Patterns and Trends in Achievement: Science 2016

4.1   Introduction

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

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 science

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

4.2   Patterns of achievement at national level
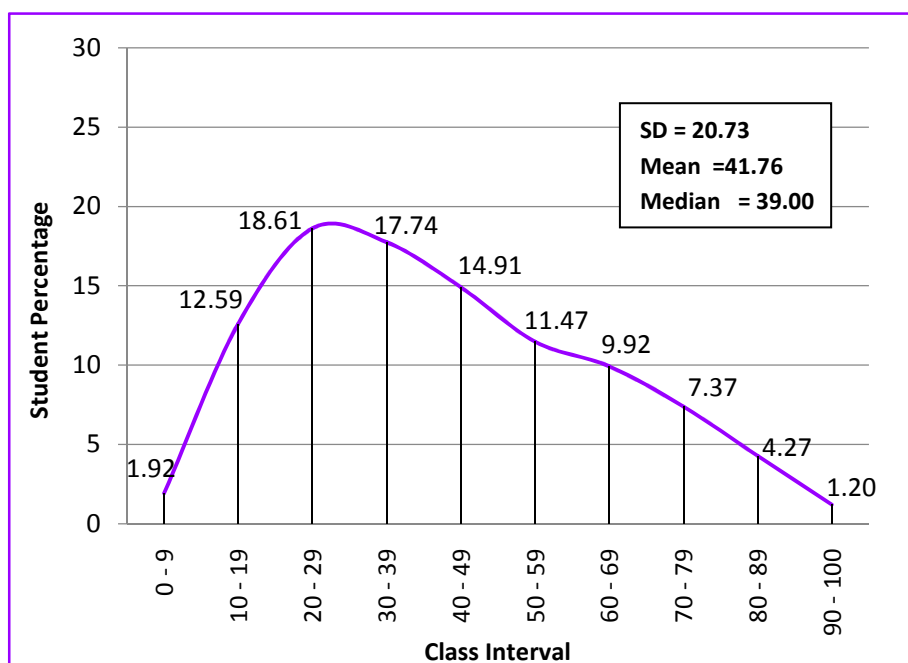
Fig. 4.1: All island achievement in science 2016 – dispersion of marks

The frequency polygon shown in Fig. 4.1 outlines the total picture of the distribution of marks of grade 8 students in science.

Fig. 4.1 depicts a positively skewed distribution of marks displaying that majority of the students has scored low marks in science. The distribution of marks is further clarified in Table 4.1.

Table 4.1: All island achievement in science 2016– cumulative percentages

Class Interval	Student %	Cumulative %
0 - 9	1.92	1.92
10 - 19	12.59	14.51
20 - 29	18.61	33.12
30 - 39	17.74	50.86
40 - 49	14.91	65.77
50 - 59	11.47	77.24
60 - 69	9.92	87.16
70 - 79	7.37	94.53
80 - 89	4.27	98.80
90 - 100	1.20	100.00
Total	100.00	

According to Table 4.1 the highest percent of students (18.61%) has scored between 20-29 marks. Further, 50.86% of students has scored below 40 marks. Fig. 4.2 illustrates student achievement patterns further.

As Fig. 4.2, the box plot displays average marks (mean) is 41.76. On the other hand the median of the achievement is 39. As the average value is above the median, more than 50% of the students has achieved values above the average value.
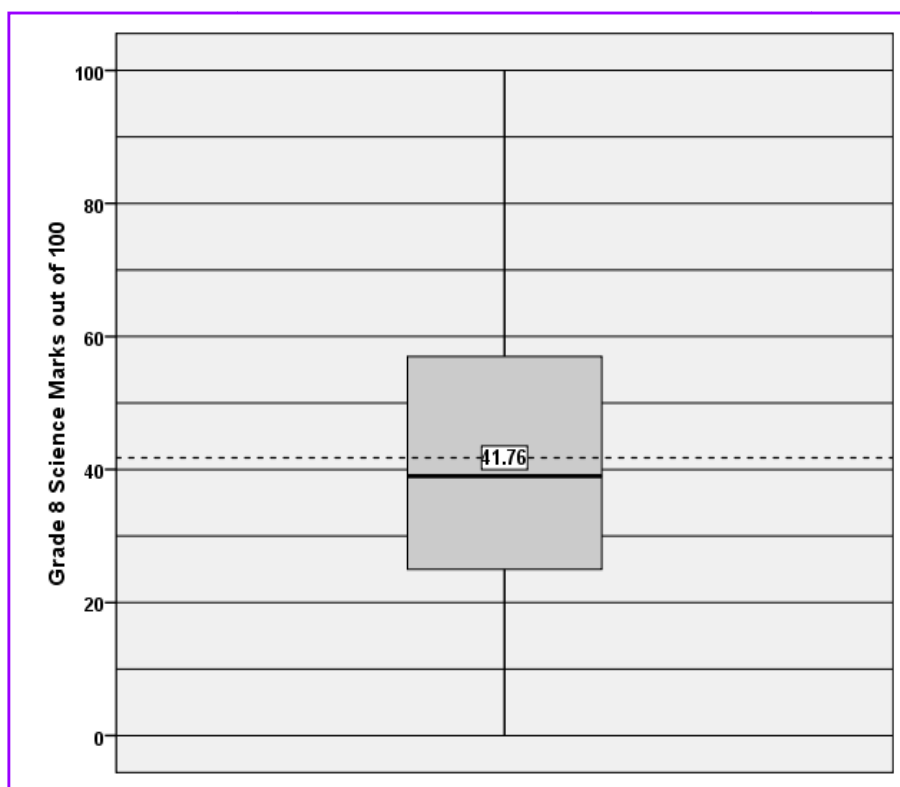
Fig. 4.2: Box plot and whisker chart representing all island science achievement

Summary of national level achievement

- National level mean is 41.76, while the median is 39.00.
- Disparity in achievement prevails with approximately 50.86% of students scoring below 40. However, the highest number of students (18.61%) has scored between the marks range of 20-29.

Provincial wise student achievement will be discussed next.

4.3   Provincial wise student achievement

The nature of the distribution of scores provincial wise reveals certain patterns. These patterns are discussed based on Table 4.2.

Table 4.2: Provincial achievement in science 2016 – Summary statistics

Province	Mean	Rank	Std. Error of Mean	Std. Deviation	Skewness	Percentile 25	Median	Percentile 75
Southern	46.51	1	0.11	22.45	0.22	27.00	45.00	64.00
Western	45.42	2	0.08	21.03	0.25	28.00	43.00	62.00
Sabaragamuwa	43.38	3	0.11	19.96	0.37	28.00	41.00	57.00
North Western	42.89	4	0.11	21.28	0.40	25.00	40.00	60.00
North Central	40.97	5	0.13	19.16	0.49	26.00	38.00	54.00
Central	39.21	6	0.09	18.88	0.70	24.00	36.00	50.00
Uva	37.57	7	0.12	18.85	0.64	23.00	34.00	50.00
Eastern	35.57	8	0.11	19.63	0.70	20.00	31.00	48.00
Northern	34.34	9	0.13	19.05	0.83	20.00	30.00	45.00
All Island	41.76		0.04	20.73	0.46	25.00	39.00	56.00

As Table 4.2 indicates based on provincial wise mean achievement Southern Province ranks first. Western Province is ranked second with only a slightly lower mean value.

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

As can be seen in Fig. 4.3 the median values of all the provinces are below that of their mean values. Therefore, 50% of the students has achieved above the mean value in each province.
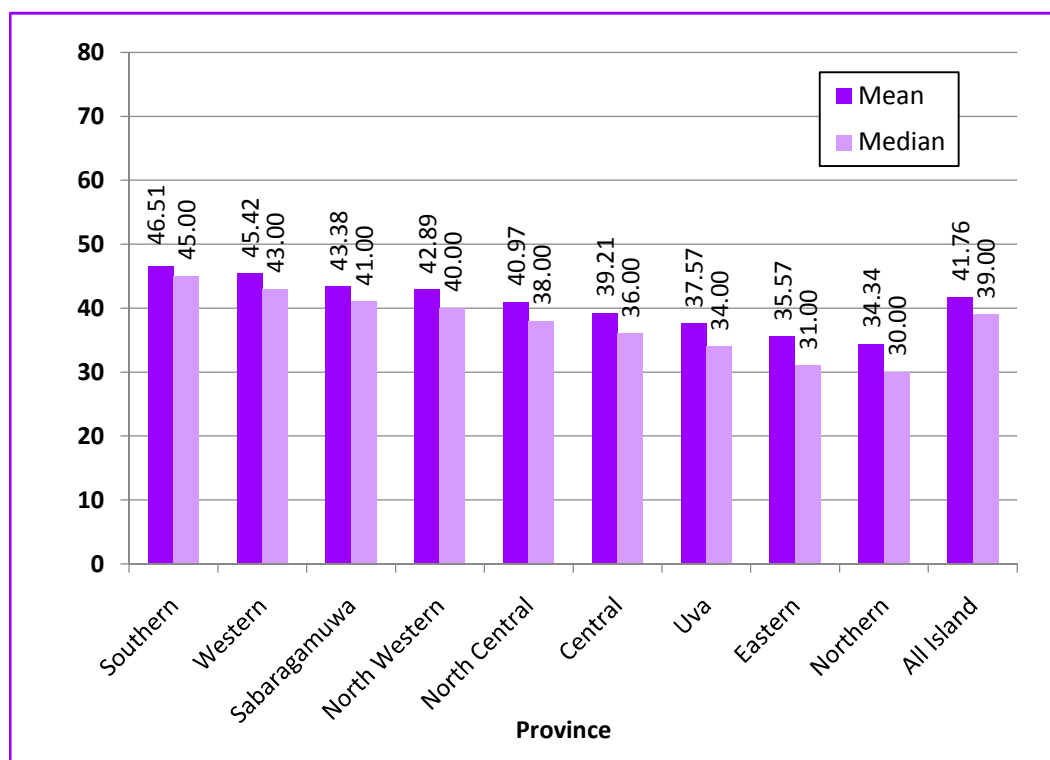
Fig. 4.3: Bar chart to represent mean and median among the provinces - Science

Disparity in achievement among provinces

According to Table 4.2, 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 both Southern and Western Provinces are higher than the all island SD value indicating that there is variation in achievement in these provinces. All the other provinces have SD values lower than the all island SD.

All the provinces have obtained positive skewed values. This indicates that student performance is low. 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.

These disparities are further highlighted through the line curves for each province given in Fig. 4.4.
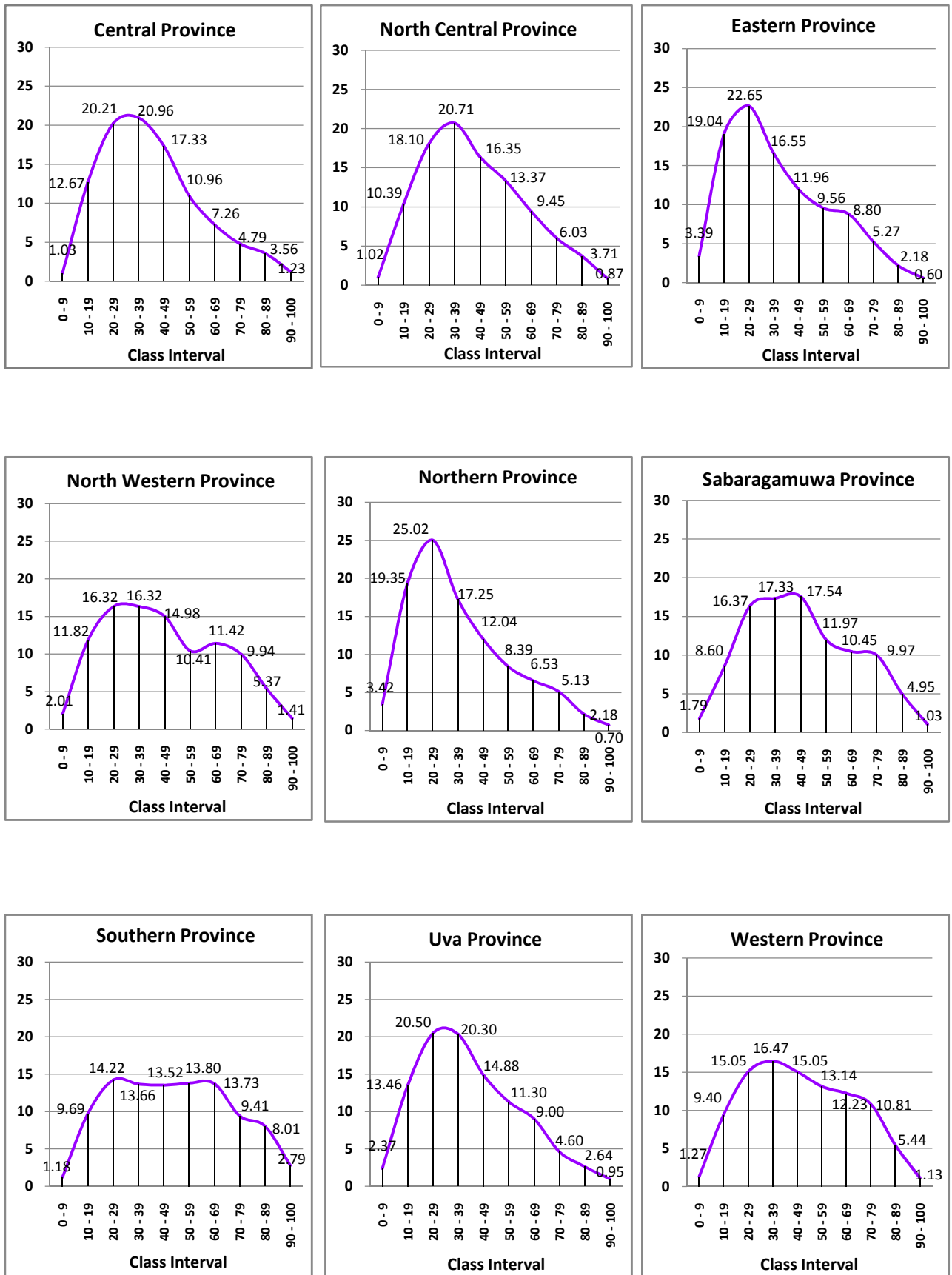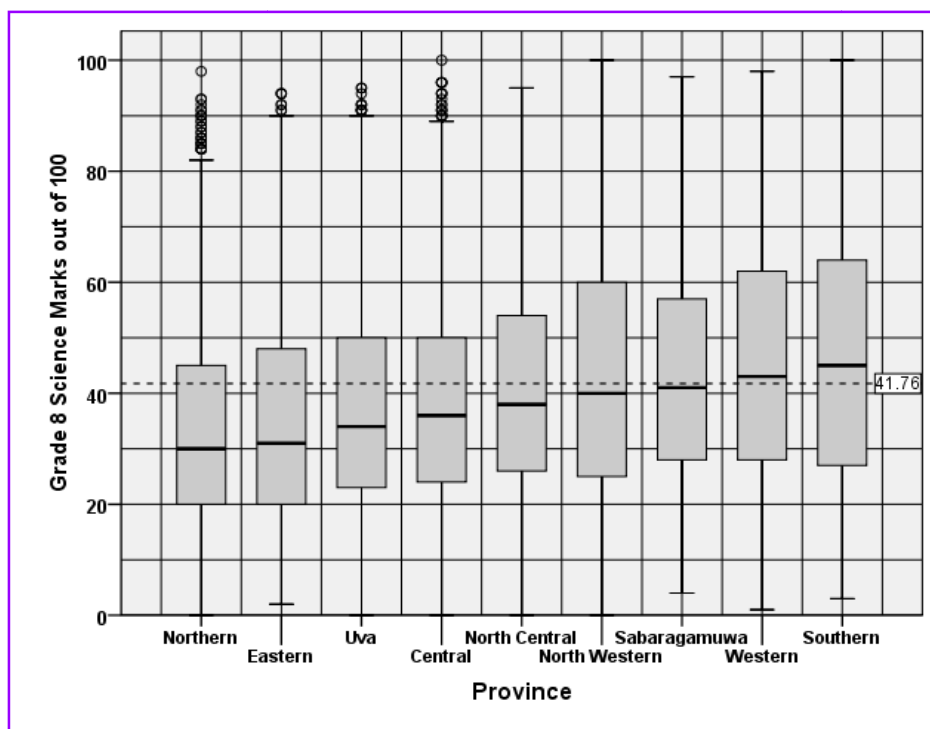
Fig. 4.4: Provincial wise distribution of marks -science

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

Fig. 4.5:   Box plot and whisker chart representing provincial wise science achievement

According to the above chart there are two provinces (Uva and Central) 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. An interesting feature in the achievement of the provinces is that there are outliers in all the low performing provinces.

Table 4.3: Percentage of student scoring 50 or above, and below 50 – Science

Province	Greater than or Equal to50	Less than 50
Central	27.81	72.19
Eastern	26.41	73.59
North Central	33.43	66.57
North Western	38.55	61.45
Northern	22.92	77.08
Sabaragamuwa	38.38	61.62
Southern	47.74	52.26
Uva	28.48	71.52
Western	42.76	57.24
All Island	34.23	65.77

Summary of provincial level analysis

- Achievement wise the provinces fall into three categories.

  Category 1 - Southern, Western, Sabaragamuwa and North Western with mean scores above the national mean (41.76)

  Category 2 – North Central and Central Provinces cluster in the middle

  Category 3 – Uva, Eastern and Northern Provinces

4.4   Achievement levels by type of school

Table 4.4: Science achievement according to school type

School Type	Mean	Std. Error of Mean	Std. Deviation	Skewness	Percentile 25	Median	Percentile 75	F	Sig.
1AB	48.63	0.05	21.62	0.12	31.00	48.00	66.00		
1C	36.00	0.05	17.51	0.60	22.00	33.00	47.00	20741.49	0.000
Type 2	33.33	0.07	16.94	0.78	20.00	30.00	43.00		
All Island	41.76	0.04	20.73	0.46	25.00	39.00	56.00		

As Table 4.4 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. 4.6
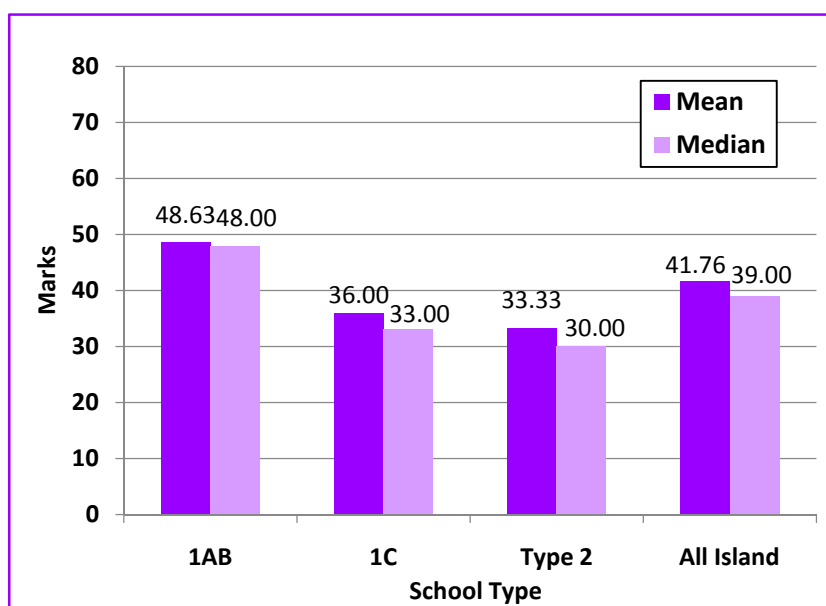
Fig. 4.6: Bar chart representing the mean and median values according to school types- Science

The performance of the school types is further highlighted when the median scores are considered in Table 4.4 and Fig. 4.6. All school types have achieved median values below the mean value for the science achievement. This means that fifty percent of students in all school types have obtained scores above their respective mean value.

Disparity in achievement

As Table 4.4 indicates the SD in 1AB schools is high. It is higher than the all island SD. Thus the deviation of marks in these schools is high. On the other hand, in Type 2 and 1C schools SD is below the all island mean.

All school types have obtained positive skewed values. It reveals that in these types there are higher number of students who 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 greater variation in achievement in these schools.

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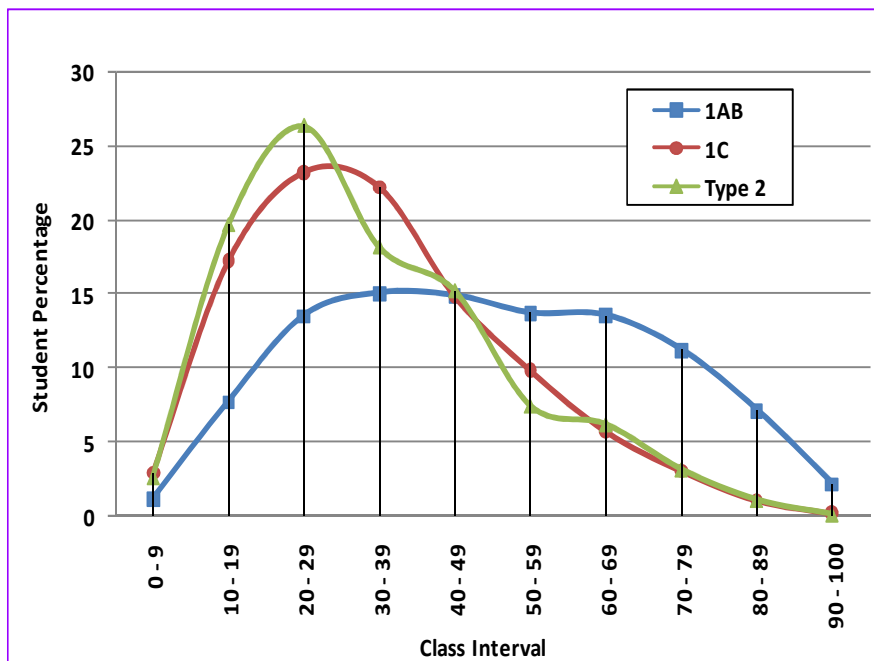

Fig. 4.7: Dispersion of marks by school type–Science

Fig. 4.7 displays that 1C and Type 2 school curves are quite similar. They are positively skewed and the majority of the students' marks fall between the class intervals 30-39 and 20-29. On the other hand in 1AB schools the peak spreads over different class intervals. It shows both high and low achiever groups. However, the low achiever group is slightly higher.

The spread of marks at different class intervals is further illustrated in the cumulative percentage Table 4.5.

Table 4.5: Cumulative student percentages according to school type- science

Class Interval	1AB		1C		Type 2	
	Student %	Cumulative %	Student %	Cumulative %	Student %	Cumulative %
0 – 9	1.14	1.14	2.88	2.88	2.62	2.62
10 – 19	7.71	8.85	17.21	20.09	19.67	22.30
20 – 29	13.51	22.36	23.23	43.32	26.37	48.67
30 – 39	15.04	37.40	22.22	65.53	18.17	66.84
40 - 49	14.86	52.26	14.82	80.35	15.22	82.06
50 - 59	13.69	65.95	9.81	90.16	7.45	89.51
60 - 69	13.53	79.48	5.68	95.85	6.18	95.69
70 - 79	11.21	90.69	3.01	98.86	3.14	98.83
80 - 89	7.14	97.83	1.01	99.87	1.08	99.91
90 - 100	2.17	100.00	0.13	100.00	0.09	100.00
Total	100.00		100.00		100.00	

In the 1AB school type high percentage of students has scored between 20-79. On the other hand in both Type 2 and 1C schools the highest percentage of students fall between the class intervals 10-49.

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

This is further illustrated through the box plot.
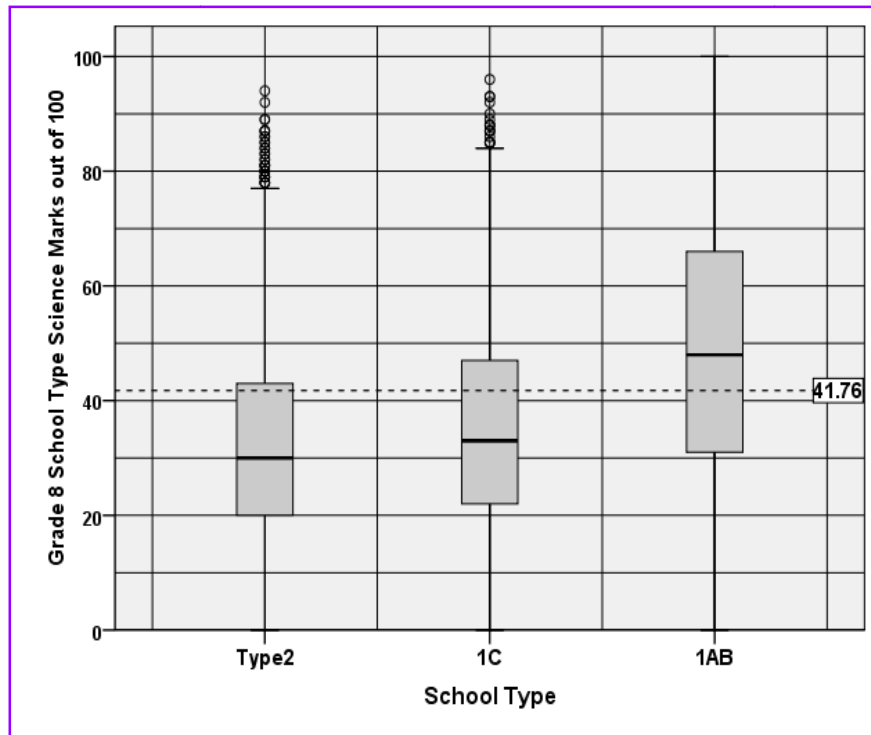
Fig. 4.8: Science marks according to school types using box plot and whisker plot

The box plots of the 1C and Type 2 schools are quite similar. This indicates that their performances are similar. However, in 1C type 25th and 75th percentiles are higher than in Type 2 schools indicating their performance is higher than that of Type 2. 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 science 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.

4.5   Achievement levels by gender

Table 4.6: Science achievement according to gender

Gender	Mean	Std. Error of Mean	Std. Deviation	Skewness	Percentile 25	Median	Percentile 75	F	Sig.
Male	39.48	0.05	21.22	0.58	23.00	36.00	54.00		
Female	43.86	0.05	20.03	0.38	28.00	41.00	59.00	3793.34	0.000
All Island	41.76	0.04	20.73	0.46	25.00	39.00	56.00		

There is a difference in the achievement of females over males. As Table 4.6 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. 4.9.
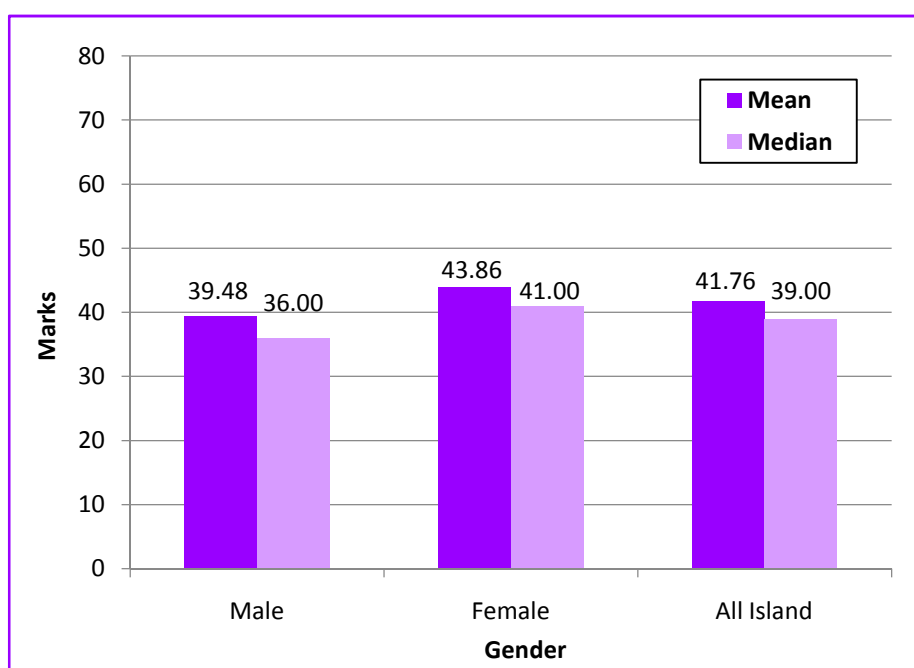
Fig. 4.9: Bar chart representing mean and median values according to gender –Science

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 4.6). On the other hand, the female SD value is closer to the all island value. Fig. 4.9 also indicates that both among males and females the

median value is below the mean. This indicates that more than 50% of the students has scored above the average mark.

Fig. 4.10 graphically illustrates the dispersion of marks according to gender.
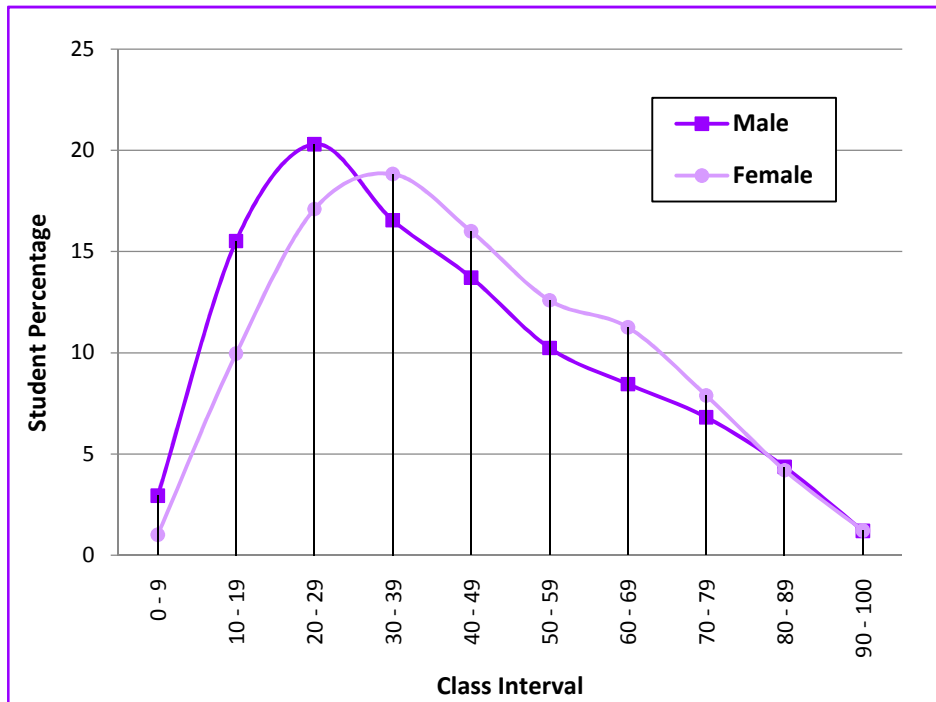
Fig. 4.10: Dispersion of marks by gender – Science

Fig. 4.10 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. While the peak of the male curve is at 20-29 class interval, the female curve then rises above the male curve and its peak is at 30-39 class interval. Finally, both curves become similar again.

The disparity in the students' achievement can be elaborated better through the cumulative percentages Table 4.7.

Table 4.7: Cumulative student percentages according to the gender –Science

Class Interval	Male		Female	
	Student %	Cumulative %	Student %	Cumulative %
0 – 9	2.93	2.93	1.00	1.00
10 – 19	15.51	18.44	9.95	10.95
20 – 29	20.29	38.74	17.09	28.05
30 – 39	16.54	55.27	18.83	46.87
40 - 49	13.71	68.98	16.00	62.87
50 - 59	10.23	79.21	12.59	75.46
60 - 69	8.44	87.65	11.25	86.71
70 - 79	6.80	94.45	7.89	94.60
80 - 89	4.35	98.81	4.19	98.79
90 - 100	1.19	100.00	1.21	100.00
Total	100.00		100.00	

According to Table 4.7 and Fig. 4.10 it could be concluded that among both females and males, there are low performing students. The highest percentage (18.83%)of female students' marks fall into the class interval 30-39. The highest percentage of male students' marks, even a higher percentage (20.29%) falls into the class interval 20-29. This indicates that the low performing boys' percentage is higher than that of the low performing girls.

While there are 46.87 cumulative percent of female students who has scored below 40 marks, there are 55.27cumulative percent of male students who has scored less than 40 marks. Therefore, the heterogeneity in achievement in science of the boys is greater than the girls.

Box plot and whisker for gender wise science achievement shows similarities that has been discussed already.
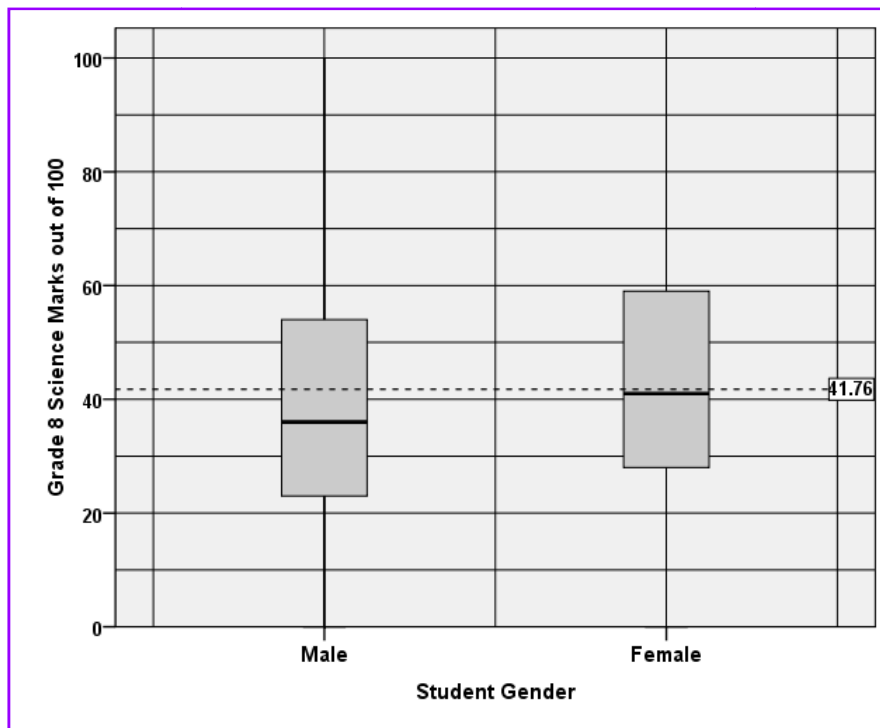
Fig. 4.11: Box plot and whisker plot representing gender wise science marks

Box plot and whisker chart shows that male students' 25th and 50th percentile is lower than the female mark range as well as the all island range.

Summary

- Female performance is better than all island and male performance.
- While 46.87 % of girls has scored below 40, the male percentage is 55.27.

4.6   Achievement levels by medium of instruction

Table 4.8: Science 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	44.54	0.04	20.83	0.35	28.00	42.00	60.00	17676.27	0.000
Tamil	34.05	0.06	18.36	0.77	20.00	30.00	45.00		
All Island	41.76	0.04	20.73	0.46	25.00	39.00	56.00		

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. 4.12.
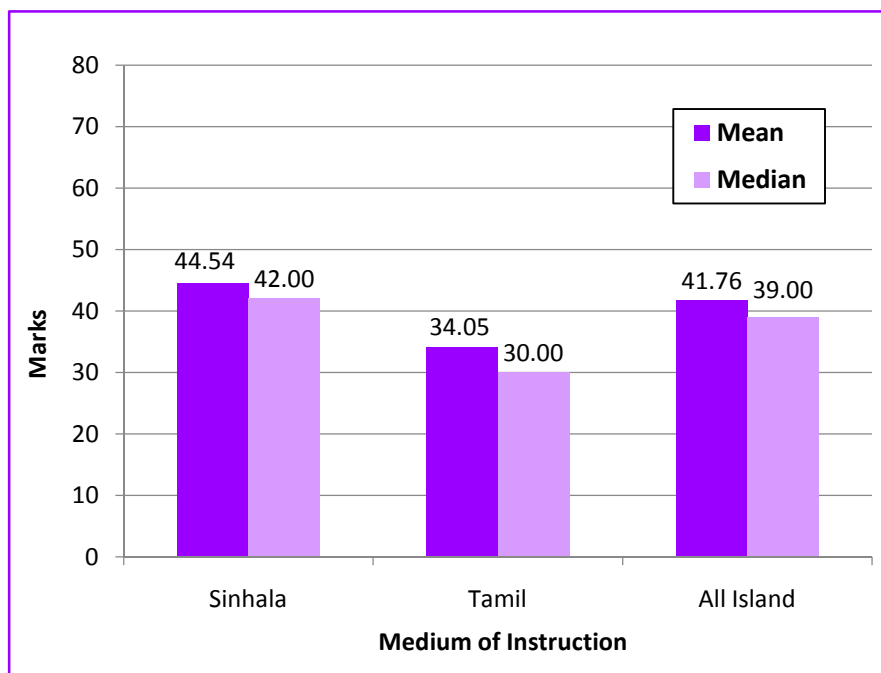
Fig. 4.12: Bar chart representing mean and median values according to medium of instruction - Science

As Table 4.8 indicates Sinhala medium students SD is higher than the Tamil medium students SD. Thus there is greater variation in their performance. However, it is closer to the national SD.

The diversity in achievement scores among the students taught through the different medium of instruction, is further highlighted through the frequency distribution graphs.
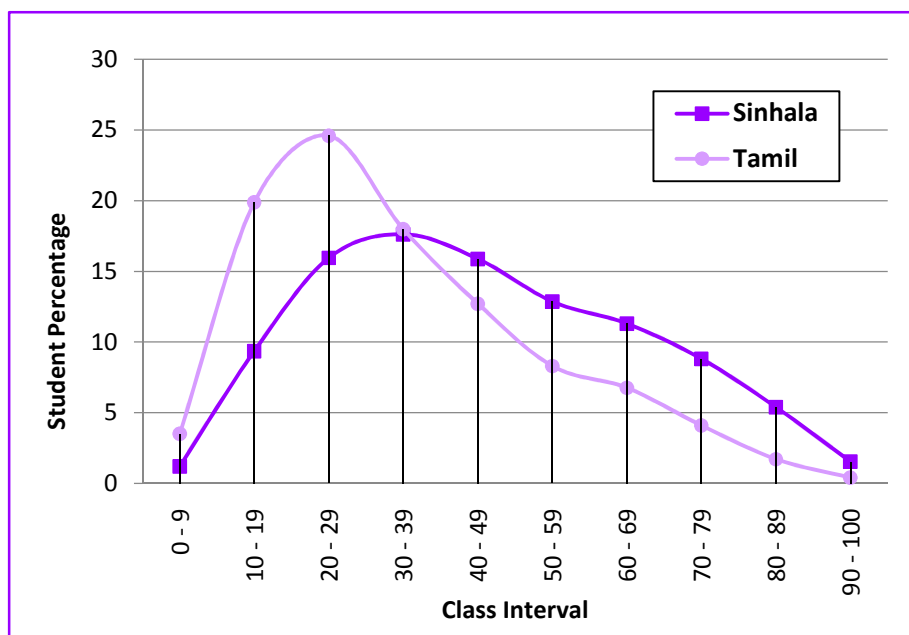
Fig. 4.13: Dispersion of marks by medium of instruction – Science

The two curves on Fig. 4.13 shows two different patterns. While both curves are positively skewed, the Sinhala medium curve is more evenly spread.While the Tamil medium students marks peak at the class interval 20-29, Sinhala medium students marks peak at the 30-39 class interval. Among the Sinhala medium students there are both low achievers as well as high achievers. However, the low achievers are slightly more. This pattern can be explained thorugh Table 4.9.

Table 4.9: Cumulative student percentages according to medium of instruction –Science

Class Interval	Sinhala		Tamil	
	Student %	Cumulative %	Student %	Cumulative %
0 – 9	1.21	1.21	3.51	3.51
10 – 19	9.36	10.58	19.89	23.40
20 – 29	15.96	26.54	24.60	48.00
30 – 39	17.63	44.17	17.99	65.99
40 - 49	15.88	60.05	12.71	78.70
50 - 59	12.87	72.92	8.30	87.01
60 - 69	11.31	84.23	6.77	93.77
70 - 79	8.82	93.05	4.10	97.87
80 - 89	5.40	98.45	1.72	99.59
90 - 100	1.55	100.00	0.41	100.00
Total	100.00		100.00	

As Table 4.9 indicates the highest percentage of the Sinhala medium students' marks is in the range of 30-39. On the other hand, the highest percentage of Tamil medium students marks concentrate between 20-29.

Considering the pass mark as 40, 44.17% of Sinhala medium students has scored below the pass mark. On the other hand 65.99% 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.
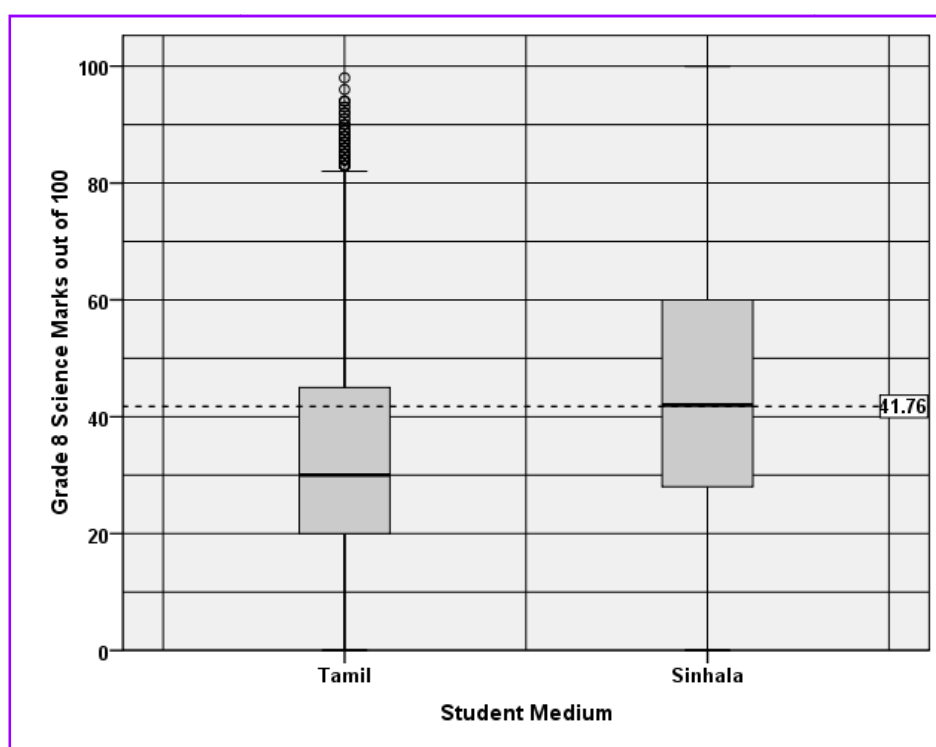
Fig. 4.14: Science marks according to medium of instruction using box plot and whisker plot

Box plot and whisker plot chart shows high differences among both media. Sinhala medium dispersion of marks in the box plot is more than the Tamil medium students' dispersion of marks. Sinhala medium student's 25th, 50th and 75th percentile values are higher than that of the Tamil medium students.

However, there are outliers among the Tamil medium students. Therefore, this confirms that there is disparity between the performance in science 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 closer to 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.

4.7   Achievement levels by location

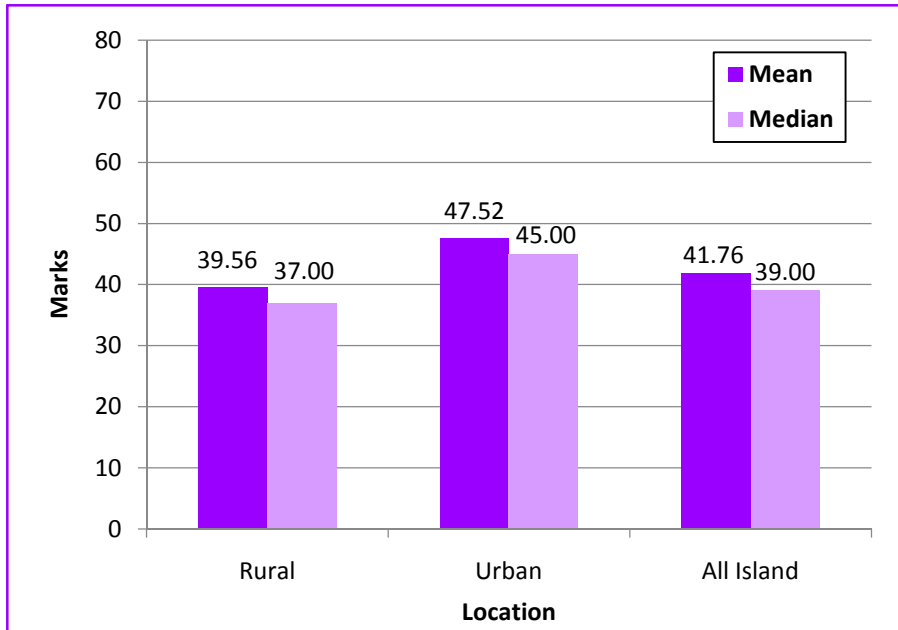**Table 4.10: Science achievement according to location**

Location	Mean	Std. Error of Mean	Std. Deviation	Skewness	Percentile 25	Median	Percentile 75	F	Sig.
Rural	39.56	0.04	19.71	0.52	24.00	37.00	53.00	10210.54	0.000
Urban	47.52	0.07	22.17	0.23	29.00	45.00	66.00		
All Island	41.76	0.04	20.73	0.46	25.00	39.00	56.00		

As Table 4.10 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 4.10 the SD also differs in the two localities. 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.
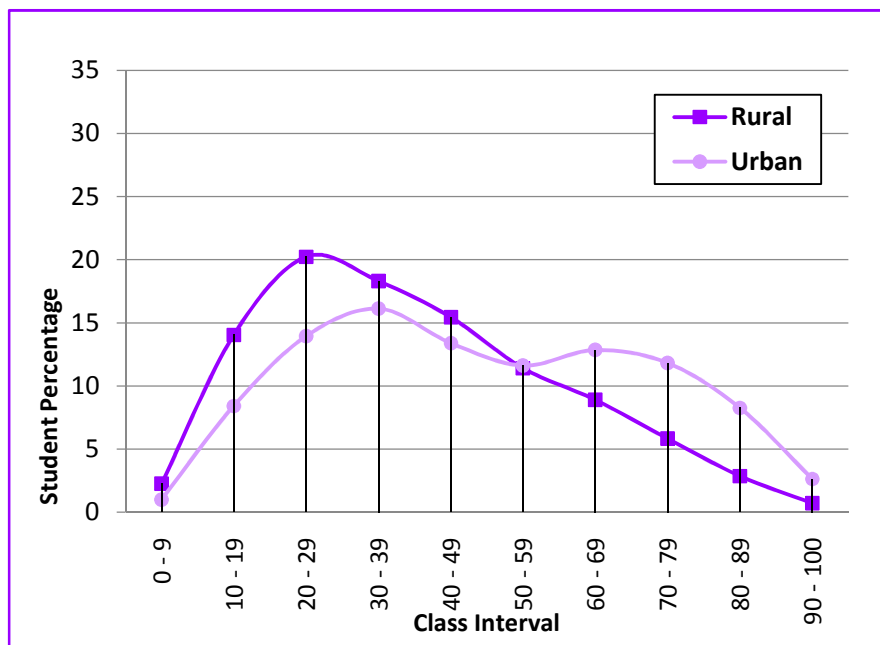
The difference in mean and median values is graphically shown in Fig. 4.15

As Fig. 4.15 indicates in both locations the median value is lower than the mean value.

Fig. 4.15: Bar chart representing mean and median values according to location– Science

Students' achievement is further elaborated through the frequency distribution graphs in Fig. 4.16.

Fig. 4.16: Dispersion of marks by location – Science

Fig. 4.16 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 bimodal. This difference can be explained using the cumulative percentage Table 4.11.

Table 4.11: Cumulative student percentages according to the location –Science

Class Interval	Rural		Urban	
	Student %	Cumulative %	Student %	Cumulative %
0 – 9	2.25	2.25	0.97	0.97
10 – 19	14.05	16.30	8.42	9.39
20 – 29	20.25	36.55	13.94	23.33
30 – 39	18.31	54.86	16.12	39.44
40 - 49	15.44	70.30	13.39	52.83
50 - 59	11.42	81.72	11.60	64.44
60 - 69	8.89	90.62	12.84	77.28
70 - 79	5.82	96.43	11.81	89.09
80 - 89	2.87	99.30	8.27	97.36
90 - 100	0.70	100.00	2.64	100.00
Total	100.00		100.00	

According to Table 4.11 the highest percentage of students in urban area schools (16.12%) falls into the class interval 30-39. This is the peak of the urban area school curve. However, there is another 12.84% of students falling into the class interval 60-69. On the other hand, in the rural area schools the highest percentage of students falls in to the class interval 20-29 and the percentage is 20.25. Those who have scored between 60-69 are only 8.89%.

The spread of marks is further illustrated through the box plot graph.
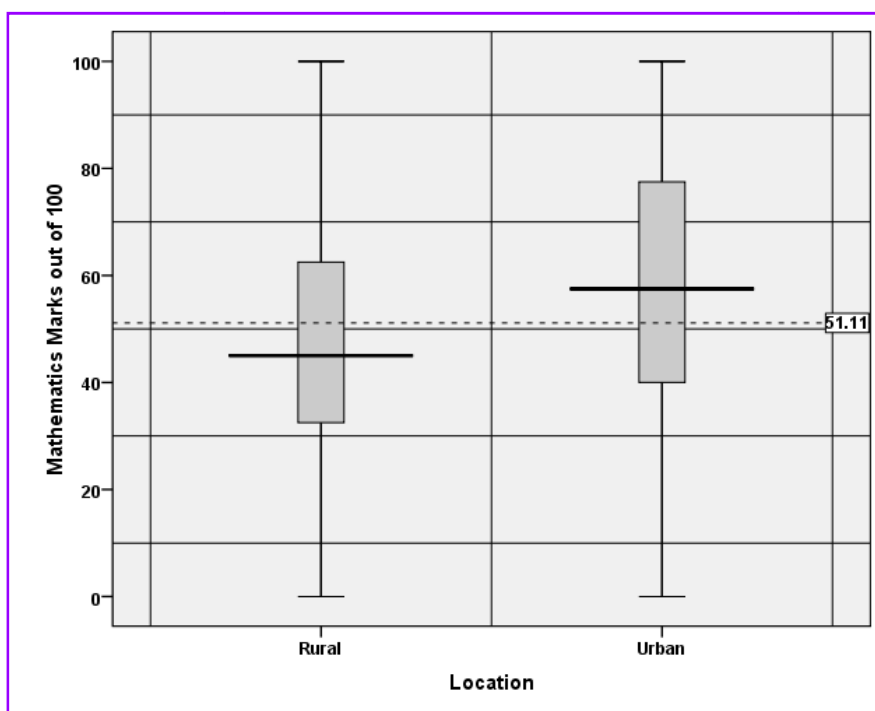
Fig. 4.17: Box plot and whisker plot representing location wise science marks

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 performances 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.
- Achievement patterns observed in relation to the achievement in science, revealed that there are variations among provinces, school type, gender and medium wise.

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

4.8   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 science paper was based on four main content areas – biology, chemistry, earth science and physics.

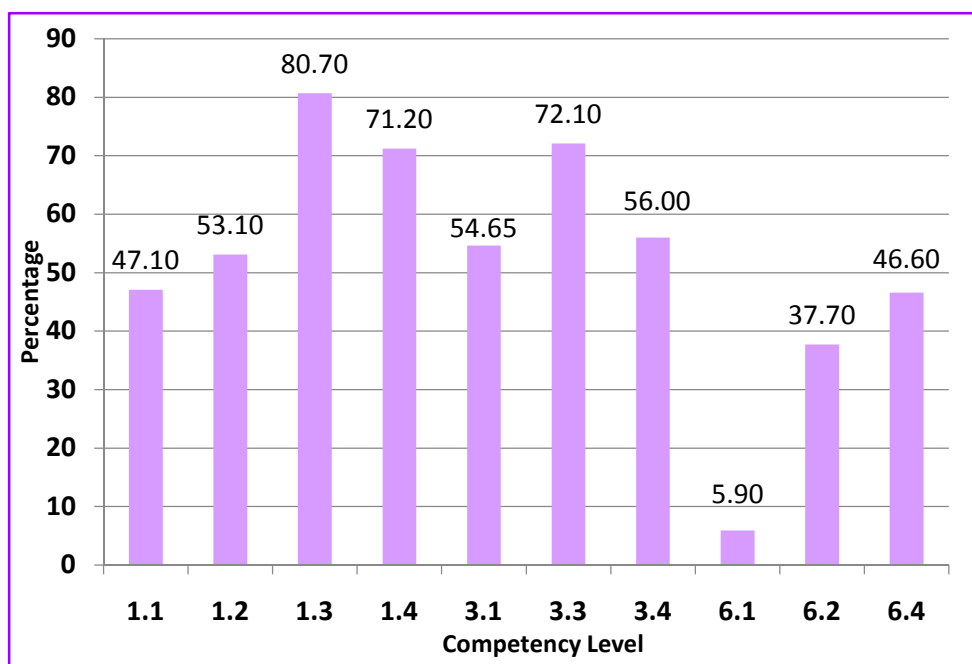**Achievement of competencies related to biology**

The percentage of students who has answered correctly the questions related to each competency level under biology is given in Table 4.12.

Table 4.12: Achievement of competency levels related to biology

Content	Competency Level	Percentage
Biology	1.1 Discovers the diversity of the natural environments	47.10
	1.2 Investigates the advantages/disadvantages of the built environments	53.10
	1.3 Focuses attention on the venomous animals that are harmful to man	80.70
	1.4 Acquires the ability to use international scientific symbols	71.20
	3.1 Observes the interactions based on life cycles	54.65
	3.3 Explains the importance of use of cultivations under specific conditions	72.10
	3.4 Investigates the biotic factors affecting the perpetuation of the environment.	56.00
	6.1 Conducts explorations to identify the morphological diversity of leaves	5.90
	6.3 Investigates the functions related to the diversity of roots.	37.70
	6.4 Uses plant related products with a scientific attitude	46.60

As Table 4.12 indicates the highest achievement recorded is in relation to competency 1.3. On the other hand, the lowest achievement recorded is in relation to competency 6.1. Out of the 10 competencies tested 50% or more students has been able to achieve only six competencies.

The achievement of competencies is further elaborated in Fig. 4.18.

Fig. 4.18: Achievement of competency levels related to biology

Achievement of competency levels related to chemistry will be discussed next.
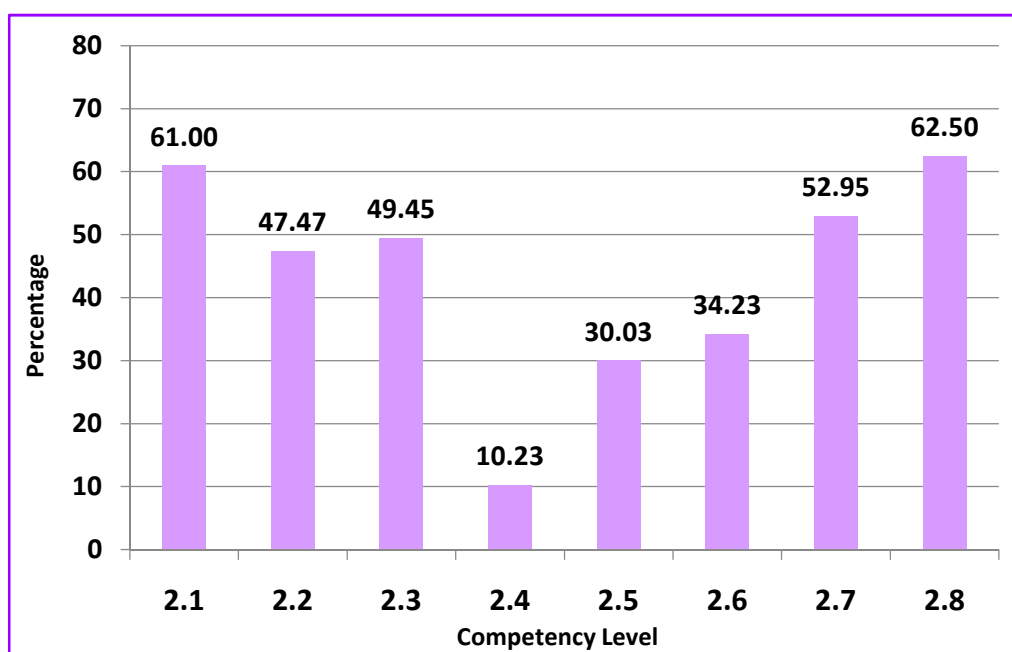
Achievement of competencies related to chemistry

Table 4.13: Achievement of competency levels related to chemistry

Content	Competency Level	Percentage
Chemistry	2.1 Inquires into the properties of matter	61.00
	2.2 Inquires into the standard symbols used for elements	47.47
	2.3 Display the ability to use the differences in density of substances in day today life.	49.45
	2.4 Uses the expansion of solids, liquids and gases in day today life effectively.	10.23
	2.5 Inquires into the usages of compounds according to their properties.	30. 03
	2.6 Inquires into the domestic uses of chemicals	34.23
	2.7 Uses parallel and serial connections of electrical appliances in human needs.	52.95
	2.8 Uses magnets in day to day life	62.50

According to Table 4.13 the competency levels 2.8 that is "uses magnets in day to day life" is the competency level achieved by the highest percentage of students (62.50). On the other hand, competency level 2.4 (Uses the expansion of solids, liquids and gases in day to day life) is the least achieved competency (10.23%.). Out of the 8 competency levels tested only 3 have been achieved by more than 50% of students.

Percentage of students who achieved the competency levels related to chemistry is graphically illustrated in Fig. 4.19.

Fig. 4.19: Achievement of competency levels related to chemistry

Achievement of competencies related to earth science

Table 4.14: Achievement of competency levels related to earth science

Content	Competency Level	Percentage
Earth science	4.1 Investigates the constituents of the atmosphere	48.39
	4.2 Acts to maintain optimum composition of the atmosphere	37.83
	4.3 Uses natural resources obtained from the earth effectively	54.94

According to Table 4.14 only the competency level 4.3 "uses natural resource obtained from the earth effectively" has been achieved by more than 50% of students. The least

achieved competency is 4.2 which is "acts to maintain optimum composition from the earth".

The achievement of the competency levels is graphically illustrated in Fig. 4.20.
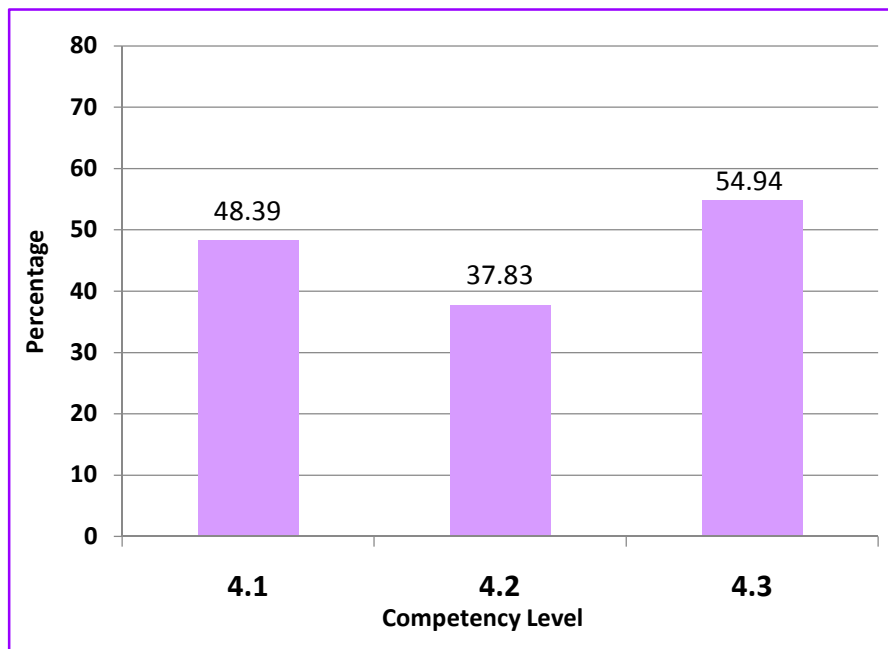

Fig. 4.20: Achievement of competency levels related to earth science

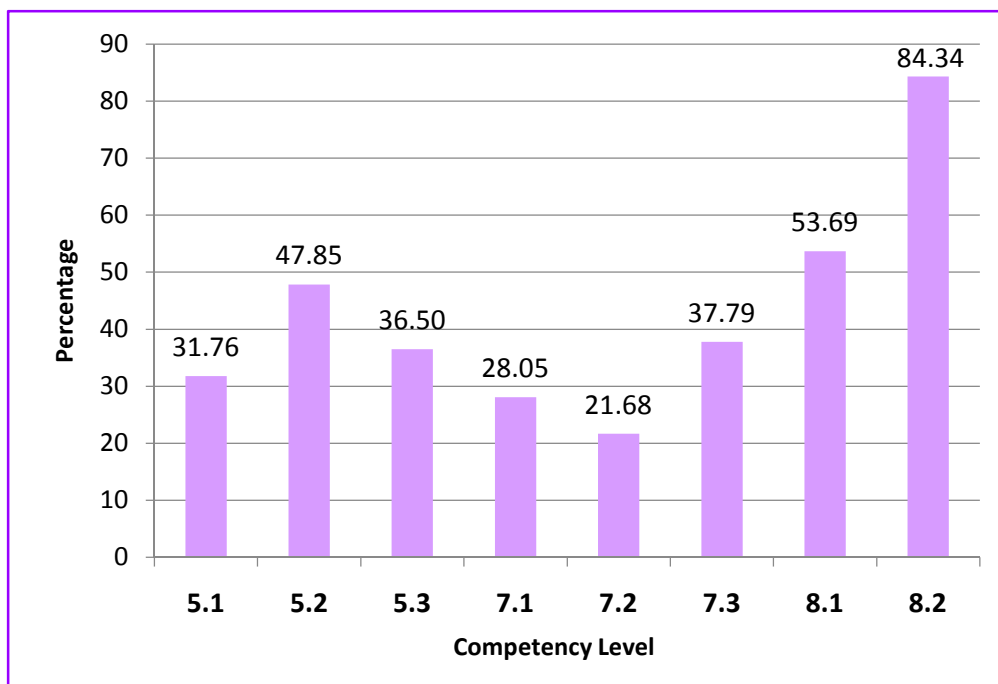## Achievement of competencies related to physics

Table 4.15: Achievement of competency levels related to physics

Content	Competency Level	Percentage
Physics	5.1 Inquires into the application of the concept "pressure" in day to day needs	31.76
	5.2 Inquires into the effect of Center of Gravity on the equilibrium of an object in relation to life experiences	47.85
	5.3 Uses work, energy and power in human concerns/needs	36.50
	7.1 Uses properties of light in human needs	28.05
	7.2 Uses generation and propagation of sound in musical instruments	21.68
	7.3 Explores the scientific basis of modern communication equipment	37.79
	8.1 Contribute to minimize the risks associated with cyclones	53.69
	8.2 Contribute to minimize the risks associated with lightning and thunder	84.34

According to Table 4.15 majority of the students (84.34%) has been able to achieve competency level 8.2 which is "contributes to minimize the risks associated with

lightning and thundering". On the other hand, only 2.68% of students has been able to achieve competency level 7.2 which is "uses generation and propagation of sound in musical instruments".

The achievement of competency levels is graphically shown in Fig. 4.21

Fig. 4.21: Achievement of competency levels related to physics

As Fig. 4.21 indicates only two competencies out of 8 has been achieved by more than 50% of students.

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.

4.9   Trends in achievement at national level
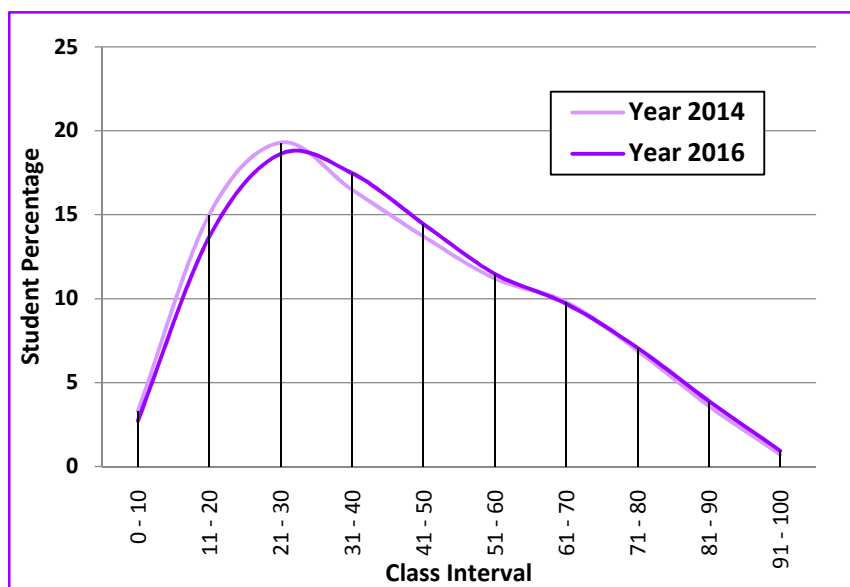
Fig. 4.22: All island achievement in science comparison 2014 -2016– dispersion of marks

As Fig 4.21 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 and the percentage of medium level achievers has increased. This has resulted in an increase in the mean value from 41.16 to 41.76. However, the percentage of high achievers has not changed.

The differences in the two curves is further elaborated through the cumulative percentage table.

Table 4.16: Comparison of all island achievement in science - cumulative percentages

Class Interval	Year 2014		Year 2016	
	Student %	Cumulative %	Student %	Cumulative %
0-10	3.29	3.29	2.71	2.71
11-20	15.01	18.30	13.68	16.40
21 - 30	19.30	37.60	18.63	35.02
31 - 40	16.49	54.09	17.48	52.50
41 - 50	13.71	67.80	14.45	66.96
51 - 60	11.20	79.00	11.48	78.43
61 - 70	9.80	88.80	9.69	88.12
71 - 80	6.90	95.70	7.07	95.19
81 - 90	3.60	99.30	3.89	99.08
91-100	0.70	100.00	0.92	100.00
Total	100.00		100.00	

The percentage of low achievers, those who have scored below 40% has decreased from 54.09% to 52.5. On the other hand the percentage of students who has scored between 40-60 has risen from 24.91 to 26.0.

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

4.10 Provincial wise comparison of student achievement

As Fig 4.23 displays while some provinces have contributed positively to the increase in all island mean value some have contributed negatively.
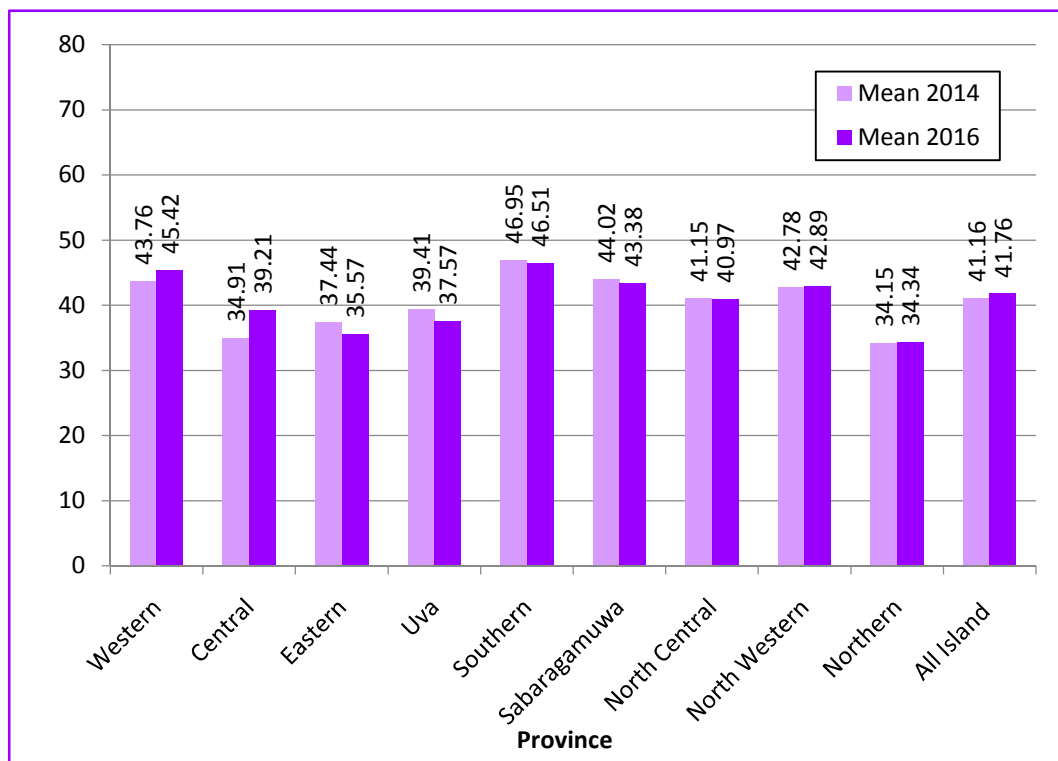

Fig. 4.23: Provincial wise comparison of student achievement - 2014 -2016

The contribution of the changes in the provincial mean values is further clarified in Table 4.17.

Table 4.17: Provincial wise comparison of student achievement – 2014 & 2016

Province	Year 2014		Year 2016		Z
	Mean	Standard Deviation	Mean	Standard Deviation	
Western	43.76	22.08	45.42	21.03	2.34**
Central	34.91	18.96	39.21	18.88	6.66**
Eastern	37.44	19.64	35.57	19.63	-2.62**
Uva	39.41	19.31	37.57	18.85	-2.77**
Southern	46.95	22.58	46.51	22.45	-0.58
Sabaragamuwa	44.02	19.97	43.38	19.96	-0.96
North Central	41.15	19.44	40.97	19.16	-0.27
North Western	42.78	20.09	42.89	21.28	0.15
Northern	34.15	18.78	34.34	19.05	0.26
All Island Mean	41.16	20.92	41.76	20.73	2.49**

* Values are significant at 95%   ** Values are significant at 99%

According to Table 4.17 mean values of Western and Central Provinces 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. The changes in performance of other provinces are not significant.

Fig. 4.24 depicts the line curves denoting the performance of each province.

As can be seen from the line curves of Western and Central Provinces there is a shift from low marks towards high marks.
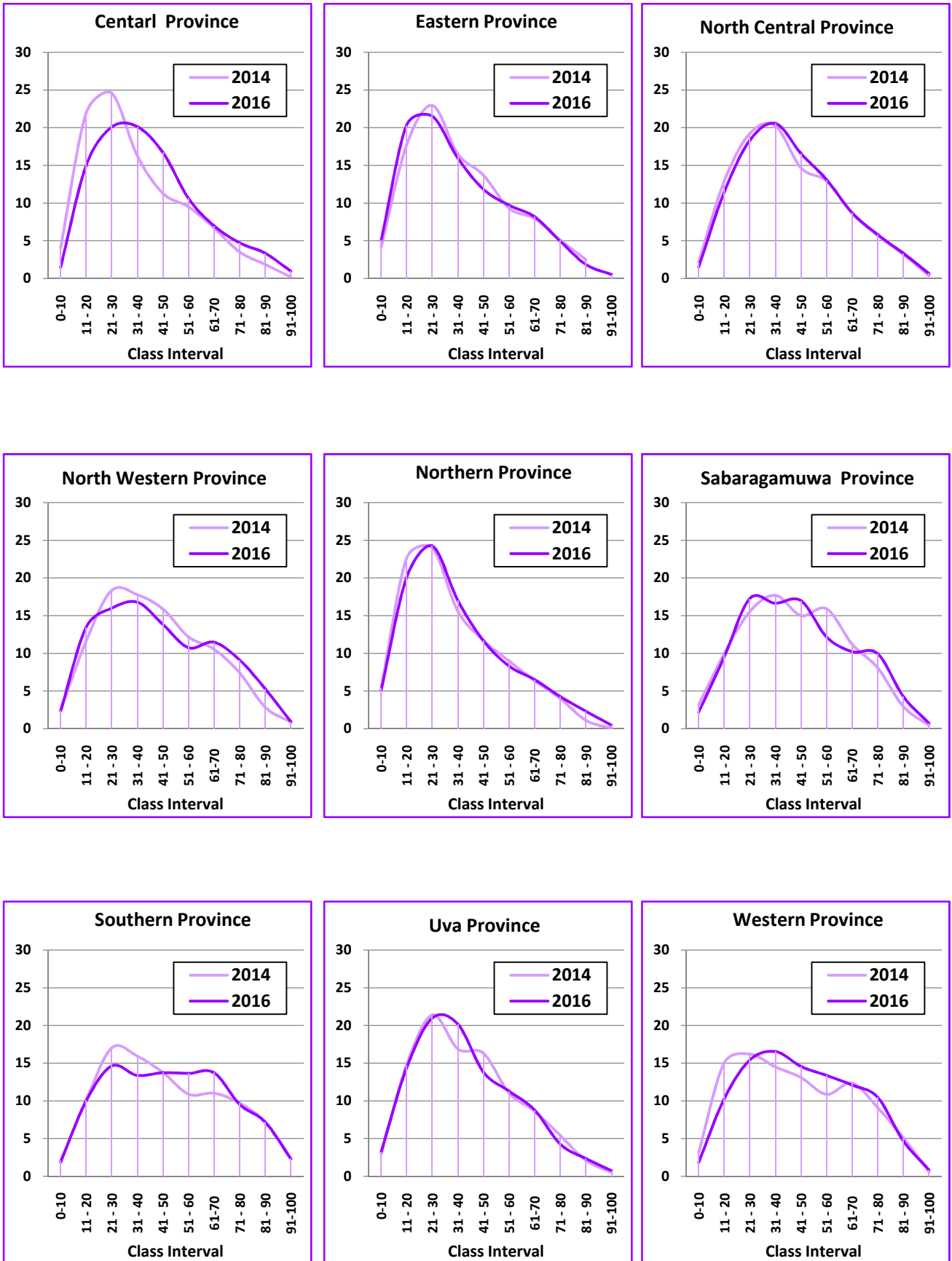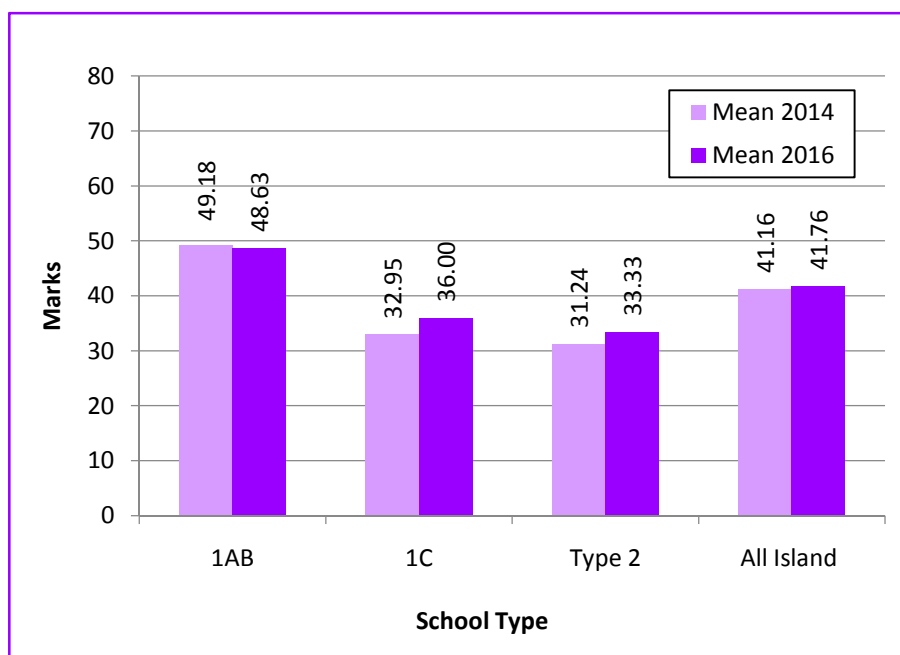
Fig. 4.24: Comparison of provincial wise distribution of marks – Science

4.11   Comparison of marks according to school types

Fig. 4.25: 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.

These changes are further elaborated in Table 4.18.

Table 4.18: Comparison of science achievement according to school type

School Type	Year 2014		Year 2016		Z
	Mean	Standard Deviation	Mean	Standard Deviation	
1AB	49.18	20.99	48.63	21.62	-1.64
1C	32.95	16.74	36.00	17.51	8.36**
Type 2	31.24	17.05	33.33	16.94	4.36**
All Island	41.16	20.92	41.76	20.73	2.49**

According to Table 4.18 the decrease in the 1AB schools mean value is not significant. However the increase in 1C and Type 2 schools is significant.

The trend in achievement gender wise will be discussed next.

4.12   Comparison of marks according to gender
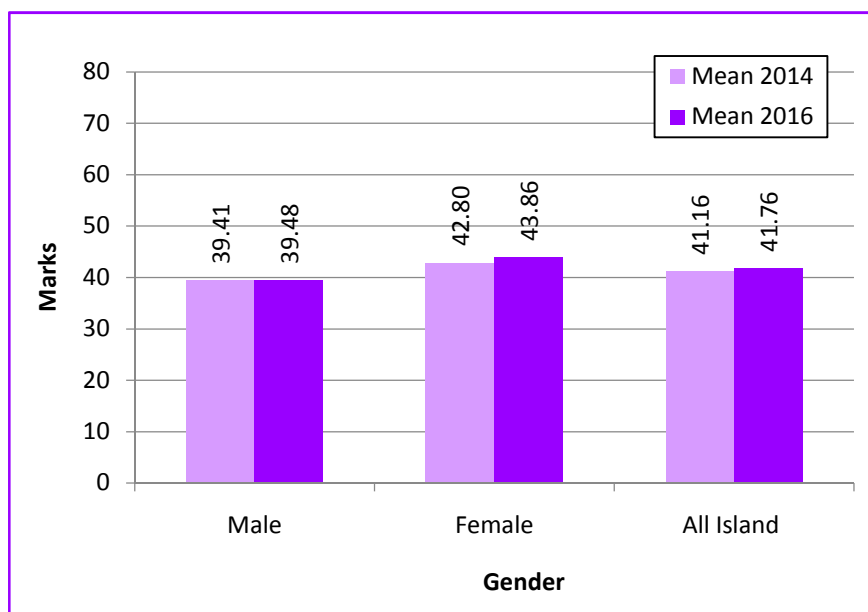
Fig. 4.26: All island comparison of mean values according to gender

As Fig. 4.26 indicates there are slight increases in both male and female performances.

However, according to Table 4.19 even though the change in the male performance is not significant, the increase in the female performance is significant.

Table 4.19: Comparison of science achievement according to gender

Student Gender	Year 2014		Year 2016		Z
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**	
Male	39.41	21.14	39.48	21.22	0.20
Female	42.80	20.58	43.86	20.03	3.20**
All Island	41.16	20.92	41.76	20.73	2.49**

4.13   Comparison of marks according to medium of instruction
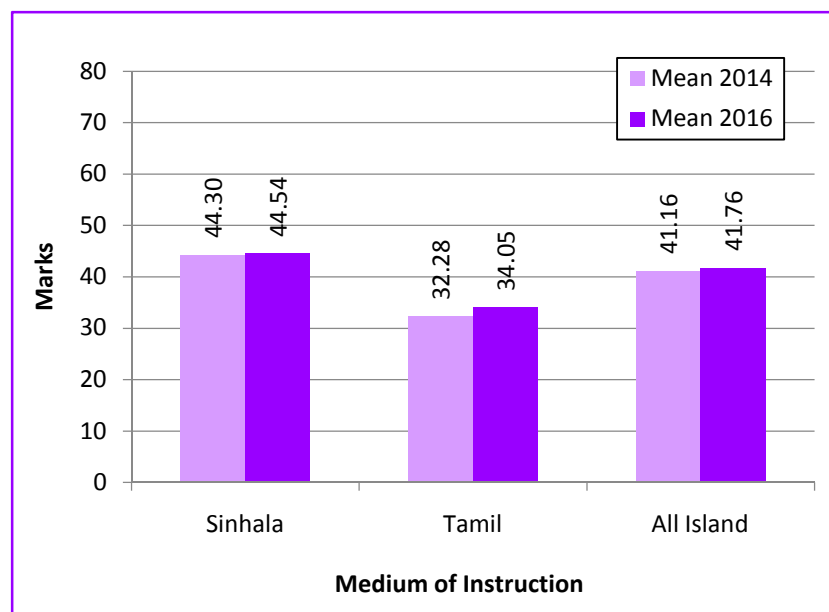
Fig. 4.27: All island comparison of mean values according medium of instruction

There is a very slight improvement in the performance of both Sinhala medium as well as Tamil medium students' performance (Fig. 4.27). However, as Table 4.20 indicates the changes in the Sinhala medium is insignificant. On the other hand, the changes in the Tamil medium performance is significant.

Table 4.20: Comparison of science achievement according to medium of instruction

Medium of Instruction	Year 2014		Year 2016		Z
	Mean	**Standard Deviation**	**Mean**	**Standard Deviation**	
Sinhala	44.30	20.98	44.54	20.83	0.84
Tamil	32.38	16.09	34.05	18.36	4.49**
All Island	41.16	20.92	41.76	20.73	2.49**

4.14   Comparison of marks according to location
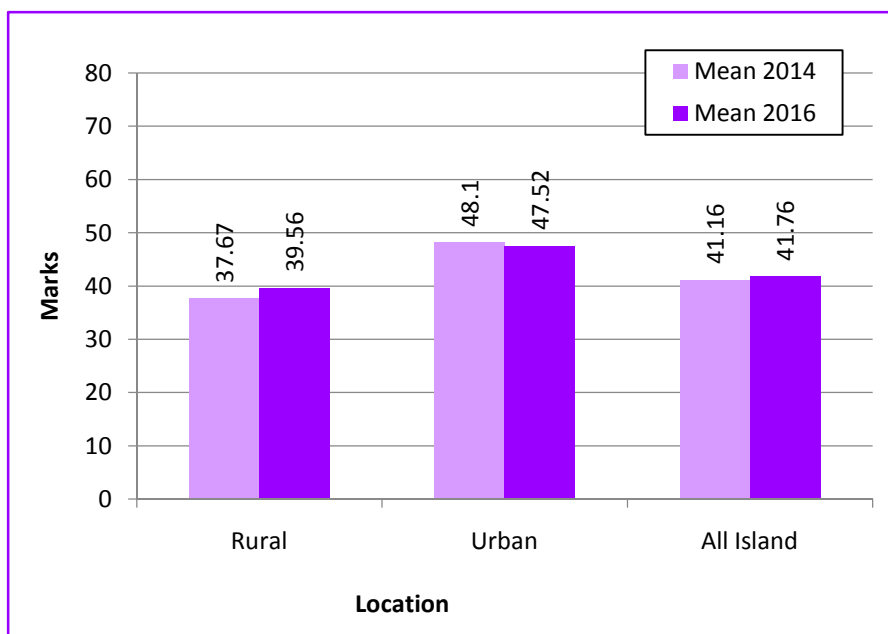
Fig. 4.28: All island comparison of mean values according to location

The urban students' performance has decreased slightly. On the other hand, the rural students' performance has increased by 2 points. According to Table 4.21 this change is significant.

Table 4.21: Comparison of science achievement according to location

Location	Year 2014		Year 2016		Z
	Mean	Standard Deviation	Mean	Standard Deviation	
Rural	37.67	19.13	39.56	19.71	7.23**
Urban	48.10	22.54	47.52	22.17	-1.15
All Island	41.16	20.92	41.76	20.73	2.49**

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 science will be discussed next.

4.15 Comparison of students' achievement in relation to ELCs

Table 4.22: Comparison of achievement of competency levels related to biology

Content	Competency Level	Percentage		Change
		2014	2016	
Biology	1.1 Discovers the diversity of the natural environments	42.00	47.10	5.10
	1.2 Investigates the advantages/disadvantages of the built environments	40.00	53.10	13.10
	1.3 Focuses attention on the venomous animals that are harmful to man	68.00	80.70	12.70
	1.4 Acquires the ability to use international scientific symbols	59.00	71.20	12.20
	3.1 Observes the interactions based on life cycles	36.00	54.65	18.65
	3.3 Explains the importance of use of cultivations under specific conditions	62.00	72.10	10.10
	3.4 Investigates the biotic factors affecting the perpetuation of the environment.	45.00	56.00	11.00
	6.1 Conducts explorations to identify the morphological diversity of leaves	8.00	5.90	-2.10
	6.3 Investigates the functions related to the diversity of roots.	33.00	37.70	4.70
	6.4 Uses plant related products with a scientific attitude	40.00	46.60	6.60

As can be seen from Table 4.22 achievement of all competencies except competency 6.1 that is "conducts explorations to identify the morphological diversity of leaves" has increased. This is a positive feature. On the other hand, the least achieved competency in 2014 not only continues to be the weakest skill but also has declined. Therefore, this is an area that needs further study.

Table 4.23: Comparison of achievement of competency levels related to chemistry

Content	Competency Level	Percentage		Change
		2014	2016	
Chemistry	2.1 Inquires into the properties of matter	50.00	61.00	11.00
	2.2 Inquires into the standard symbols used for elements	47.00	47.47	0.47
	2.3 Display the ability to use the differences in density of substances in day today life.	41.00	49.45	8.45
	2.4 Uses the expansion of solids, liquids and gases in day today life effectively.	8.00	10.23	2.23
	2.5 Inquires into the usages of compounds according to their properties.	25.00	30.03	5.03
	2.6 Inquires into the domestic uses of chemicals	21.00	34.23	13.23
	2.7 Uses parallel and serial connections of electrical appliances in human needs.	44.00	52.95	8.95
	2.8 Uses magnets in day today life	53.00	62.50	9.50

In relation to the achievement of competency levels related to chemistry, in 2014 only one competency level has been achieved by more than 50% of students. In 2016 also only two competency levels have been achieved by more than 50% of students.

However, when compared with the performance in 2014, there is an increase in the achievement of all competency levels. Competency level 2.4 continues to be the least achieved competency.

Table 4.24: Comparison of achievement of competency levels related to earth science

Content	Competency Level	Percentage		Change
		2014	2016	
Earth Science	4.1 Investigates the constituents of the atmosphere	32.00	48.39	16.39
	4.2 Acts to maintain optimum composition of the atmosphere	38.00	37.83	-0.17
	4.3 Uses natural resources obtained from the earth effectively	47.00	54.94	7.94

According to Table 4.24 in 2014 students have not achieved more than 50% in any competency level. In 2016 there has been a slight improvement in the achievement of the sub skill.

Table 4.25: Comparison of achievement of competency levels related to physics

Content	Competency Level	Percentage		Change
		2014	2016	
Physics	5.1 Inquires into the application of the concept "pressure" in day today needs	22.00	31.76	9.76
	5.2 Inquires into the effect of Center of Gravity on the equilibrium of an object in relation to life experiences	58.00	47.85	-10.15
	5.3 Uses work, energy and power in human concerns/needs	31.00	36.50	5.50
	7.1 Uses properties of light in human needs	21.00	28.05	7.05
	7.2 Uses generation and propagation of sound in musical instruments	17.00	21.68	4.68
	7.3 Explores the scientific basis of modern communication equipment	31.00	37.79	6.79
	8.1 Contribute to minimize the risks associated with cyclones	44.00	53.69	9.69
	8.2 Contribute to minimize the risks associated with lightning and thunder	59.00	84.34	25.34

In 2014 only two competency levels have been achieved by more than 50% of students. However, in 2016 also only two competency levels have been achieved by more than 50% of students. Yet while this is an increase in the achievement of all other competency levels there is almost 10 points decrease in competency level 5.2.

4.16 Summary

Part I of this chapter described student performance in relation to the achievement of learning outcomes in science. 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 competency levels expected to be achieved by grade 8 pupils related to science.

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

It could be concluded that even though there is a slight improvement in overall performance in science there is still disparity in achievement provincial wise as well as location, medium and gender wise. A slight increase in achievement in rural schools and 1C and Type 2 schools is a positive sign. There is a slight improvement in overall achievement of competencies related to the main content areas in science. However, achievement of certain competencies continues to be unsatisfactory.