Chapter Three

Patterns in Achievement – Mathematics 2012

3.1 Introduction

In 2007, a competency based curriculum was introduced in Sri Lanka. The present National Assessment is the first study conducted on the Grade 8 mathematics curriculum since the new curriculum was introduced.

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

3.2 Patterns of achievement at National Level

National Level student achievement would be discussed in relation to student performance pertaining to mathematics.

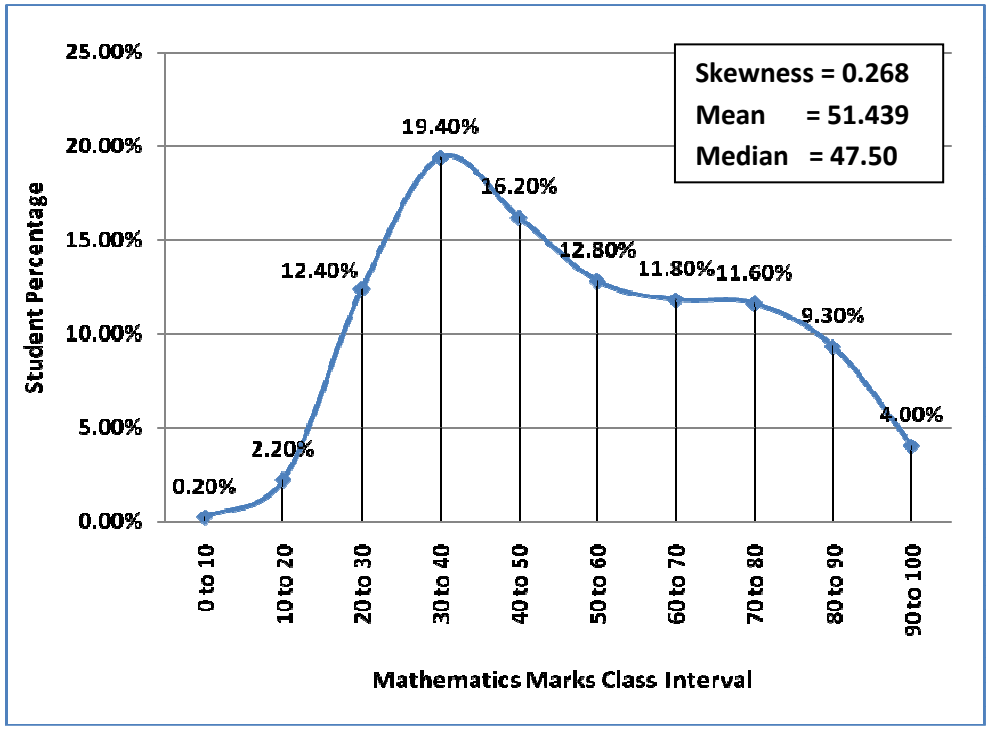


Fig. 3.1: All island achievement in Mathematics 2012 – dispersion of marks

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 skewed distribution of marks. A distribution is ***skewed*** "***when one tail of the distribution is longer than the other tail, making the distribution asymmetrical"*** (Burks and Christerson, 2012, p.461). In this distribution the tail to the right is longer, however the numbers even though increasing in numerical value is less frequent than towards the left tail. Hence it is positively skewed.

Even though the mark distribution indicates a positive skewness it is not very high. A perfectly symmetrical distribution has a skewness of 0. All Island mathematics skewness is 0.268. This indicates that there is a higher percentage of students with low marks. Similarly, the distributions are said to be skewed positively when there are more individuals in a group who score less than the average score for heir group.

Fig. 3.2 illustrates student achievement patterns further.

As Fig. 3.2 displays all island mathematics scores range from zero to approximately 97%.

The all island ***median*** which is *is the mid point value of the marks distribution when it is arranged according to ascending order* is 47.5. This means that 50% of the students in the sample has scored higher than or equal to 47.5 mark points. On the other hand the mean of the distribution which is the arithmetic average of the scores is 51.4.

A positively skewed distribution of marks can be observed. That is the higher number of low achievers compared to the high achievers has impacted on the median value. Hence there is a difference between the mean and the median.

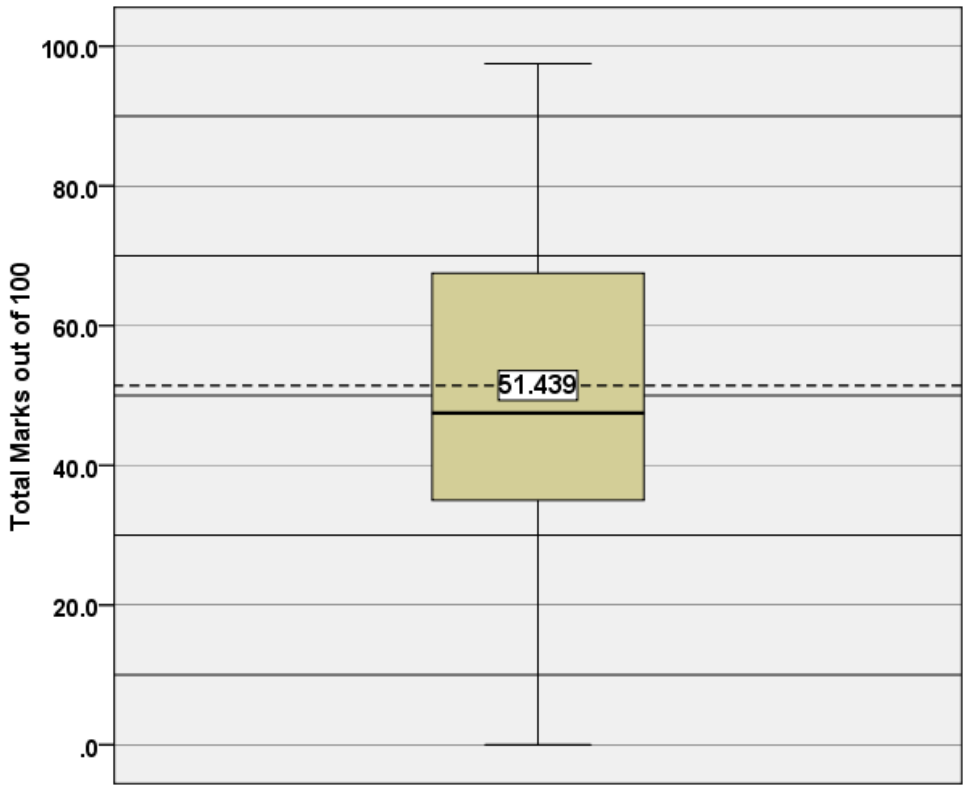


Fig. 3.2: All island achievement in mathematics 2012 – boxplot

Table 3.1: All island achievement in mathematics 2012 – cumulative percentages

Marks Interval	Student Percentage	cumulative Percentage
90 to 100	4.02	100.00
80 to 89	9.35	95.98
70 to 79	11.56	86.64
60 to 69	11.83	75.08
50 to 59	12.79	63.25
40 to 49	16.25	50.46
30 to 39	**19.36**	**34.21**
20 to 29	**12.42**	**14.86**
10 to 19	**2.22**	**2.43**
0 to 9	**0.21**	**0.21**

All island mathematics marks corresponding to the class intervals indicate that 34.21 of students score less than the pass mark. On the other hand, another 24.93 of students have scored above 70, while 50.46% has scored below 50 marks.

These differences emphasize the disparity that prevails in achievement of learning outcomes, even though the mean score is relatively satisfactory.

Although no comparison is possible with previous grade 8 studies due to the instruments being different, it is interesting to note that the mean value in the 2008 study had been 50.4.

Summary of National Level achievement

- The national level mean score is 51.4, while the median is 47.5.
- Disparity in achievement prevails with 34.2 of the national sample scoring less than 40 and 24.93 scoring above 70.

Provincial wise student achievement will be discussed next.

3.3 Provincial wise student achievement

Table 3.2: Provincial achievement in mathematics 2012 – Summary Statistics

Province Name	Mean	Rank	Standard Deviation	Standard Error of Mean	Percentile (p25)=Q1	Median (p50)=Q2	Percentile (p75)=Q3	Skewness
Western	54.765	1	21.1161	0.2073	37.5	55.00	72.5	0.065
Southern	54.739	2	21.4272	0.2234	37.5	52.50	72.5	0.111
North Western	52.802	3	21.6044	0.2483	35	50.00	72.5	0.233
Sabaragamuwa	52.619	4	20.5242	0.2261	35	50.00	70	0.209
Central	51.203	5	20.6198	0.2448	35	47.50	67.5	0.325
Northern	50.792	6	21.0793	0.3000	32.5	47.50	67.5	0.327
Eastern	48.482	7	21.7137	0.2757	30	42.500	67.5	0.416
North Central	47.160	8	18.7199	0.2162	32.5	42.50	60	0.433
Uva	46.288	9	19.6501	0.2591	30	42.50	60	0.455
All Island	**51.439**		**20.9757**	**0.0811**	**35.0**	**47.50**	**67.5**	**0.268**

F=170.164, Significance = 0.000

As Table 3.2 indicates based on Provincial wise mean achievements Western Province ranks first. Although Western Province is ranked first, the Southern Province is ranked second with only a slightly decimal value.

Achievement wise the provinces fall into three categories. Western, Southern, North Western and Sabaragamuwa with mean scores above the national mean, fall into the higher category. Northern and Central Provinces cluster in the middle while Eastern, North Central and Uva fall into the lowest category. Between the Western and Uva Provinces there is more than 8 point difference in mean values indicating the disparity in achievement among the Provinces.

These disparities are further highlighted through the bar chart given in Fig, 3.3.

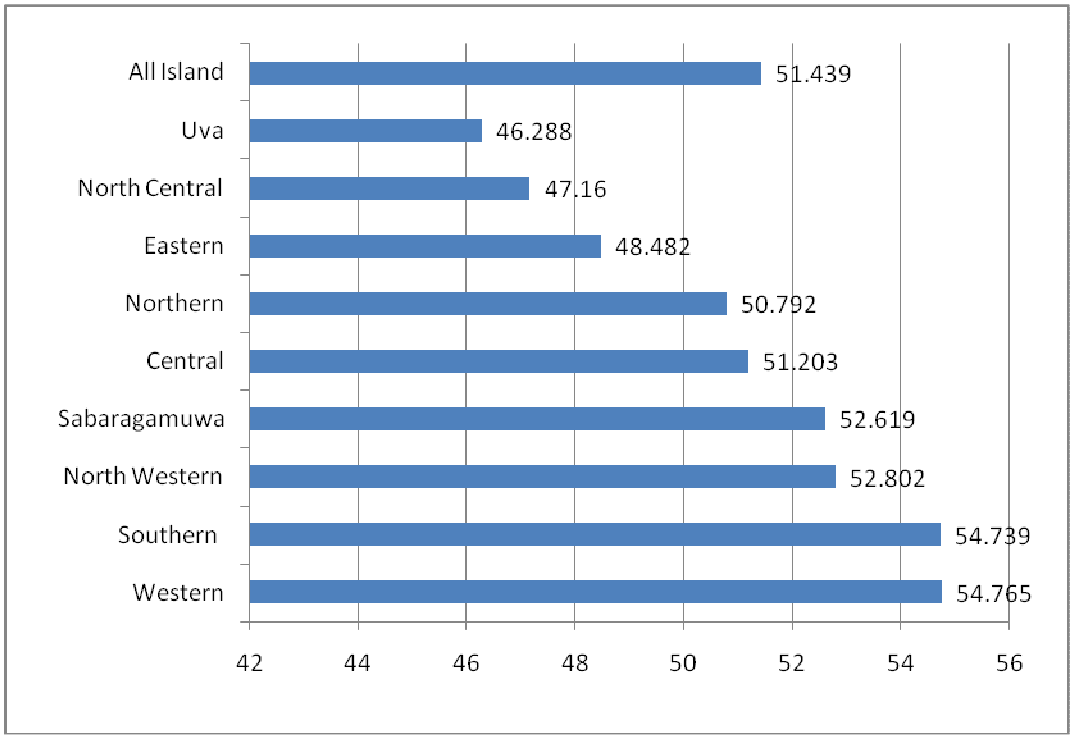


Fig. 3.3: Bar chart to represent mean among the provinces - Mathematics

Although superficially there appears to be similarity in mean achievement among Western and Southern Provinces differences can be observed by using other statistics. Median difference between Western and Southern reveals more information than the mean difference. Western Province median being 55 indicates that out of 50% of the students in the Western Province sample has scored higher than or equal to 55 mark

points. In the Sothern Province 50% of the students have scored higher or equal only to 52.5, mark points.

Similarities in achievement among the other provinces can be seen when the median value is analysed. It is interesting to note that three distinct groups can be seen. Western, Southern, North Western and Sabaragamuwa fall into category 1 with 50% of the students scoring higher than or equal to 50 marks. Central and Northern fall into category 2 with 50% of the students scoring higher than or equal to 47.5 marks.

Eastern, North Central and Uva fall into category 3 with 50% of the students scoring higher than or equal to 42.5 marks. In these provinces the median value is below the all island median.

3.3.1 Variation among students

Standard deviation (SD) indicates the deviation of student marks from the mean (average) value of the marks distribution. According to Table 3.2, all the standard deviation values lie between 18 to 21 ranges. Therefore, in most of the provinces the deviation of marks from the mean is similar. As already discussed, the mean difference between Western and Southern provinces is very little. However, the deviation of marks from the mean in the Southern province is higher compared to the Western Province. Therefore, it could be claimed that the achievement differences among the students in the Sothern province is higher than in the Western Province.

Highest standard deviation is seen in the Eastern Province. This means that student marks deviation from the mean value is higher. This indicates that there is lot of variation among student achievement in this province.

North Central and Uva Provinces obtained lower standard deviations compared to other provinces and below the National standard deviation. Therefore, in these provinces deviation of student achievement from the mean value is less, compared to other provinces. Lower SD value indicates homogeneous performance among these

provinces. However, these provinces have obtained lower mean than the other provinces. Therefore, the homogeneity is among low achievers.

Disparity in achievement

In all the provinces skewness values are positive. Western Province skewness value being 0.065 indicates that value is near to zero than the values in other provinces. This means majority of the students' achievement lies closer to higher values than the lower values.

On the other hand, in provinces like Eastern, North Central and Uva the skewness is higher due to majority of student marks falling among low scores and they are further away from the zero value.

Use of Box plot and whisker plot to present provincial wise mathematics marks

"A percentile may be defined as a point on the score scale below which a given percent of the cases lie". Defined in this way, 1st percentile (written as P1) will mean "a point in the given series or distribution below which one percent cases lie and above which 99% cases lie". Going further, the 25th percentile (p25) will indicate that score point below which 25% of the cases lie. Similarly, 75th percentile (p75) will reveal a score point in a given series or distribution below which the scores of 75% and above which 30 % students of the group fall.

The Percentile index calculated can be used to identify further characteristics of the marks distribution.

Western Province first Quartile (Q1) mark 37.5 indicates that 25% of students from the Western Province sample are below this mark. On the other hand, Q3 denotes that 75% of the students from the Western Province sample has scored below 72.5 Although inter quartiles are similar between Western and Sothern Province, as already discussed the median is higher in Western Province. First Quartile in all provinces lies between 30 to

37.5. This shows that there is some similarity in this mark range among provinces. However, the third Quartile ranges from 60 to 72.5 marks, indicate greater differences among provinces.

"A boxplot shows the five statistics (minimum, first quartile, median, third quartile, and maximum). It is useful for displaying the distribution of a scale variable and pinpointing outliers". The length of the box is the **interquartile range** based on Tukey's hinges. That is, IQR=Q3−Q1

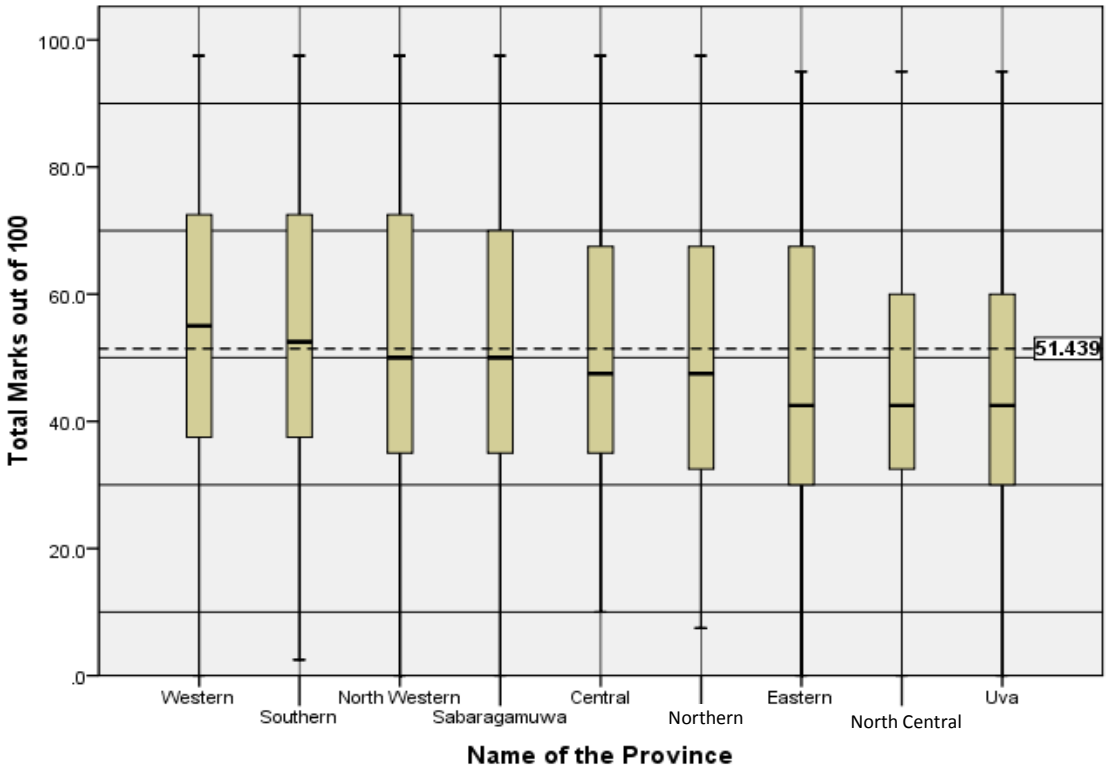


Fig. 3.4: Box plot chart representing all island mathematics achievement

Western and Southern provinces show similar characteristics in relation to the mark range between P25 and P75. North Western p75 is equal to Western and Southern, but p25 is lower, indicating that while there are high achievers there are also low achievers. Sabaragamuwa achievement mark range is better than the Central, North, Eastern North Central and Uva. It is interesting to note that Eastern and Uva are similar with respect to p25. However, in the Eastern province P75 is very much higher equaling Central and Northern Provinces.

Therefore, the box plot confirms the disparity of achievement that exists among the provinces and especially in the Eastern province.

Table 3.3: Representation of students scoring below 50 and 50 or above - Mathematics

Province	Gender of the student							
	Female				Male			
	Marks less than 50		Marks equal or above 50		Marks less than 50		Marks equal or above 50	
	No. of students	%	No. of students	%	No. of students	%	No. of students	%
Central	435	55.9%	343	44.1%	387	65.7%	202	34.3%
Eastern	411	64.6%	225	35.4%	414	58.5%	294	41.5%
Nothern	408	64.3%	227	35.7%	380	58.2%	273	41.8%
North Western	416	55.4%	335	44.6%	393	57.5%	290	42.5%
North Central	437	63.3%	253	36.7%	512	67.2%	250	32.8%
Sabaragamuwa	421	50.2%	418	49.8%	445	60.6%	289	39.4%
Southern	369	45.1%	450	54.9%	365	53.3%	320	46.7%
Uva	473	65.9%	245	34.1%	461	71.7%	182	28.3%
Western	323	41.1%	462	58.9%	383	54.2%	323	45.8%
All Island	3693	55.5%	2958	44.5%	3740	60.7%	2423	39.3%

Summary of Provincial Level analysis

- Achievement wise the provinces fall into three categories.

  Category 1 – Western, Southern, North Western and Sabaragamuwa with mean scores above the national mean (>51.439)

  Category 2 –Northern and Central provinces cluster in the middle.

  Category 3 – Eastern, North Central and Uva.
- Disparity of marks within a province is highest in the Eastern province.
- In North Central and Uva provinces the disparity of marks is less, but the marks are low. Therefore, in these provinces achievement is more homogeneous but low.

3.4 Achievement levels by type of school

Table 3.4: Mathematics marks achievement according to the school type

School Type	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
1AB	61.121	20.1235	0.1070	-0.260	45.0	62.500	77.5
1C	41.719	16.4140	0.1144	0.693	30.0	37.500	52.5
Type 2	38.335	14.8774	0.1427	0.796	27.5	35.000	47.5
All Island	**51.439**	**20.9757**	**0.0811**	**0.268**	**35.0**	**45.500**	**67.35**

As Table 3.4 indicates there is a considerable gap between the mean scores of 1AB schools and type 1C and type 2 schools. While the mean difference between 1AB and 1C is 19.402, the difference between 1AB and Type2 is 22.786. These differences are very high between school types. 1AB students' performance appears to very strongly affect to increase the all island mathematics mean statistics. 1AB schools and all island mean difference is closer to 10 marks, whereas 1C type schools mean value is 10 marks below that of the all island mean value. Type 2 performance is even worse, but more closer to Type 1C. The need to improve the performance of 1C and Type 2 schools have been repeatedly stressed in the previous studies and analysis (World Bank, 2011). However, in spite of the curriculum revision the gap seems to continue. This is highlighted in Fig. 3.5.

The difference in mean scores is graphically shown in Fig. 3.5.

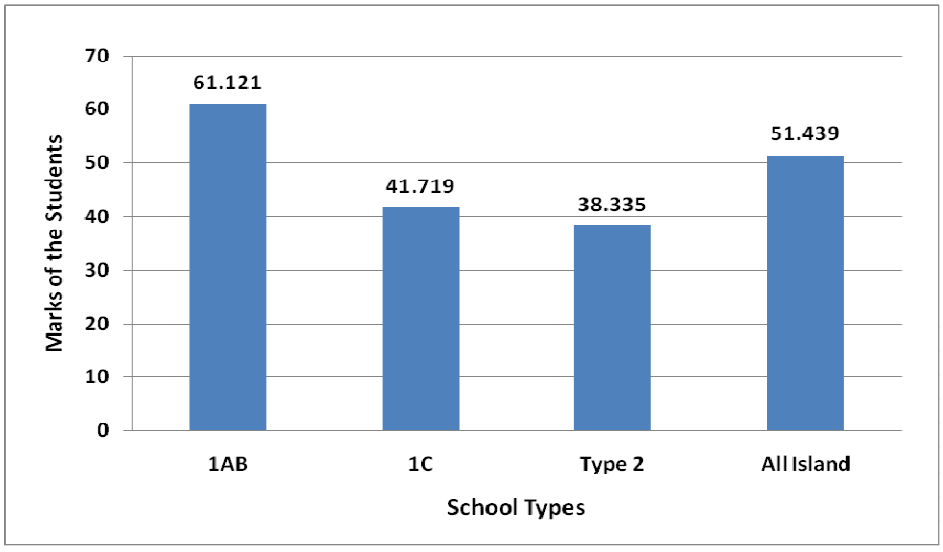


Fig. 3.5: Bar chart representing the mean values according to school types - Mathematics

The gap between the school types is further highlighted when the median scores are considered. The median value of the 1AB schools is considerably higher than the 1C and Type 2 Schools. This reveals that 50% of student achievement is above or equal to 62.50 mark value in the 1AB schools. On the other hand, in 1C and Type 2 schools 50% of students are scoring below the pass mark. In fact, in 1AB schools even the bottom 25% is scoring above the median of 1C and Type 2 schools.

Variation among students

Although achievement is higher in 1AB schools, variation among student achievements can also be seen. As shown in Table 3.4 standard deviation of the 1AB schools is quite high and second only to the all island value. All Island standard deviation had become so high due to the disparity between the high performance of the1AB schools and the low performance of the other two types of schools. Type 2 and 1C schools' standard deviations have become more than one third of the mean statistics. On the other hand, 1AB schools' standard deviation is only less than one third of the mean value. Therefore, even though SD of the 1AB schools is higher than the other two type of schools, relatively achievement differences among students in 1AB schools is less than 1C and Type 2 schools.

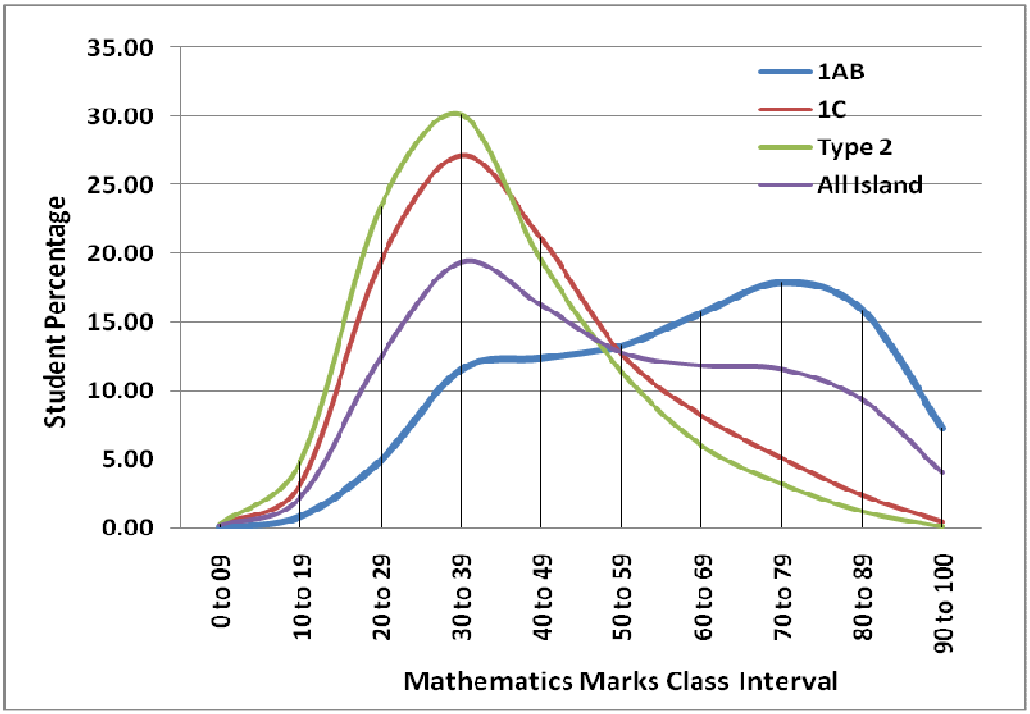


Fig. 3.6: Dispersion of marks by school type - Mathematics

Disparity in achievement

As Fig. 3.6 depicts, two distinct types of curves. The negatively skewed curve for the 1AB schools indicate a larger percentage of students with high scores and lower percentage of students with low performance. On the other hand, 1C and Type 2 schools' marks distribution shows a positively skewed curve. As can be seen from Fig. 3.6 the negative skewness of the 1AB curve had contributed to lower the skewness of the all island curve even though it is still positive. Contribution of the different types of schools to the all island mathematics performance can be further explained through Table 3.5 giving the cumulative percentage of students' performance.

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

Class Interval	1AB Student (%)	Cumulative (%)	1C Student (%)	Cumulative (%)	Type 2 Student (%)	Cumulative (%)
90 to 100	7.30	**100.00**	0.50	**100.00**	0.10	**100.00**
80 to 89	15.90	**92.70**	2.40	**99.50**	1.20	**99.90**
70 to 79	17.90	**76.80**	5.10	**97.10**	3.20	**98.70**
60 to 69	15.70	**58.90**	8.20	**92.00**	6.00	**95.50**
50 to 59	13.30	**43.20**	12.70	**83.80**	11.40	**89.50**
40 to 49	12.40	**29.90**	21.10	**71.10**	19.50	**78.10**
30 to 39	11.56	**17.50**	27.10	**50.00**	30.10	**58.60**
20 to 29	4.96	**5.94**	19.40	**22.90**	23.40	**28.50**
10 to 19	0.88	**0.98**	3.20	**3.50**	4.80	**5.10**
0 to 9	0.10	**0.10**	0.30	**0.30**	0.30	**0.30**

Fig. 3.6 displays that 1AB school curve peaked at the 70-79 class interval. Table 3.5, indicates that 76.80% of the students' have scored up to this level. On the other hand, when the pass mark is considered as 40, in Type 2 and 1C schools 58.60% and 50% of students are below this mark.

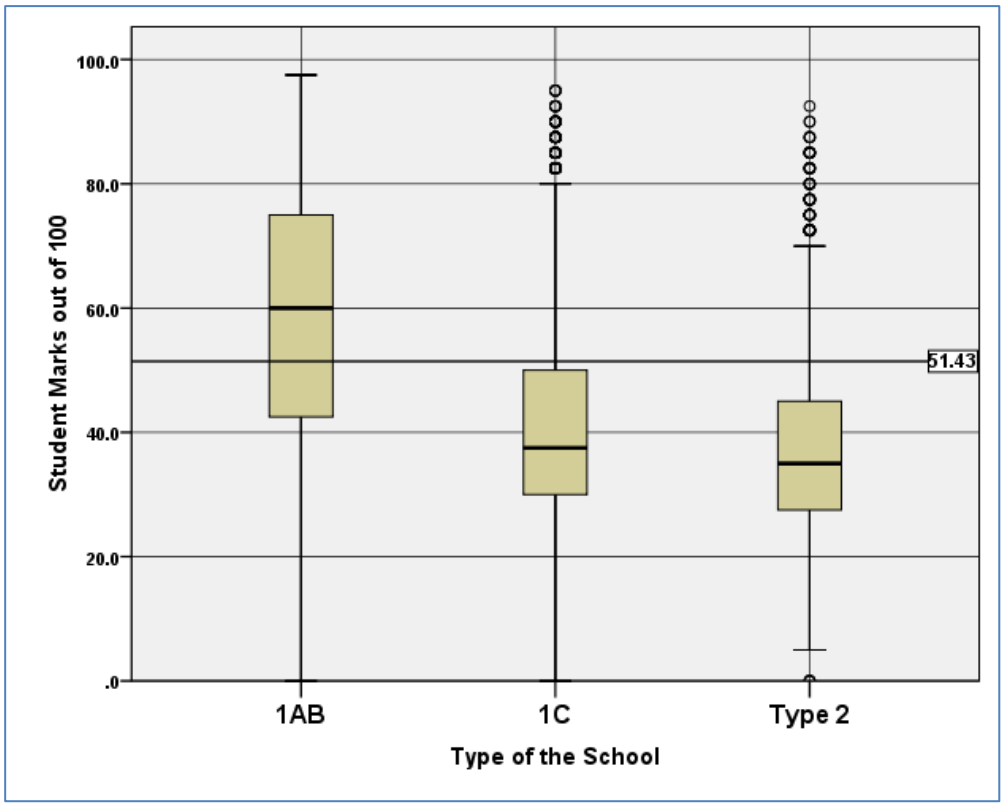


Fig. 3.7: Mathematics marks according to the school types using Box plot and whiksper plot

Box plot and whiksper chart graphically shows that Type 2 schools' achievements are very low compared to 1C and 1AB school types. More than 75 percent of the students are below the all island mean statistics indicated by the horizontal line. However, there are also a few students who have scored exceptionally high marks in the Type 2 schools. 1C schools' achievement indicated by the interquartile is slightly higher than the Type 2, but the 3rd Quartile is just below the all island mean Value line. There are also students who have done exceptionally well in 1C schools as well. However, the numbers are less compared to Type 2 schools. 1AB schools' interquartile range is also higher than the other two school types. However there are no exceptional cases indicated in the boxplot.

The reasons for exceptional performance by a few students in the 1C and Type 2 schools need further investigation.

Summary

- The gap between the achievement of students in 1AB schools and 1C and type 2 is wide.
- Majority of the students in 1C and type2 schools, 50% and 58.6% respectively have scored below 40 marks. On the other hand, only 17.5% have scored below 40 marks in 1AB schools.

3.5 Achievement levels by gender

Table 3.6: Mathematics achievement in summary statistics table

Student Gender	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
Female	52.518	20.5271	0.1100	0.228	35.0	50.000	70.0
Male	50.263	21.3916	0.1196	0.332	32.5	47.500	67.5
All Island	**51.439**	**20.9757**	**0.0811**	**0.268**	**35.0**	**47.500**	**67.5**

There is a slight difference in the achievement of females over males. As Table 3.6 indicates, male performance is also lower than the all island mean score.

These differences could also be seen in Fig. 3.8

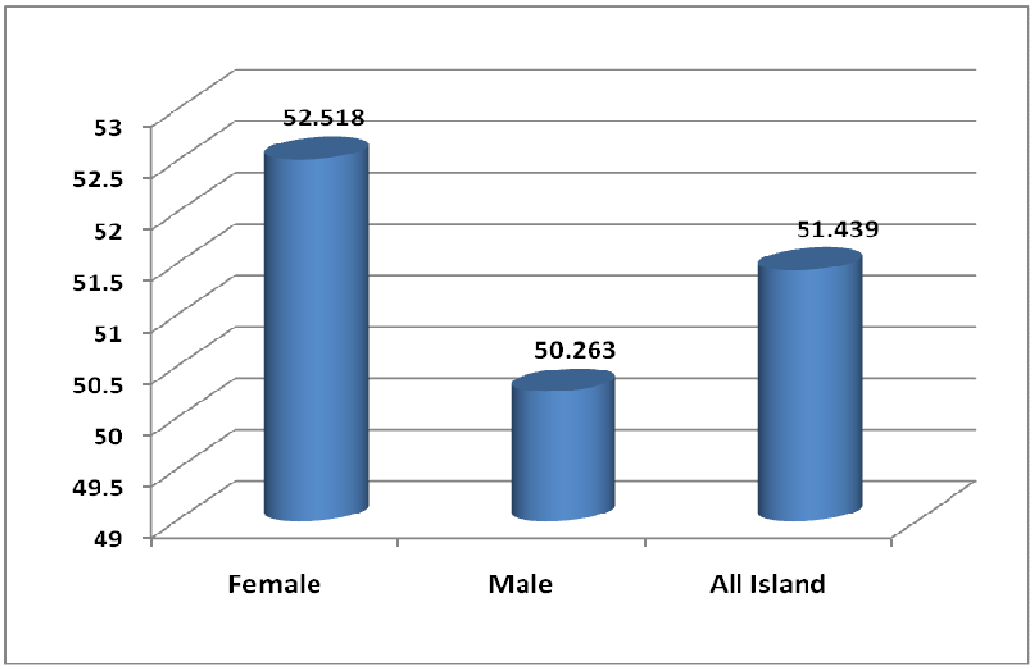


Fig. 3.8: Bar chart representing mean values according to gender

Although the mean score of the male students is below the all island mean, when considering the median the score for males is equal to the all island score. According to Table 3.5, 50% of the male students score is equal or above 47.5 which is also the all island score. On the other hand, the female students outperform both the male performance and the all island performance.

Although male students' mean achievement is lower than the female students, they have obtained a higher standard deviation value. Therefore, the deviation from the mean is higher among the male students indicating greater variation among their performance.

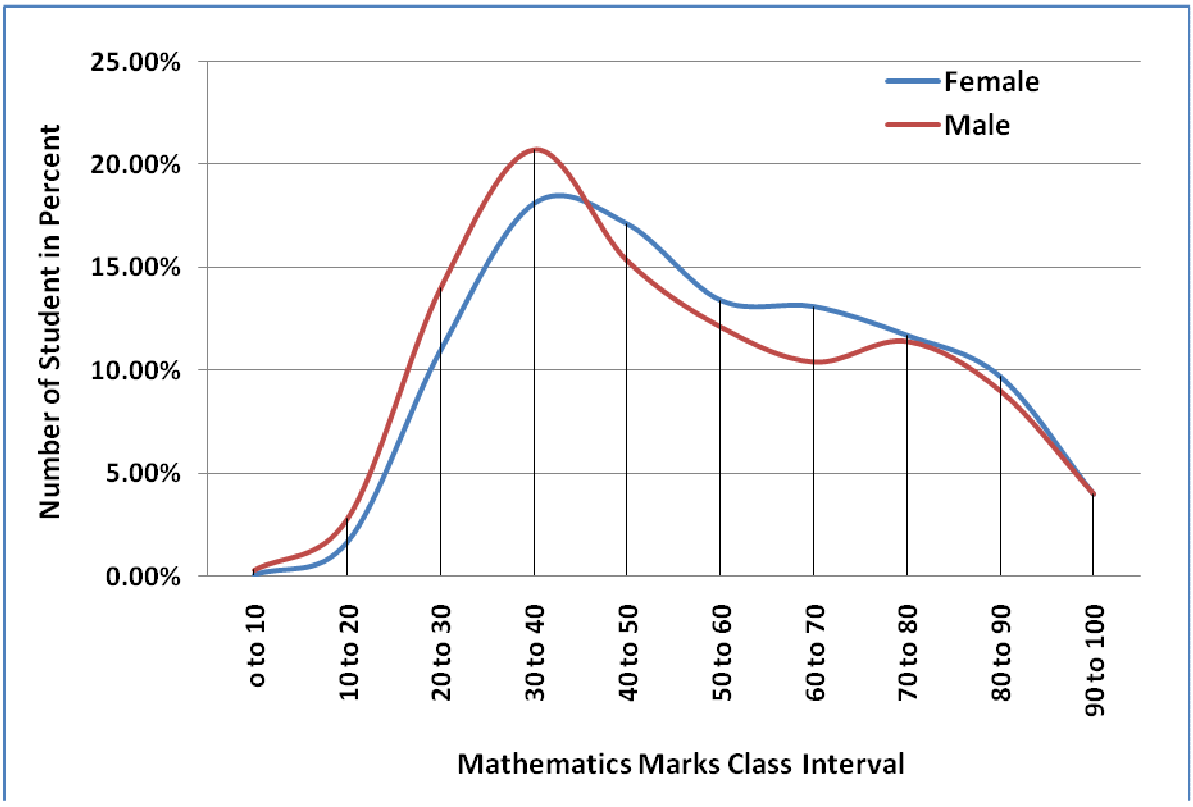


Fig. 3.9: Dispersion of marks by gender

Fig. 3.9 displays two curves which are both positively skewed. However, as Table 3.6 indicates the male curve has a higher positive value than the female, as well as the all island value.

Pattern of the two curves are similar at the beginning, then peaks become different up to the 8th class interval (70 to 79). Finally, both curves become similar again.

The disparity in the male students' achievement can be elaborated better through the cumulative percentages. As can be seen in Table 3.7, the differences between male and female performances can be seen mainly up to the 8th class interval (70 to 79). There on the cumulative percentages become almost similar.

Table 3.7: Gender wise mathematics analysis cumulative table

Class Interval	Female (%)	Cumulative Percentage	Male (%)	Cumulative Percentage
90 to 100	4.00	100.00	4.00	100.00
80 to 89	9.70	96.00	9.00	96.00
70 to 79	11.70	86.30	11.40	87.00
60 to 69	13.14	74.60	10.40	75.60
50 to 59	13.40	61.46	12.10	65.20
40 to 49	17.10	48.06	15.30	53.10
30 to 39	18.14	30.96	20.70	37.80
20 to 29	11.00	12.82	14.00	17.10
10 to 19	1.71	1.82	2.80	3.10
0 to 9	0.11	0.11	0.30	0.30

According to Table 3.7 and Fig. 3.9 it could be concluded that among both females and males, there are high performing students. On the other hand, among both groups there are low performing students as well. The highest percentage of students in both groups fall into the class interval 30-39, which means they are below the pass mark. However, the percentage of males falling into this group is higher than the females. This is a matter of concern with respect to equity. Therefore, attention should be paid to improve the performance of nearly 30-38% of low achievers and especial attention should be paid to the low performing males.

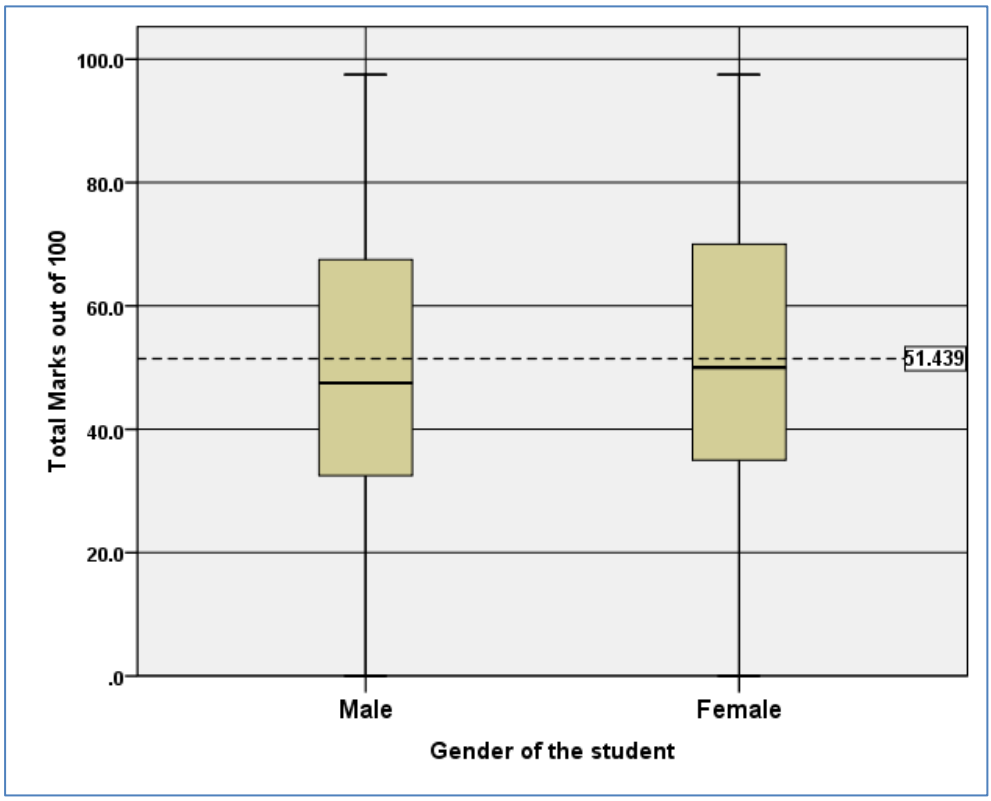


Fig. 3.10: Box plot and whiksper plot representing gender wise mathematics marks

Box plot and whiksper for gender wise mathematics achievement shows similarities that has been discussed already. Both student groups start at a similar base and reach higher mark ranges at a similar mark points. Median of the female students is very close to all island mean achievement.

Summary

- Female performance is slightly better than all island and male performance.
- While 30.96% of girls have scored below 40, the male is 37.8%
- Equal percentage of males and females have reached the higher mark range - 70-100.

3.6 Achievement levels by medium of instruction

Table 3.8: Achievement level by medium of instruction - Mathematics

Medium of the Student	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
Sinhala	52.606	20.9390	0.0940	0.212	35.0	50.0	70.0
Tamil	48.093	20.7191	0.1576	0.440	30.0	42.5	65.0
All Island	**51.439**	**20.9757**	**0.0811**	**0.268**	**35.0**	**47.500**	**67.5**

There is a wide 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. 3.11.

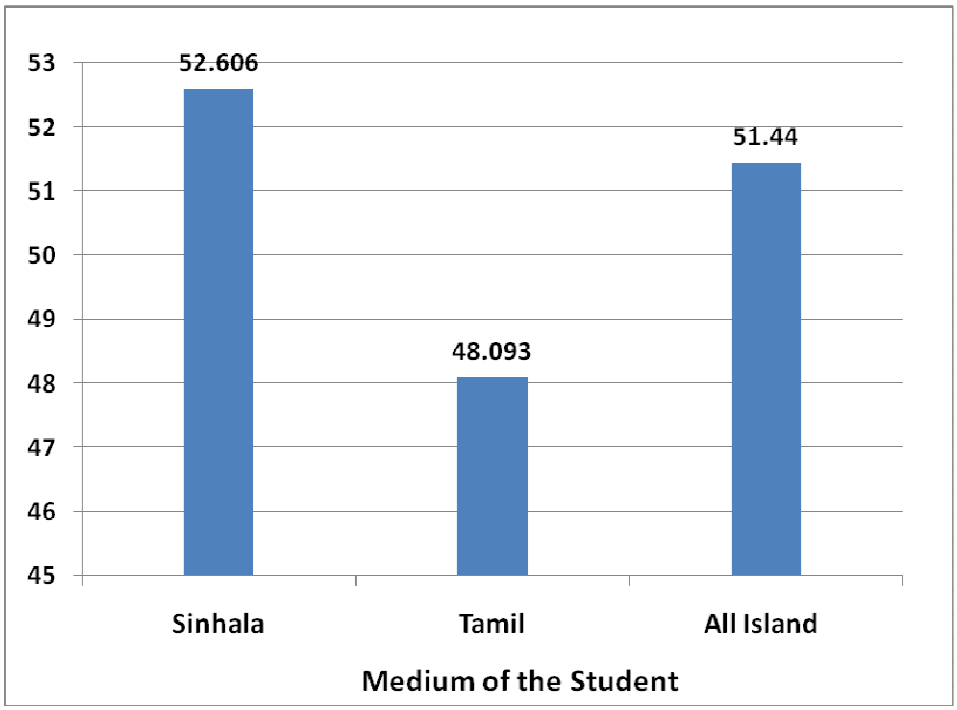


Fig. 3.11: Bar chart representing mean values according to medium of instruction - Mathematics

Sinhala medium students' performance is above the all island performance with respect to the median value as well. This means that 50% of Sinhala medium students score

equal or above 50. On the other hand, 50% of Tamil medium students have scored less than 42.5.

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

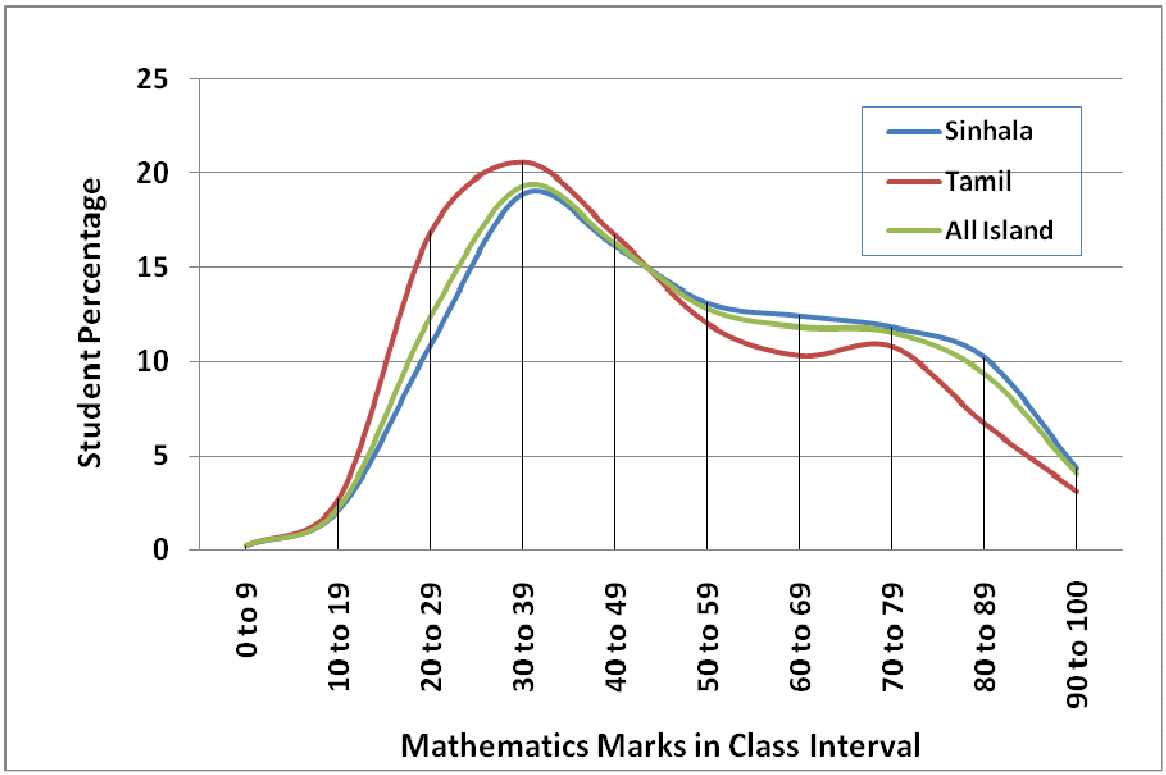


Fig. 3.12: Dispersion of marks by medium of instruction - Mathematics

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

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

Table 3.9: Medium wise cumulative percentage table - Mathematics

Marks Interval	Sinhala	Cumulative Percentage	Tamil	Cumulative Percentage
90 to 100	4.3	100	3.1	100
80 to 89	10.2	95.7	6.7	96.9
70 to 79	11.8	85.5	10.8	90.2
60 to 69	12.4	73.7	10.3	79.4
50 to 59	13.1	61.3	12	69.1
40 to 49	16.1	48.2	16.7	57.1
30 to 39	18.9	32.1	20.6	40.4
20 to 29	10.9	13.2	16.9	19.8
10 to 19	2.1	2.3	2.7	2.9
0 to 9	0.2	0.2	0.2	0.2

Considering the pass mark as 40, 32.1% of Sinhala medium and 40.4% of Tamil medium students have scored below the pass mark.

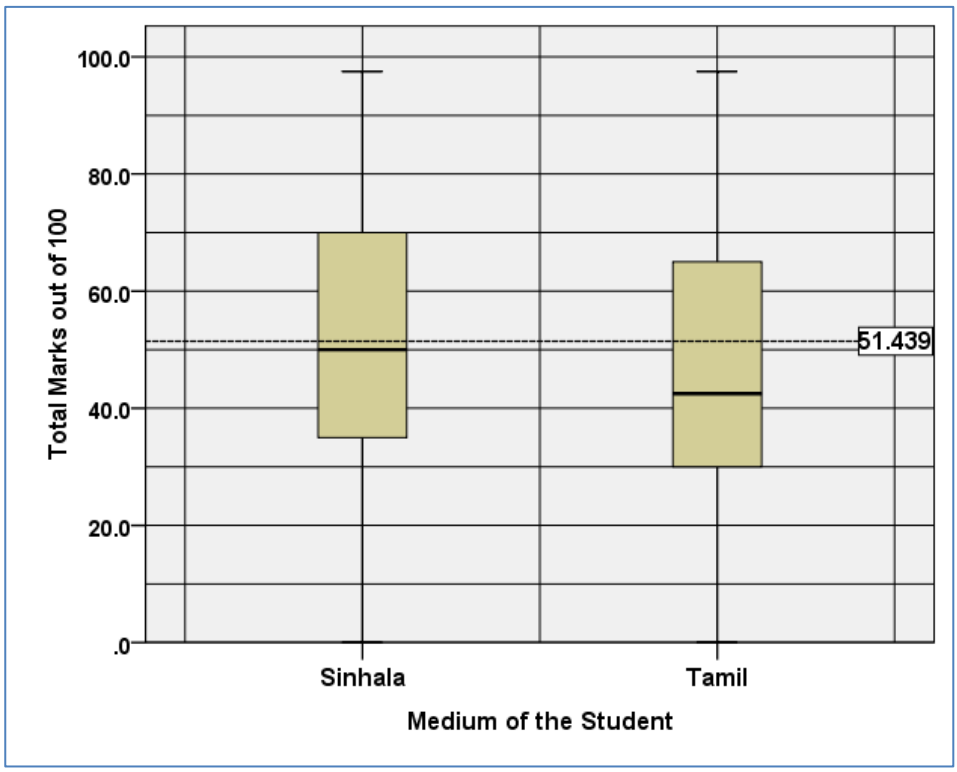


Fig. 3.13: Box plot for medium wise achievement - Mathematics

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

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

Summary

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

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

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

3.7 Analysis of achievement by competency levels

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 3.10

Table 3.10: Achievement of competency level related to knowledge and skills

Competency Level	Question numbers	percentage
1.1 Inquires into the relationships between the whole numbers.	2	53.1%
1.2 Manipulates directed numbers under the basic mathematical operations	1	36.9%
2.1 Builds relationships between the terms of number patterns by investigating various properties	7	39.1%
3.1 Manipulates units and parts under multiplication	3	63.2%
5.1 Develops the relationship between fractions, ratios and percentages	8	35.9%
7.1 Satisfies various requirements by investigating the perimeter of rectilinear plane figures	20	38%
9.1 Facilitates daily work by investigating large masses	18	51%
10.1 Determines for daily needs, the space that is taken up by various solids	15	54.9%
11.1 Facilitates daily work by investigating the capacity of liquid containers	21	23.7%
12.1 Investigates the rotation of earth and inquires into its results	19	56.1%
12.2 Investigates the difference in time between countries and finds their relative positions	23	34.4%
13.1 Indicates the direction of a location using angles	24	31.8%
15.1 Factorizes algebraic expressions	26	34.6%
20.2 Illustrates the behavior of a variable pictorially	31	32.4%
20.3 Represents location on a Cartesian Plane	30	44.1%
21.1 Examines the angles made by various straight lines	35	43.7%
21.2 Performs calculations using the relationships between various angles	36	37.4%
22.1 Created solids and confirms the relationships between properties related circles	34	58.3%
23.1 Inquires into the relationships between the various angles of rectilinear plane figure	33	33.6%
24.1 Inquiries into the special properties related to circles	32	67.7%
25.1 Inquires into the results of a rotation that are based on symmetry	37	47%
27.1 Compares varies movements with the basic foci	11	70.6%
29.1 Inquires into numerical representative values of a group of data	12	68.2%
31.1 Determines the likelihood of an event occurring by investigating the various methods of finding a suitable value	13	64.4%

As Table 3.10 indicates the highest percentage of students has achieved competency level 24.1. On the other hand, the lowest percentage of students has achieved competency level 11.1.

The achievement of different competency levels is also graphically shown in Figure 3.14

Competency levels related to knowledge and skills

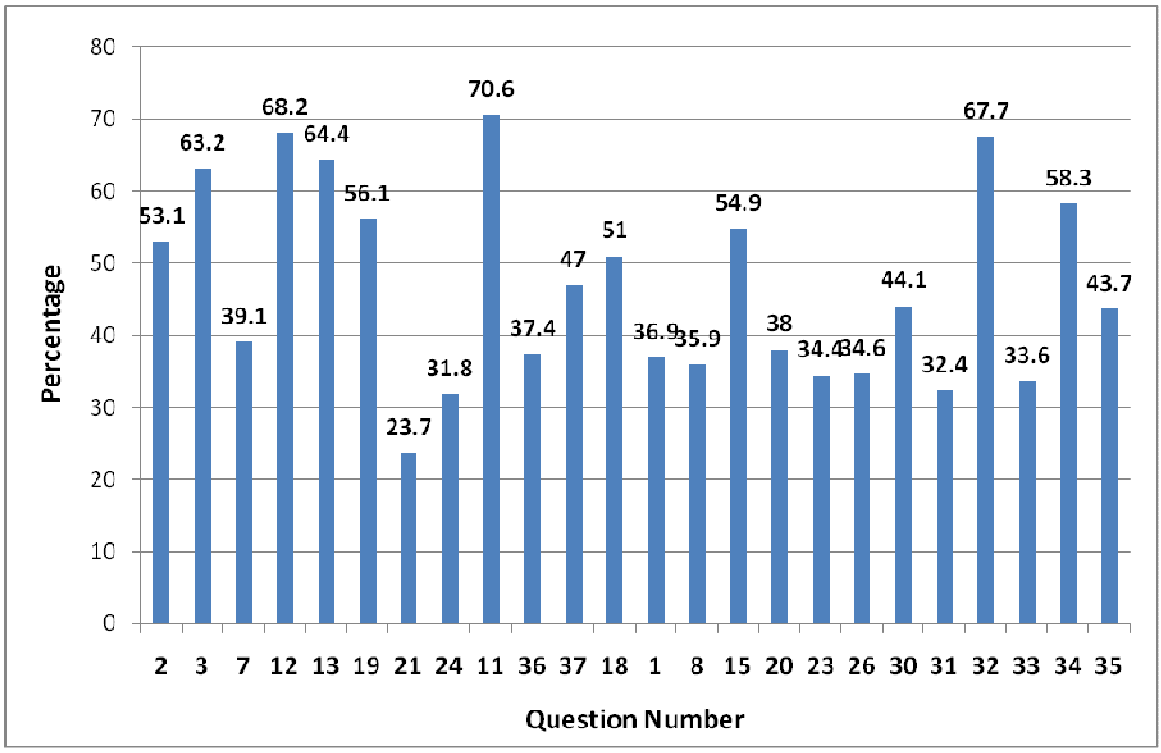


Fig. 3.14: Achievement of competency levels related to knowledge and skills

Achievement of Competency levels related to communication

The percentage of students who has answered correctly the questions related to each competency level under communication is given in Table 3.11

Table 3.11 indicates the achievement of competency levels related to communication.

Table 3.11: Achievement of competency levels related to communication

Competency level	Question no.	Percentage
3.2 Manipulates units and parts of units under division	9	26.7
3.3 Manipulates decimal numbers under the mathematical operations of multiplication and division.	4	70.4
6.2 Expands a power of a negative integer and finds the value	5	60.1
8.2 Fulfils daily needs by investigating the surface area of various solids.	16	18.7
13.2 Describes various locations in the environment using scale drawings	22	62.4
14.1 Simplifies algebraic expressions by removing brackets and finds the value by substitution.	25	45.8
18.1 Uses the relationships between two quantities that can be used to enhance beauty.	28	51.6
20.1 Uses a number line to represent fractions and decimal numbers	29	38.2
26.1 Studies shapes by creating various patterns that can be used to enhance beauty.	39	53.4
30.1 Analyze the various relationships related to sets.	40	53.9

As Table 3.11 indicates that the lowest achievement relates to competency level 8.2. On the other hand, the highest percentage can be seen in relation to competency level 3.3. However, students have been able to perform better in the competency level 30.1 which is higher than the lowest performing competency. Therefore, this analysis implies that the reordering of the competency levels may be necessary.

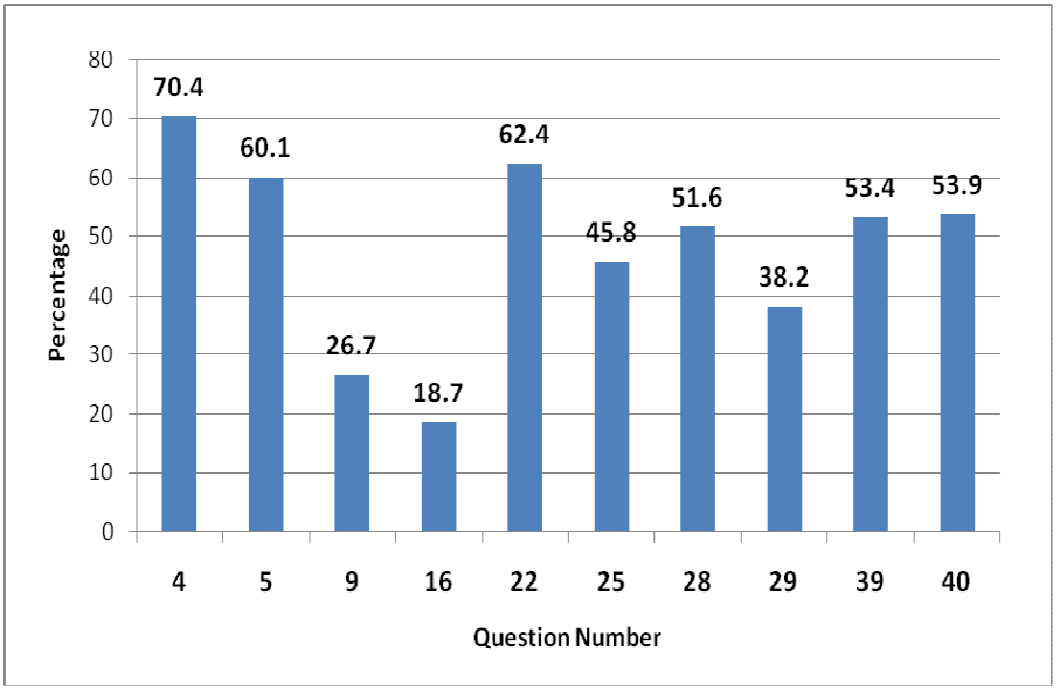


Fig. 3.15: Achievement of competency levels related to communication

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

Table 3.12 indicates achievement of competency levels related to relationships, reasoning and problem solving.

Table 3.12: Achievement of competency levels related to relationships, reasoning and problem solving

Standard	Competency Level	Q. No	%
Relationships	4.1 Uses ratios in day to day activities	6	56.3
	4.2 Solves problems constructing relationships between two ratios	10	41.5
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	52.9
	17.1 Uses linear equations to solve problems	27	38.4
Reasoning	27.2 Constructs triangles	38	59
	28.1 Represents data such that comparison is facilitated	14	64.8

As Table 3.12 indicates students' performance in all three standards are similar. The test papers were constructed based on the weightage given to different competency levels in the curriculum. Therefore, it could be seen that the weightage given to relationships, problem solving and reasoning is less compared to knowledge and skills.

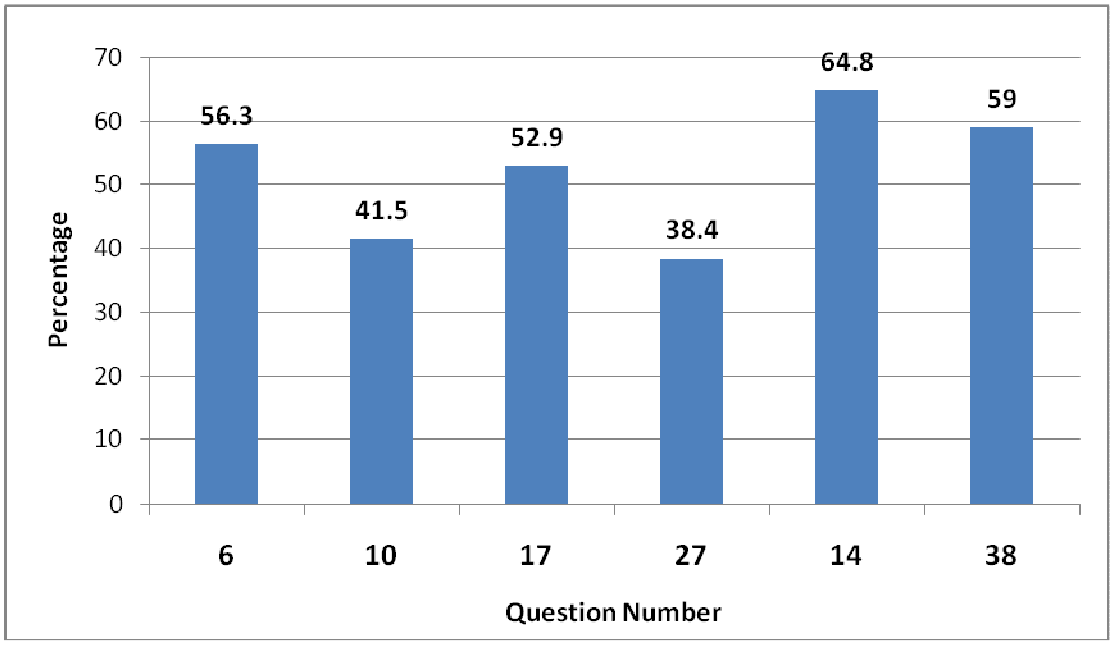


Fig. 3.16: Achievement of competency levels related to relationships, reasoning and problem solving

As Fig. 3.16 displays that students' performance in these standards is average. On the other hand these are skills essential to be developed in a knowledge society. However, the curriculum does not provide adequate opportunities to develop these skills.

Facility index values for the mathematics paper

The mathematics paper consisted of forty supply type questions.

Fig. 3.17 displays the facility values for questions 1-40.

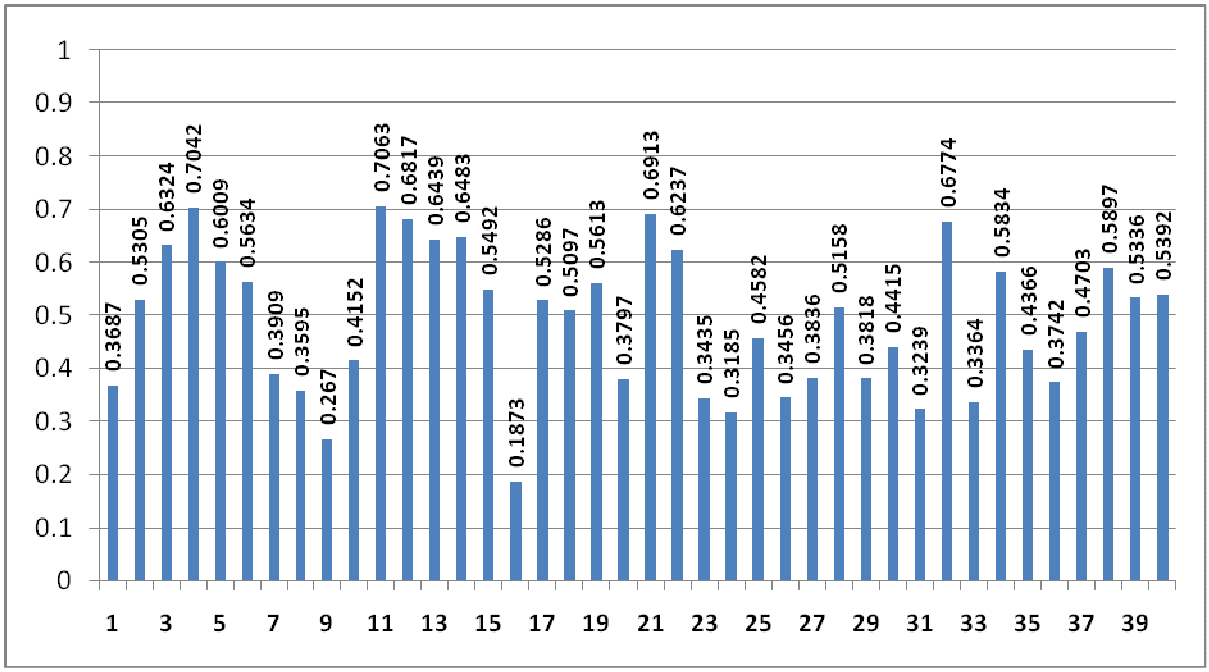
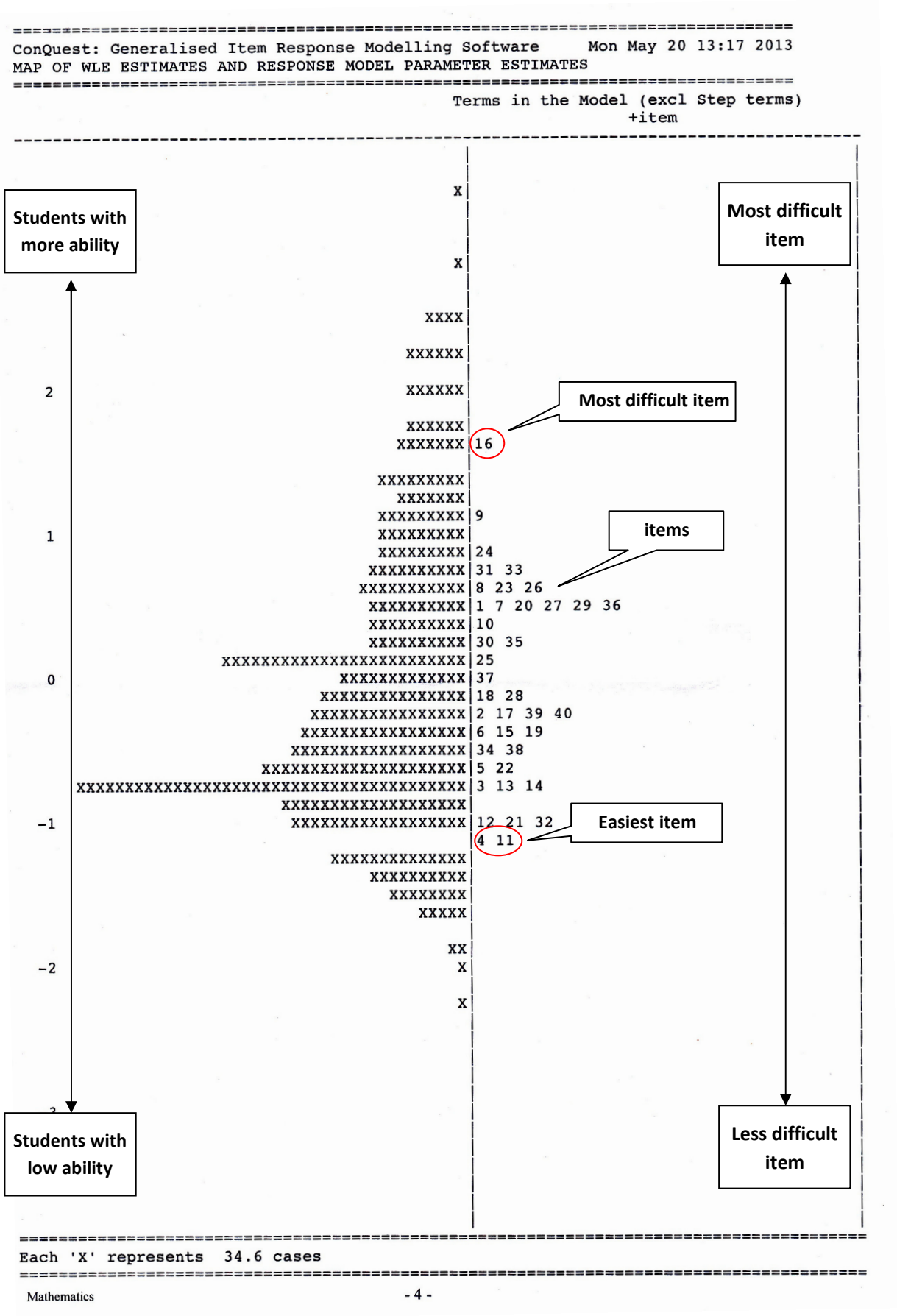


Fig.3.17: Facility index value for mathematics

According to Fig. 3.17 the facility values ranges from 0.1873 to .7063.

Disparity in achievement seen through item analysis

The Item Person Map (IRT) given on pg. 48 displays the range of difficulty of the test items as well as the range in student ability. According to the map there are approximately 7958 students whose abilities are higher than the most difficult item. On the other hand there is much greater number of students whose abilities are lower than the easiest item. Therefore, this analysis confirms, the disparity in achievement which has been already discussed.


ConQuest: Generalised Item Response Modelling Software Mon May 20 13:17 2013
MAP OF WLE ESTIMATES AND RESPONSE MODEL PARAMETER ESTIMATES
Terms in the Model (excl Step terms)
+item
Students with more ability
Most difficult item
Most difficult item
items
Easiest item
Students with low ability
Less difficult item
2
1
0
-1
-2
16
9
24
31 33
8 23 26
1 7 20 27 29 36
10
30 35
25
37
18 28
2 17 39 40
6 15 19
34 38
5 22
3 13 14
12 21 32
4 11
Each 'X' represents 34.6 cases

3.8 Summary

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

Further, test items used to assess students' performance were analyzed to assess how far they have been successful in achieving the competency levels identified for grade 8 It could be concluded that there is disparity in achievement of learning outcomes in the learning of mathematics.