investigating the capacity of liquid containers	21	26.00
12.1 Investigates the rotation of earth and inquires into its results	19	58.30
12.2 Investigates the difference in time between countries and finds their relative positions	23	39.80
13.1 Indicates the direction of a location using angles	24	34.30
15.1 Factorizes algebraic expressions	26	38.80
20.2 Illustrates the behavior of a variable pictorially	31	35.00
20.3 Represents location on a Cartesian Plane	30	46.90
21.1 Examines the angles made by various straight lines	35	45.20
21.2 Performs calculations using the relationships between various angles	36	40.40
22.1 Created solids and confirms the relationships between properties related circles	34	66.60
23.1 Inquires into the relationships between the various angles of rectilinear plane figure	33	36.70
24.1 Inquiries into the special properties related to circles	32	71.90
25.1 Inquires into the results of a rotation that are based on symmetry	37	55.30
27.1 Compares varies movements with the basic foci	11	69.90
29.1 Inquires into numerical representative values of a group of data	12	71.70
31.1 Determines the likelihood of an event occurring by investigating the various methods of finding a suitable value	13	69.50

According to Table 3.12 the competency levels 24.1 and 29.1 have been achieved by more than 70% of students. On the other hand, competency level 11.1 (Facilitates daily work by investigating the capacity of liquid containers) has been achieved only by 26.00%. Out of the 24 competency levels tested only 11 have been achieved by more than 50% of students.

Percentage of students who achieved the competency levels related to knowledge and skills is graphically illustrated in Fig. 3.18.

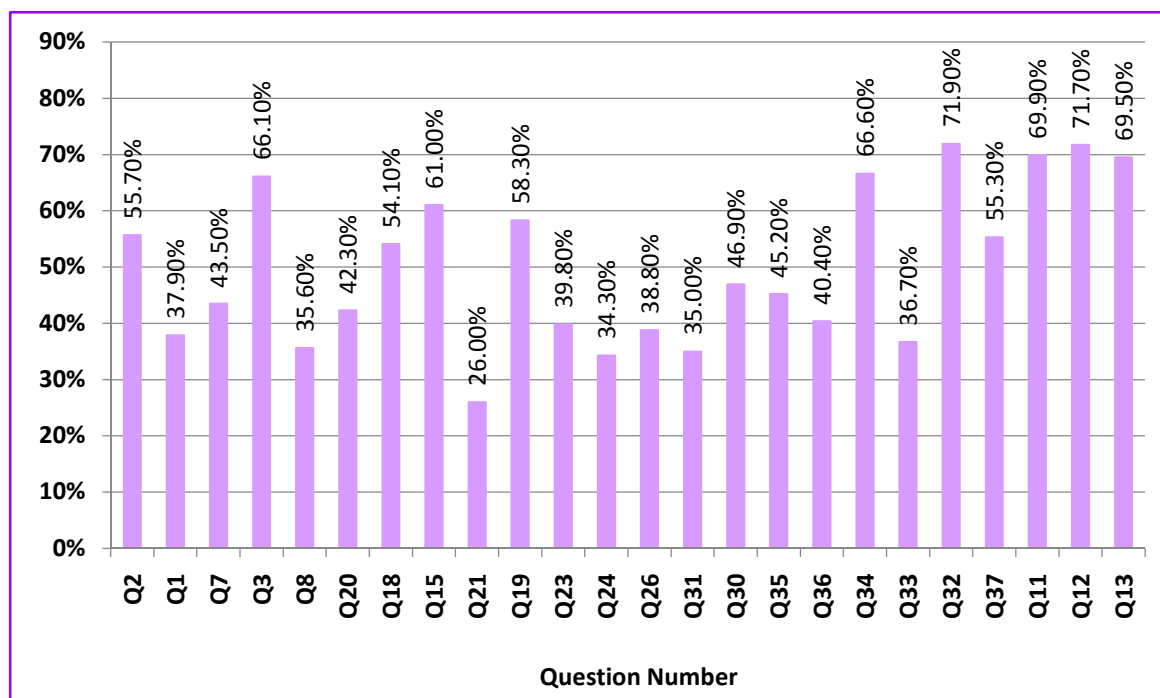


Fig. 3.18: Achievement of competency levels related to knowledge and skills

Achievement of competency levels related to communication will be assessed next.

Achievement of competency levels related to communication

Table 3.13: Achievement of competency levels related to communication

Competency level	Question No.	Percentage
3.2 Manipulates units and parts of units under division	9	27.90
3.3 Manipulates decimal numbers under the mathematical operations of multiplication and division.	4	73.10
6.2 Expands a power of a negative integer and finds the value	5	63.80
8.2 Fulfils daily needs by investigating the surface area of various solids	16	19.80
13.2 Describes various locations in the environment using scale drawings	22	66.80
14.1 Simplifies algebraic expressions by removing brackets and finds the value by substitution.	25	47.90
18.1 Uses the relationships between two quantities that can be used to enhance beauty.	28	53.60
20.1 Uses a number line to represent fractions and decimal numbers	29	40.20
26.1 Studies shapes by creating various patterns that can be used to enhance beauty.	39	62.20
30.1 Analyze the various relationships related to sets.	40	65.60

The competency level achieved by the highest percentage of students in relation to the competency communication is 3.3. That is “Manipulates decimal numbers under the mathematical operations of multiplication and division”. On the other hand the least achieved competency level is 8.2. That is “Fulfils daily needs by investigating the surface area of various solids”. Out of the ten competency levels tested only six have been achieved by more than 50% of the students in the sample.

The percentage of students who has achieved the competency levels related to communication is graphically shown in Fig. 3.19.

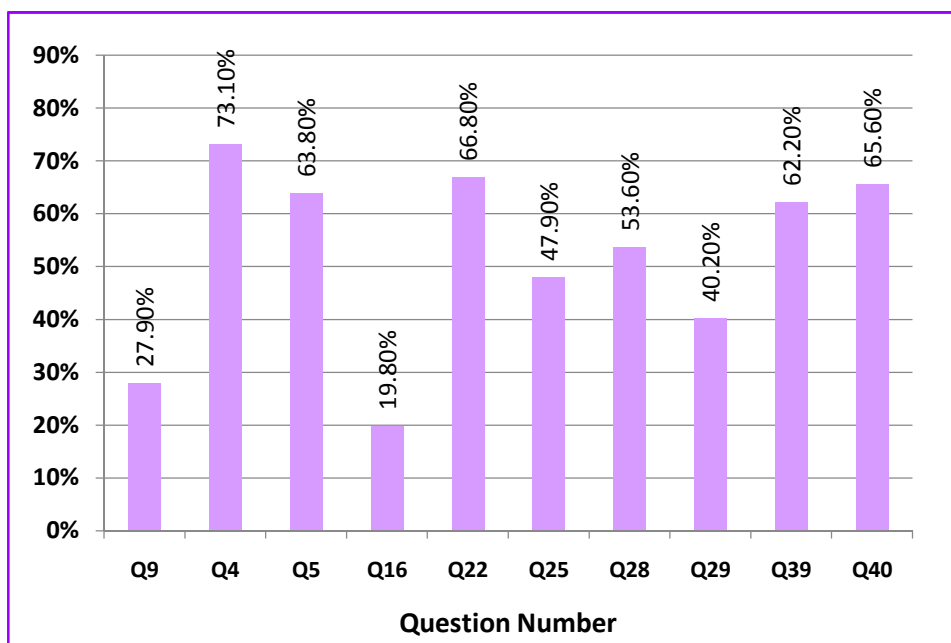


Fig. 3.19: Achievement of competency levels related to communication

Achievement of competency levels related to relationship, reasoning and problem solving will be discussed next.

Achievement of competency levels related to relationship, reasoning and problem-solving

Table 3.14: Achievement of competency levels related to relationships, reasoning and problem solving

Standard	Competency Level	Question No.	Percentage
Relationships	4.1 Uses ratios in day to day activities	6	59.50
	4.2 Solves problems constructing relationships between two ratios	10	52.20
Problem solving	8.1 Finds the area of a compound plane figure in the environment and has an awareness of the space allocated for them.	17	58.50
	17.1 Uses linear equations to solve problems	27	41.00
Reasoning	27.2 Constructs triangles	38	62.00
	28.1 Represents data such that comparison is facilitated	14	67.50

According to Table 3.14 more than 50% of the students has achieved the competency levels related to reasoning and relationships. However, the achievement of competency level 17.1 that is ‘uses linear equations to solve problems’ related to problem solving is less than 50%.

The percentage of students who has achieved the competency levels related to relationships, reasoning and problem solving is graphically shown in Fig. 3.20.

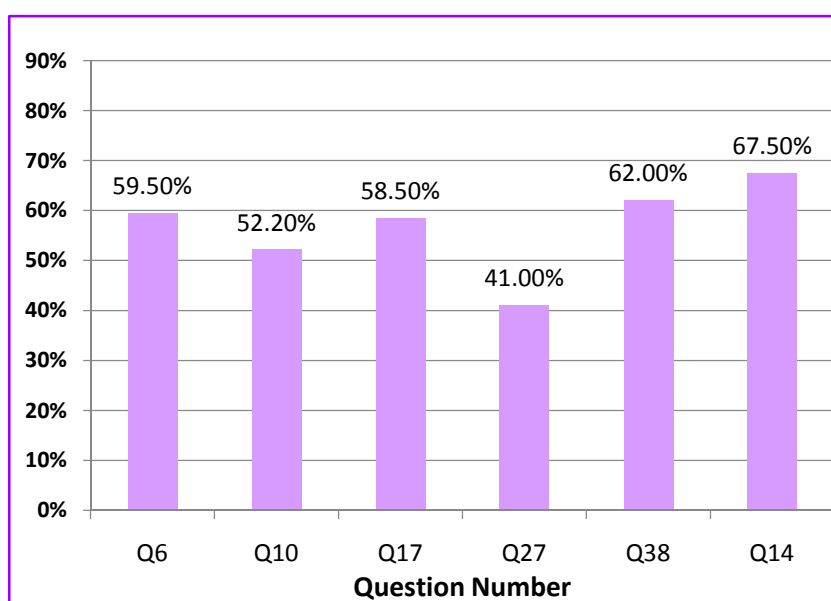


Fig. 3.20: Achievement of competency levels related to relationships, reasoning and problem solving

Part II - Comparison of achievement level of students in 2014 with that of 2016

Trends in achievement over the period 2014-2016 will first be discussed at national level.

3.9 Trends in achievement at national level

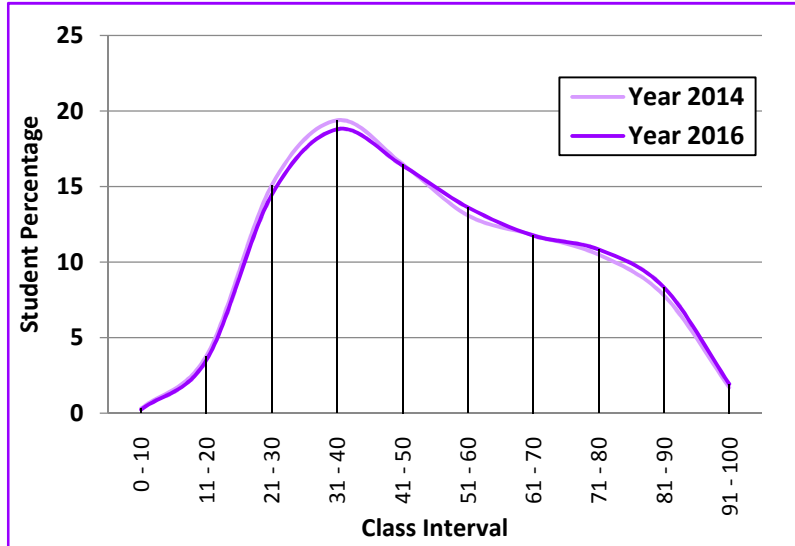


Fig. 3.21: All island achievement in mathematics comparison 2014 -2016- dispersion of marks

As Fig 3.21 indicates there is a slight improvement in students’ achievement in the year 2016. The line curve for 2016 shows that the percentage of low achievers has decreased slightly and the percentage of high achievers has slightly increased. This has resulted in an increase in the mean value from 50.87 – 51.11.

This change is further elaborated through the cumulative percentage table.

Table 3.15: Comparison of all island achievement in mathematics - cumulative percentages

Class Interval	Year 2014		Year 2016	
	Student %	Cumulative %	Student %	Cumulative %
0-10	0.30	0.30	0.25	0.25
11-20	3.80	4.10	3.53	3.78
21-30	15.10	19.20	14.47	18.25
31-40	19.40	38.60	18.80	37.05
41-50	16.50	55.10	16.40	53.45
51-60	13.10	68.20	13.64	67.09
61-70	11.80	80.00	11.77	78.86
71-80	10.50	90.50	10.85	89.71
81-90	7.80	98.30	8.34	98.05
91-100	1.70	100.00	1.94	100.00
Total	1 00		100	

The percentage of low achievers, those who have scored below 40% has decreased from 38.60% to 37.05%. On the other hand the percentage of students who has scored between 50-100 has risen from 44.9 to 46.54.

Provincial level performance has contributed to the national level achievement. The trend in provincial level achievement will be discussed next.

3.10 Provincial wise comparison of student achievement

As Fig 3.22 displays while some provinces have contributed positively to the increase in all island mean value some have contributed negatively.

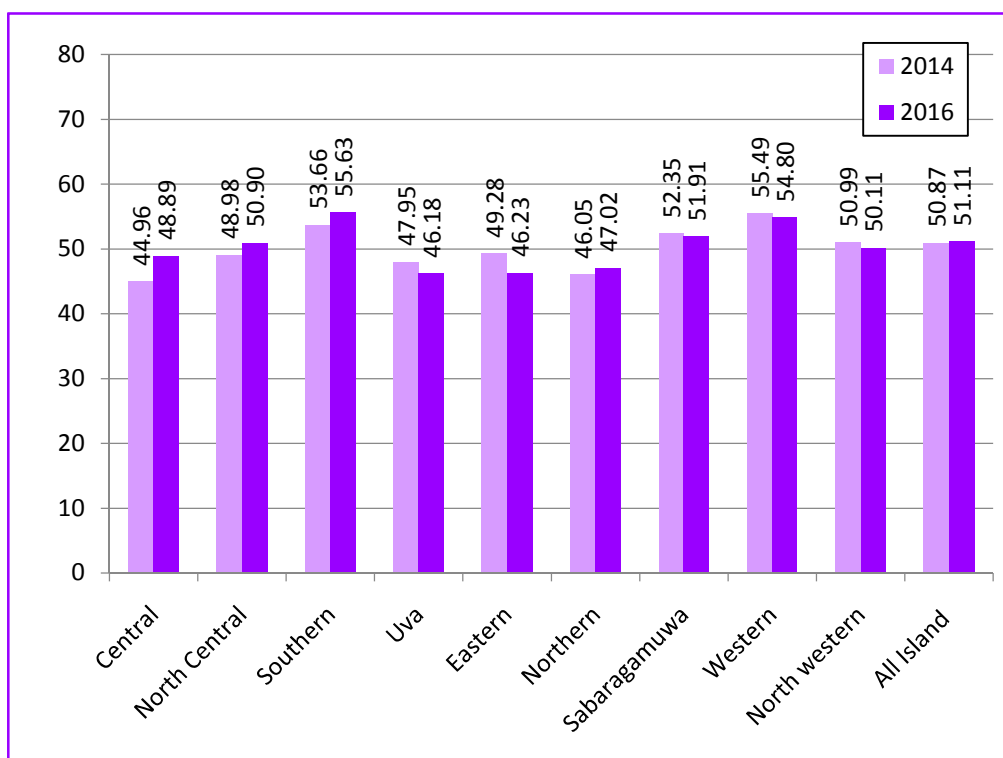


Fig. 3.22: Provincial wise comparison of student achievement - 2014 -2016

The contribution of the changes in the provincial mean values are further clarified in Table 3.16.

Table 3.16: Provincial wise comparison of student achievement – 2014 & 2016

Province	Year 2014		Year 2016		Z
	Mean	Standard Deviation	Mean	Standard Deviation	
Central	44.96	18.77	48.89	19.20	6.06**
North Central	48.98	19.17	50.90	18.99	2.87**
Southern	53.66	21.44	55.63	21.31	2.76**
Uva	47.95	18.80	46.18	18.48	-2.73**
Eastern	49.28	20.28	46.23	19.18	-4.25**
Northern	46.05	19.55	47.02	20.24	1.27
Sabaragamuwa	52.35	19.46	51.91	20.49	-0.65
Western	55.49	20.73	54.80	20.30	-1.02
North western	50.99	19.58	50.11	19.98	-1.29
All Island Mean	50.87	20.29	51.11	20.23	1.02

* Values are significant at 95%

** Values are significant at 99%

According to Table 3.16 mean values of Central, North Central and Southern have increased in 2016 and these increases are significant. On the other hand, the mean values of Uva and Eastern Provinces have decreased and these decreases are also significant. Even though, the mean value in the Northern Province has increased it is not significant. At the same time, Sabaragamuwa, Western and North Western records declines in mean values. Yet, they are also not significant.

Fig: 3.23 depicts the line curves denoting the performance of each province.

As the line curve for the Central Province illustrates the percentage of high achievers in the range of 50-90 has increased.

Similarly, the North Central and Southern Provinces curves also show an increase in high performances. These increases have positively impacted on the mean values of these provinces. As Table 3.16 indicates these changes are significant.

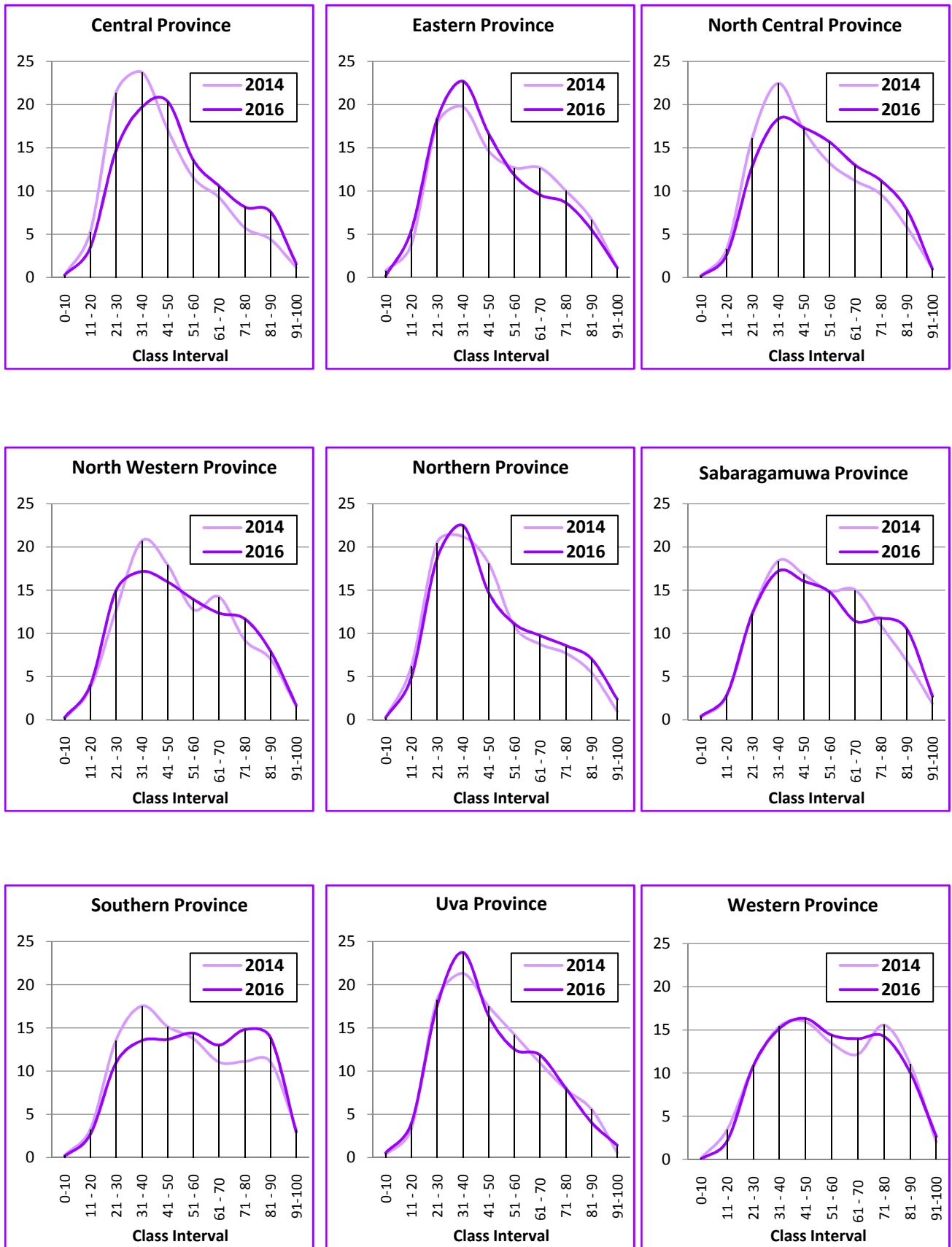


Fig. 3.23: Comparison of provincial wise distribution of marks – Mathematics

3.11 Comparison of marks according to school type

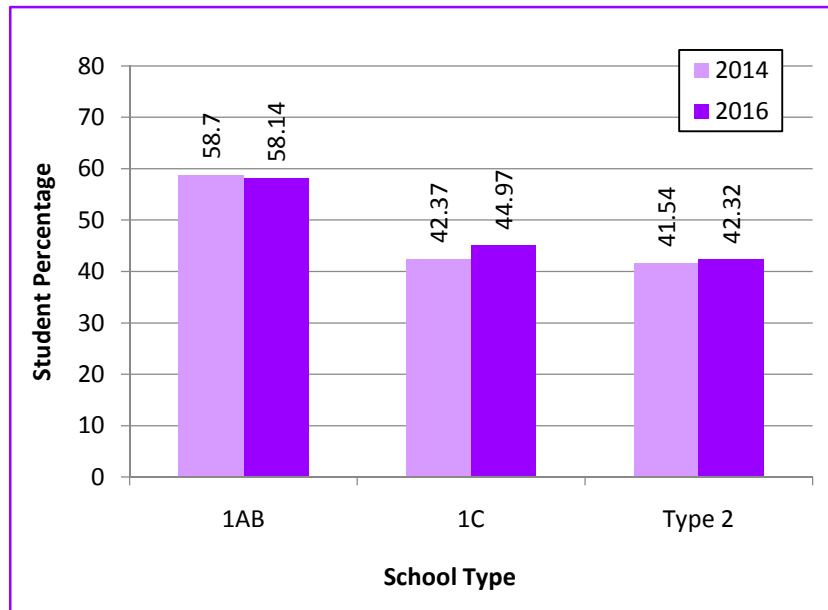


Fig. 3.24: All island comparison of mean values according to school type

As the bar graphs indicate there is a slight decrease in achievement in 1AB schools while there is a slight increase in 1C and Type 2 schools. This increase in 1C and Type 2 schools is a positive sign.

Table 3.17: Comparison of mathematics achievement according to school type

School Type	Year 2014		Year 2016		Z
	Mean	Standard Deviation	Mean	Standard Deviation	
1AB	58.70	20.01	58.14	20.55	-1.75*
1C	42.37	16.42	44.97	17.45	7.21**
Type 2	41.54	17.08	42.32	16.65	1.65*
All Island	50.87	20.29	51.11	20.23	1.02

* Values are significant at 95%

** Values are significant at 99%

According to Table 3.17 the decrease in the 1AB schools mean value is significant. At the same time the increase in 1C and Type 2 schools is also significant.

The trend in achievement gender wise will be discussed next.

3.12 Comparison of marks according to gender

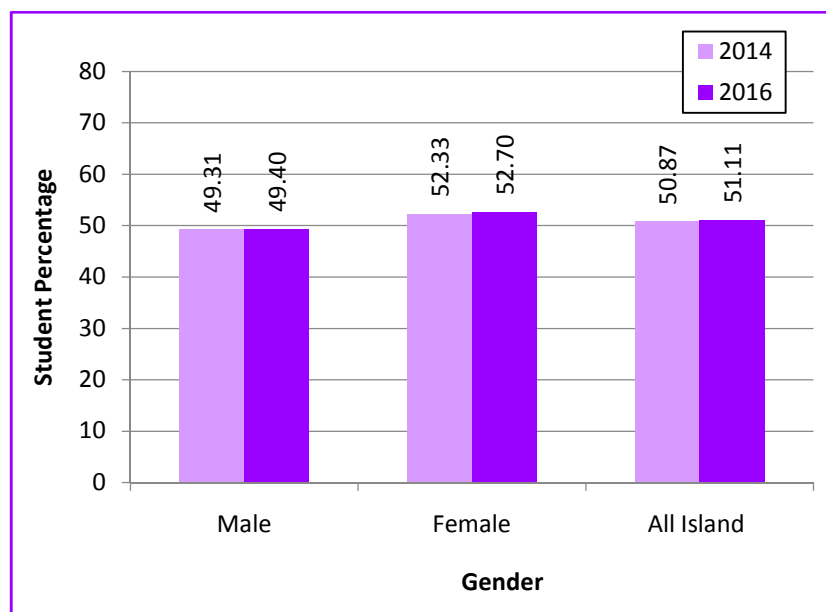


Fig. 3.25: All island comparison of mean values according to gender

As Fig. 3.25 indicates there are slight increases in both male and female performances.

However, according to Table 3.18 these changes are not significant.

Table 3.18: Comparison of mathematics achievement according to gender

Student Gender	Year 2014		Year 2016		Z
	Mean	Standard Deviation	Mean	Standard Deviation	
Male	49.31	20.30	49.40	20.61	0.27
Female	52.33	20.17	52.70	19.74	1.15
All Island	50.87	20.29	51.11	20.23	1.02

3.13 Comparison of marks according to medium of instruction

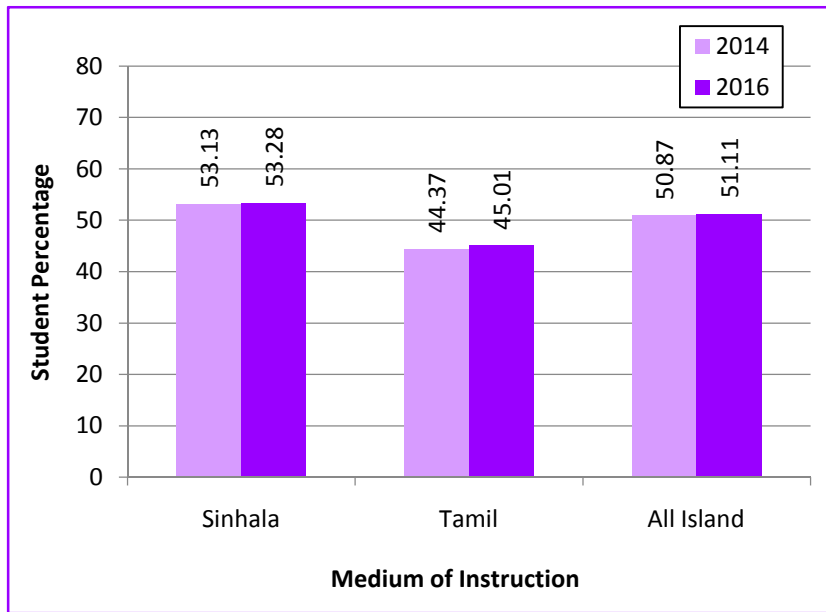


Fig. 3.26: All island comparison of mean values according medium of instruction

There is a very slight improvement in the performance of both Sinhala medium as well as Tamil medium students' performance (Fig. 3.26). However, as Table 3.19 indicates these changes are insignificant.

Table 3.19: Comparison of mathematics achievement according to medium of instruction

Medium of Instruction	Year 2014		Year 2016		Z
	Mean	Standard Deviation	Mean	Standard Deviation	
Sinhala	53.13	20.34	53.28	20.33	0.54
Tamil	44.37	18.69	45.01	18.66	1.59
All Island	50.87	20.29	51.11	20.23	1.02

3.14 Comparison of marks according to location

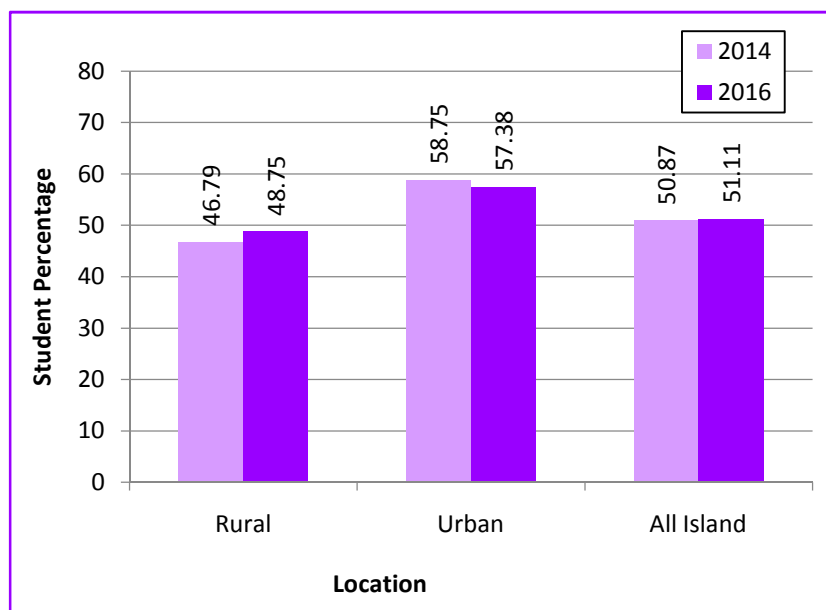


Fig. 3.27: All island comparison of mean values according to location

The urban students' performance has decreased by one point. On the other hand, the rural students' performance has increased by 2 points. According to Table 3.20 this change is significant.

Table 3.20: Comparison of mathematics achievement according to location

Location	Year 2014		Year 2016		Z
	Mean	Standard Deviation	Mean	Standard Deviation	
Rural	46.79	18.65	48.75	19.27	7.67**
Urban	58.75	21.01	57.38	21.36	-2.87*
All Island	50.87	20.29	51.11	20.23	1.02

Increase in rural students' performance is a positive feature even though the urban rural gap in achievement continues.

Trends in performance according to the sub skills in mathematics will be discussed next.

3.15 Comparison of students' achievement in relation to ELCs

Table 3.21: Comparison of achievement of competency levels related to knowledge and skills

Competency Level	Question Numbers	Percentage		Change
		2014	2016	
1.1 Inquires into the relationships between the whole numbers.	Q2	56.50	55.70	-0.80
1.2 Manipulates directed numbers under the basic mathematical operations	Q1	38.80	37.90	-0.90
2.1 Builds relationships between the terms of number patterns by investigating various properties	Q7	44.30	43.50	-0.80
3.1 Manipulates units and parts under multiplication	Q3	66.70	66.10	-0.60
5.1 Develops the relationship between fractions, ratios and percentages	Q8	34.90	35.60	+0.70
7.1 Satisfies various requirements by investigating the perimeter of rectilinear plane figures	Q20	38.80	42.30	+3.50
9.1 Facilitates daily work by investigating large masses	Q18	51.30	54.10	+2.80
10.1 Determines for daily needs, the space that is taken up by various solids	Q15	59.90	61.00	+1.10
11.1 Facilitates daily work by investigating the capacity of liquid containers	Q21	25.40	26.00	+0.60
12.1 Investigates the rotation of earth and inquires into its results	Q19	58.30	58.30	+0.00
12.2 Investigates the difference in time between countries and finds their relative positions	Q23	39.00	39.80	+0.80
13.1 Indicates the direction of a location using angles	Q24	34.10	34.30	+0.20
15.1 Factorizes algebraic expressions	Q26	38.00	38.80	+0.80
20.2 Illustrates the behavior of a variable pictorially	Q31	35.10	35.00	-0.10
20.3 Represents location on a Cartesian Plane	Q30	46.50	46.90	+0.40
21.1 Examines the angles made by various straight lines	Q35	45.10	45.20	+0.10
21.2 Performs calculations using the relationships between various angles	Q36	40.00	40.40	+0.40
22.1 Created solids and confirms the relationships between properties related circles	Q34	63.70	66.60	+2.90

Competency Level	Question Numbers	Percentage		Change
		2014	2016	
23.1 Inquires into the relationships between the various angles of rectilinear plane figure	Q33	35.50	36.70	+1.20
24.1 Inquiries into the special properties related to circles	Q32	72.00	71.90	-0.10
25.1 Inquires into the results of a rotation that are based on symmetry	Q37	52.90	55.30	+2.40
27.1 Compares varies movements with the basic foci	Q11	69.00	69.90	+0.90
29.1 Inquires into numerical representative values of a group of data	Q12	72.30	71.70	-0.60
31.1 Determines the likelihood of an event occurring by investigating the various methods of finding a suitable value	Q13	67.60	69.50	+1.90

Considering the Table 3.21 there is not much change in the achievement of skills between 2014 -2016. In 2014 only 11 competencies have been achieved by more than 50% of students. In 2016 also the same 11 competencies have been achieved by more than 50% of students.

Table 3.22: Comparison of achievement of competency levels related communication

Competency Level	Question Numbers	Percentage		Change
		2014	2016	
3.2 Manipulates units and parts of units under division	Q9	27.90	27.90	No Change
3.3 Manipulates decimal numbers under the mathematical operations of multiplication and division.	Q4	72.50	73.10	+0.60
6.2 Expands a power of a negative integer and finds the value	Q5	65.60	63.80	-1.80
8.2 Fulfils daily needs by investigating the surface area of various solids	Q16	18.50	19.80	+1.30
13.2 Describes various locations in the environment using scale drawings	Q22	65.60	66.80	+1.20
14.1 Simplifies algebraic expressions by removing brackets and finds the value by substitution.	Q25	48.30	47.90	-0.40
18.1 Uses the relationships between two quantities that can be used to enhance beauty.	Q28	52.50	53.60	+1.10

Competency Level	Question Numbers	Percentage		Change
		2014	2016	
20.1 Uses a number line to represent fractions and decimal numbers	Q29	36.80	40.20	+3.40
26.1 Studies shapes by creating various patterns that can be used to enhance beauty.	Q39	59.40	62.20	+2.80
30.1 Analyze the various relationships related to sets.	Q40	64.60	65.60	+1.00

In relation to the competency communication, in 2014 only six competencies have been achieved by more than 50% of students. In 2016 also only the same six competencies have been achieved by more than 50% of students.

Table 3.23: Comparison of achievement of competency levels related relationships, reasoning and problem solving

Standard	Competency Level	Question Numbers	Percentage		Change
			2014	2016	
Relationships	4.1 Uses ratios in day to day activities	Q6	59.20	59.50	+0.30
	4.2 Solves problems constructing relationships between two ratios	Q10	50.00	52.20	+2.20
Problem solving	8.1 Finds the area of a compound plane figure in the environment and has an awareness of the space allocated for them.	Q17	57.30	58.50	+1.20
	17.1 Uses linear equations to solve problems	Q27	39.60	41.00	+1.40
Reasoning	27.2 Constructs triangles	Q38	63.20	62.00	-1.20
	28.1 Represents data such that comparison is facilitated	Q14	68.30	67.50	-0.80

According to Table 3.23 in 2014 students have achieved more than 50% in all competencies except competency 17.1. In 2016 there has been a slight improvement in the achievement of the sub skill.

3.16 Summary

Part I of this chapter described student performance in relation to the achievement of learning outcomes in the mathematics. The discussion pertained to both national and provincial level. Further, achievement was analyzed according to school type, gender, medium of instruction and location.

Test items used to assess students' performance were analyzed to assess how far they have been successful in achieving sub skills of the language expected to be achieved by grade 8 pupils.

Part II described the trends in achievement between 2014-2016.

It could be concluded that even though overall the achievement of learning outcomes in the mathematics is satisfactory there is still disparity in achievement provincial wise as well as location and gender wise.

Although there is a slight improvement in achievement between 2014-2016 overall achievement of competencies is not satisfactory. The achievement of competency levels that were unsatisfactory in 2014 has not improved in 2016.