Chapter 5
Patterns in Achievement – TIMSS, 2009

5.1 Introduction

The Trends in International Mathematics and Science Study (TIMSS), is the largest study conducted under the auspices of the International Association for the Evaluation of Educational Achievement (IEA). TIMSS compares the teaching and learning in Mathematics and Science at the elementary and secondary school levels, with the aim of informing educators around the world about exemplary practices and outcomes. Approximately 50 countries from all over the world participate in TIMSS (Canada Report, TIMSS, 1999) Although, Sri Lanka is not one of the participating countries, a decision was taken to administer a paper, comprising of TIMSS test items to find out, SriLankan students' performance, in relation to internationally accepted standards.

In the National Assessment of Achievement of Grade 04 students in Sri Lanka – 2007, a paper consisting of twenty five items, selected from the Mathematics test items from TIMSS was administered. These items were selected to suit the Sri Lankan curriculum, and were translated to Sinhala and Tamil, the two First languages. In the 2009 study, TIMSS Mathematics question paper, as explained in chapter2, consisted of forty items selected from the earlier released TIMSS items (in 1995, 2003 and 2007-published in February, 2009), to suit the Sri Lankan grade 4 Mathematics curriculum.

The purpose of this chapter is to present the achievement patterns of students in "TIMSS" Mathematics paper. Since, the two papers administered in 2007 and 2009 are different, a comparison between the two points of time will not be possible.

Student performance in the Sri Lankan version of "TIMSS," would first be analyzed in relation to Island wide performance by medium of instruction, school type, location, and gender.
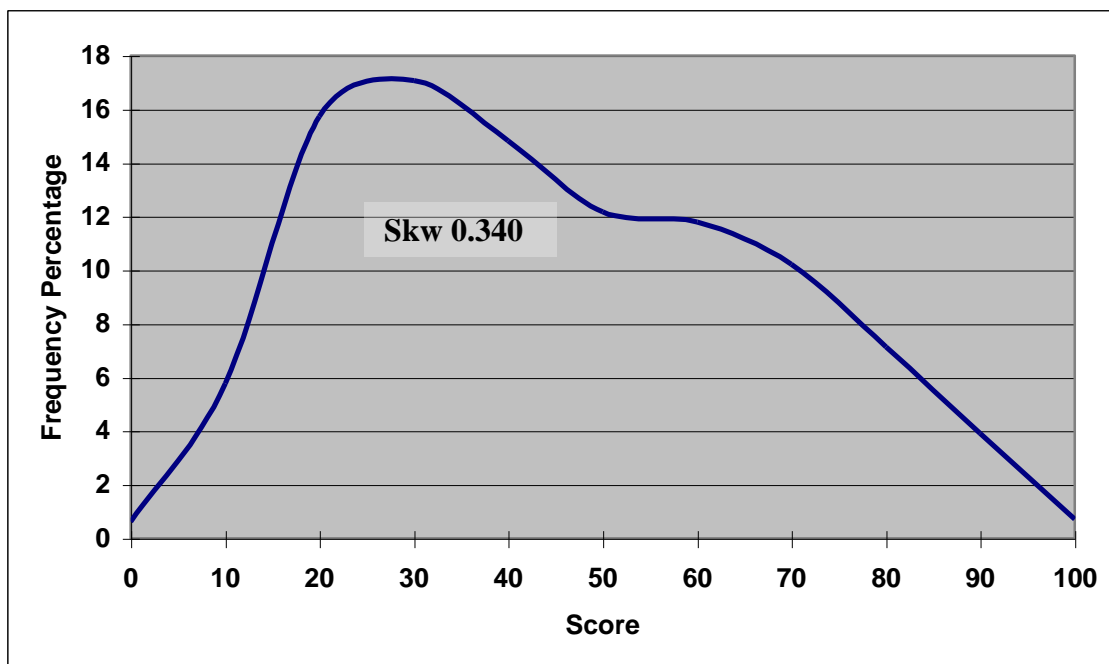
5.2   Island wide performance

Figure 5.1: All Island performance in "TIMSS" -2009

The majority of the students Island wide has obtained low scores in "TIMSS". This low performance is shown through the positively skewed frequency polygon (Figure 5.1). The highest percentage of students has scored between 01-30.

5.2.1 All Island achievement by medium of instruction

Table 5.1: Summary of achievement by medium of instruction

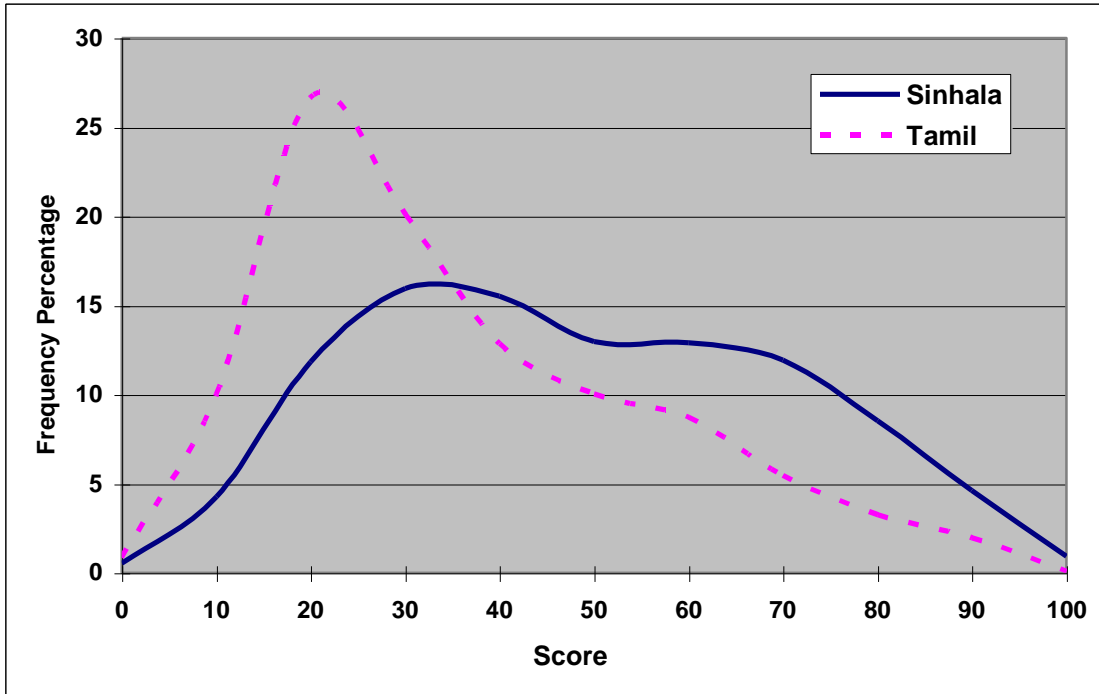| Medium	Mean	Std. Deviation	Std. Error of Mean	Skewness	F	Sig.
Sinhala	43.467	21.6163	.0459	.203	1.901	.000
Tamil	31.431	19.6074	.0696	.792		
Island wide	40.294	21.7613	.0397	.340		

Figure 5.2: All Island achievement in TIMSS by medium of instruction -2009

According to Table 5.1 and 5.2, Sinhala medium students have performed better than the Tamil medium students. However, both frequency polygons are positively skewed, displaying that there are more low achievers than high achievers among both media. The high skewness value for Tamil medium indicates that there is a high percentage of low achievers among the Tamil medium than among Sinhala medium

5.2.2 All Island achievement by school type

Table 5.2: Summary of achievement by school type

School type	Mean	Std. Deviation	Std. Error of Mean	Skewness	F	Sig.
1AB	47.105	21.6071	.0955	.061	3.328	.000
1C	40.304	20.7997	.0711	.298		
Type 2	35.857	20.8046	.0649	.548		
Type 3	42.015	23.0101	.0926	.284		
Island wide	40.294	21.7613	.0397	.340		

There is high variation in average achievement among the School types. However, no such differences can be seen in the SD, which suggest that variation in scores among the school types is similar. While the average performance in the 1C Type schools is similar to the Island mean, the 1AB and Type 2 schools have performed better. While

the variation in marks of the 1AB, 1C and Type 2 is similar among the group, Type 3 school students' mark differences are very high. Moreover, their mean score is also the lowest.
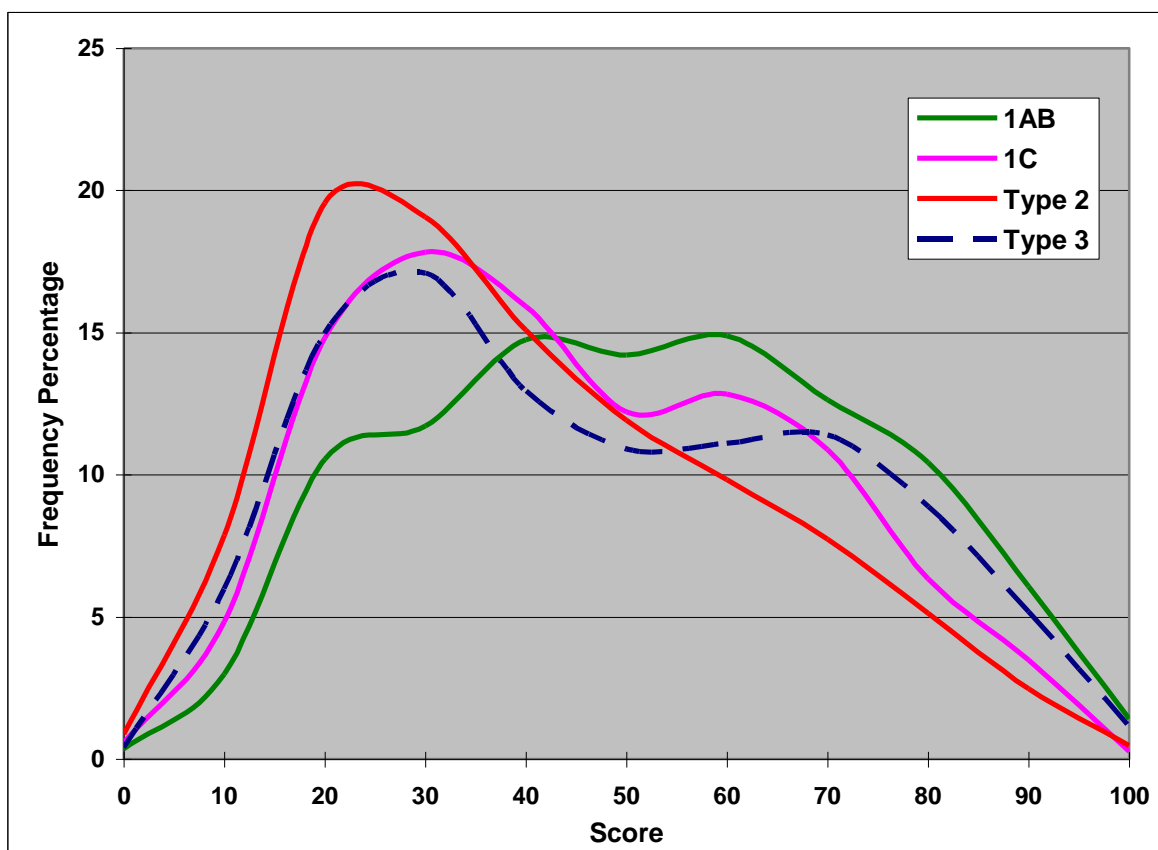

Figure 5.3: All Island achievement in TIMSS by school type -2009

As Figure 5.3 shows, all frequency polygons are positively skewed indicating that the majority of the students are low achievers. Only 1AB schools show a slightly different curve indicating that majority of the students have scored marks in the middle range.

5.2.3 All Island achievement by location

Table 5.3: Summary of achievement by location

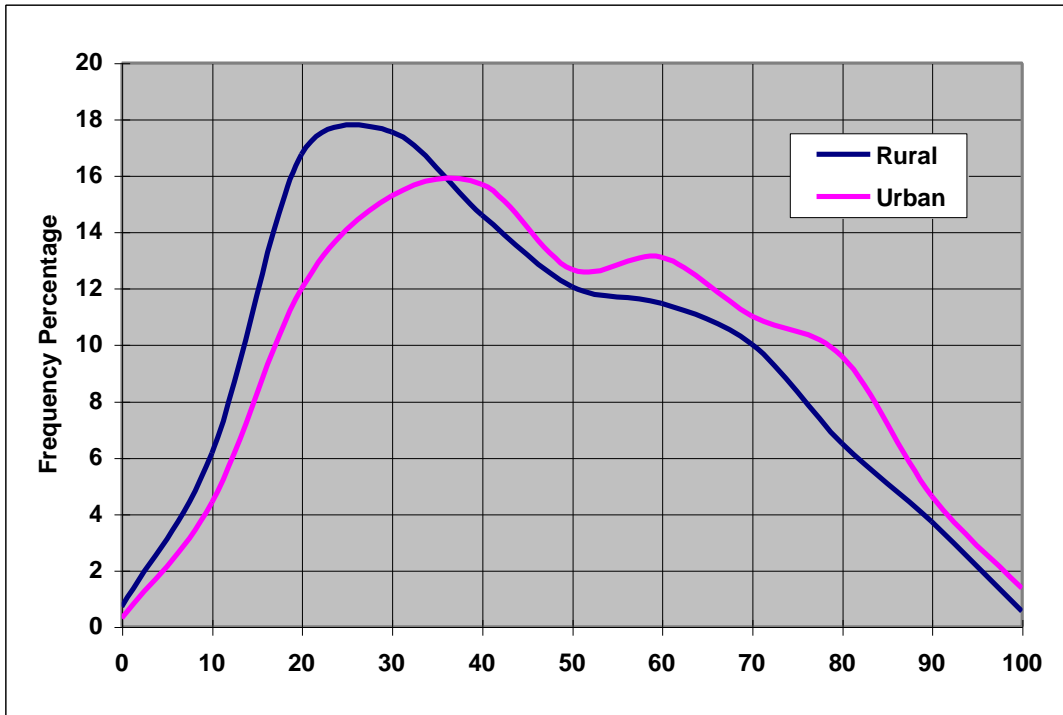| Location	Mean	Std. Deviation	Std. Error of Mean	Skewness	F	Sig.
Rural	39.320	21.6124	.0443	.375	2.270	.000
Urban	43.932	21.9296	.0870	.213		
Island wide	40.294	21.7613	.0397	.340		

Figure 5.4: All Island achievement in TIMSS by location - 2009

There is not much difference in performance between urban and rural students. As shown in Figure 5.4, both polygons are positively skewed. However, there is a slightly higher percentage of low achievers among the rural students.

5.2.4 All Island achievement by gender

Table 5.4: Summary of achievement by gender

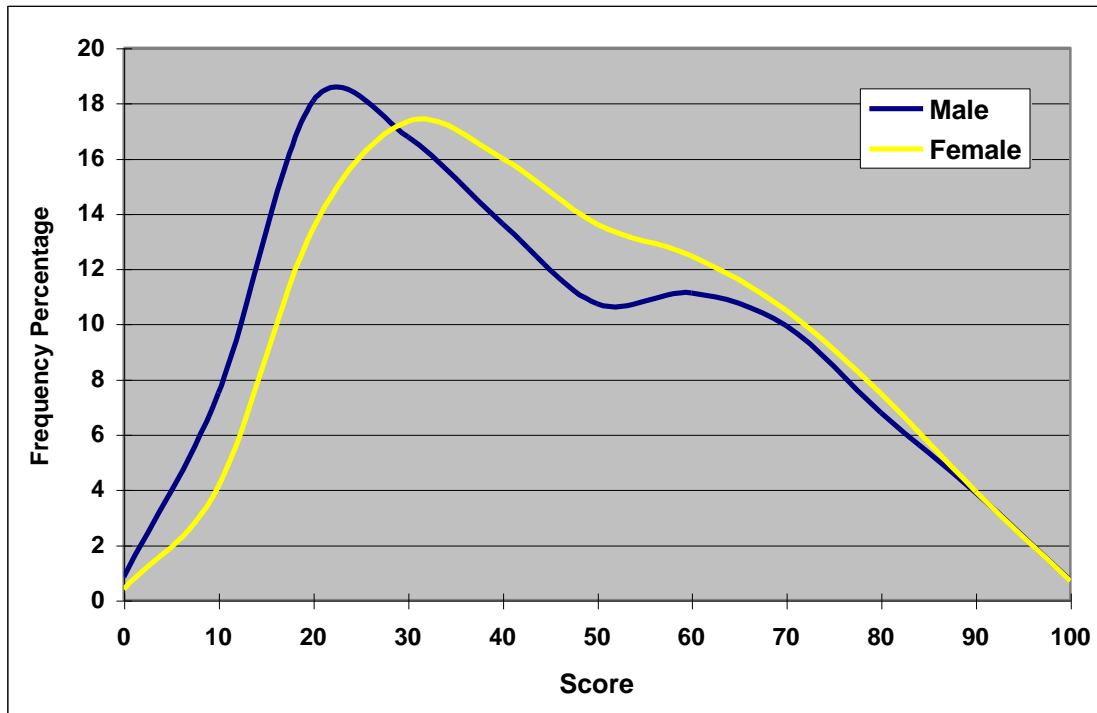| Gender	Mean	Std. Deviation	Std. Error of Mean	Skewness	F	Sig.
Female	41.787	21.0473	.0538	.312	1.466	.000
Male	38.757	22.3689	.0581	.391		
Island wide	40.294	21.7613	.0397	.340		

Figure 5.5: All Island achievement in TIMSS by gender

There is not much difference in performance by gender. Although, female students average performance is higher than the male students (Table 5.4) the standard deviation and the standard error is quite similar. These indicate that the difference among student performance is low and the homogeneity is high. Figure 5.5 also displays positively skewed polygons, indicating that the majority of both boys and girls have scored low marks.

5.2.5 Summary of All Island achievement in 'TIMSS'

The above analysis of All Island achievement indicates that students' performance in "TIMSS" is generally low. There is much disparity between Sinhala and Tamil medium students' performance.

On the other hand, there is not much difference in achievement by medium of instruction, by school type, location and gender.

5.3   Skill analysis

There are clearly defined assessment frameworks, for the TIMSS (International) Mathematics test papers. TIMSS test papers are framed by two organizing dimensions, a content domain and a cognitive domain.

The same Framework was followed in selecting items, for the "TIMSS," in the Sri Lankan Grade Four National Assessment, 2009. This Framework is summarized in Table 5.5

Table 5.5: 'TIMSS' Framework -2009

	Cognitive domain	MCQ	FRQ			
Number	Knowing	6	2	8		
	Applying	6	2	8		
	Reasoning	1	3	4	20	50%
Geometric Shapes & Measures	Knowing	5	1	6		
	Applying	2	3	6		
	Reasoning	1	1	2	13	33%
Data Display	Knowing	1	1	2		
	Applying	0	2	2		
	Reasoning	1	2	2	7	17%
					40	
	Knowing	16	40%			
	Applying	16	40%			
	Reasoning	8	20%			
		40				
MCQ- Multiple Choice Questions						
FRQ - Free Response Questions						

The analysis of students' performance in the "TIMSS", Mathematics paper will be based on this Framework.

The first domain, *knowing,* covers the facts, procedures, and concepts students need to know, while the second, *applying,* focuses on the ability of students to apply knowledge and conceptual understanding to solve problems or answer questions. The third domain, *reasoning,* shows the ability of higher order problem solving skills to encompass unfamiliar situations, complex contexts, and multi-step problems (Mullis et al, 2005).

5.3.1 All Island skill analysis for TIMSS

As Figure 5.5 indicates, there is not much difference in the students' performance in "TIMSS" with respect to achievement of skills. The percentage of students achieving the three different types of skills is the same. However, the percentage of little over 40 percent cannot be considered as satisfactory.

When considering the three skill areas, students' performance is weakest in the "Reasoning" skills.
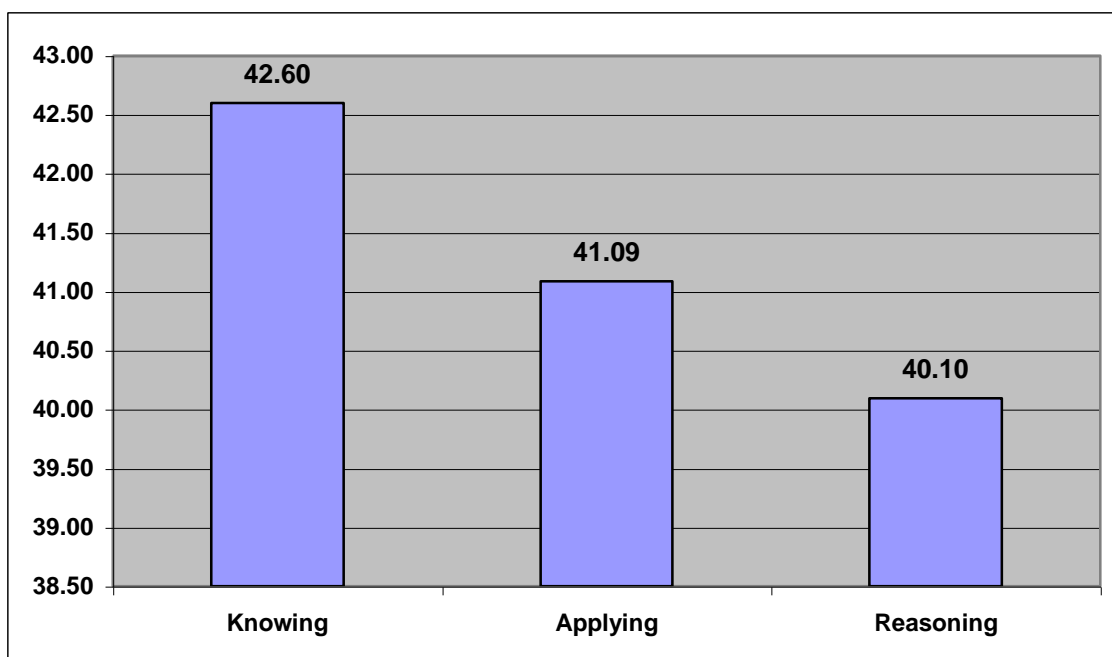

Figure 5.6: All Island achievement in "TIMSS" by skills

5.3.2 All Island skill analysis for TIMSS by medium of instruction

The Sinhala medium students' performance in "TIMSS" is better than the performance of Tamil medium students in all three skill areas (Figure 5.7). In both mediums, the reasoning skills are the weakest. In the Tamil medium, there is not much of a difference between achievement in "knowing" skills and "applying" skills. On the other hand, the Sinhala medium students' achievement is better in "knowing" skills.
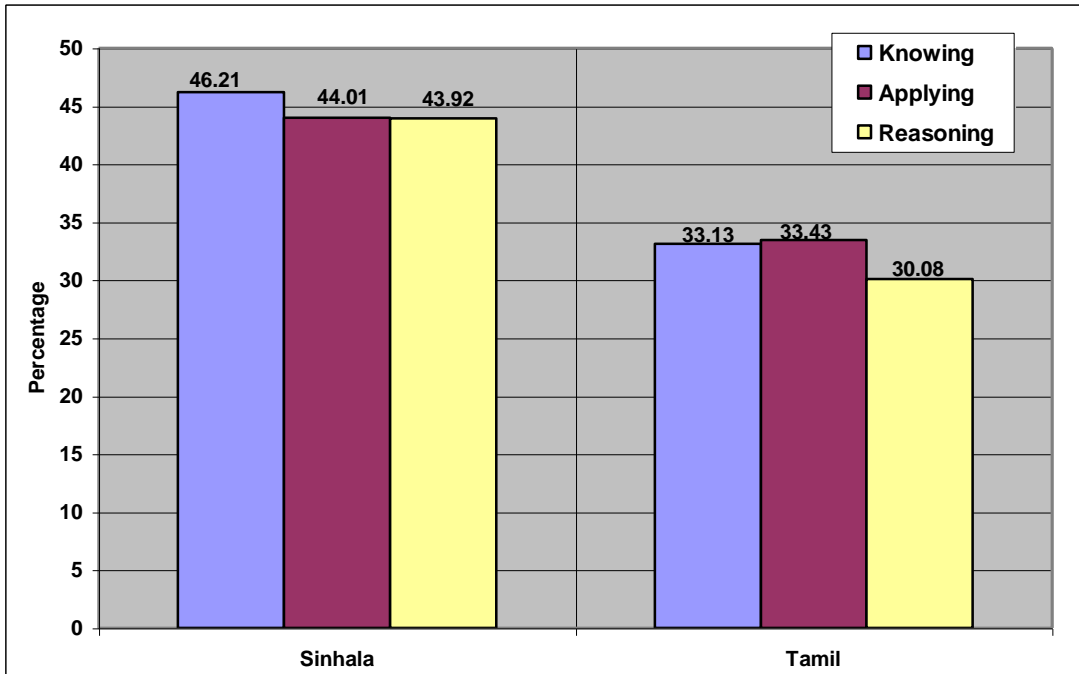
Figure 5.7: All Island skill analysis for TIMSS by medium of instruction - 2009

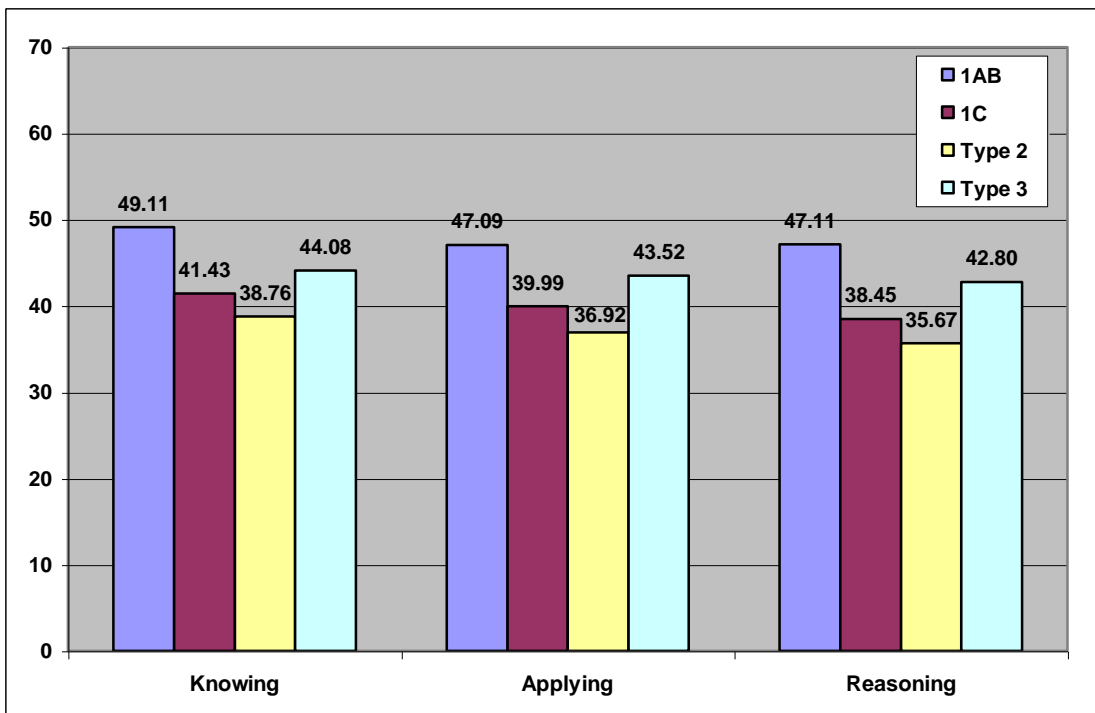## 5.3.3 All Island skill analysis for TIMSS by school type

Figure 5.8: All Island skill analysis for TIMSS by school type- 2009

The same pattern observed in the All Island performance can be seen among school types as well. As Figure 5.8 displays, in all school types, the difference in

achievement of skill types is minimal. However, when compared with the All Island performance (Table 5.1), the performance of the I AB Type schools is higher in achievement of all three skill types when compared with the other school types. On the other hand, performance of the Type 2 schools is lower than the All Island average achievement in all skill types. Further, in all school types, the percentage achieving "knowing" skills is higher than in the achievement of other skills. Except in 1AB Type schools, in all other schools, the lowest achievement is shown in "Reasoning" skills. However, in 1AB schools there is not much difference in the percentage achieving "Applying" and "Reasoning" skills.

5.3.4 All Island skill analysis for TIMSS by location
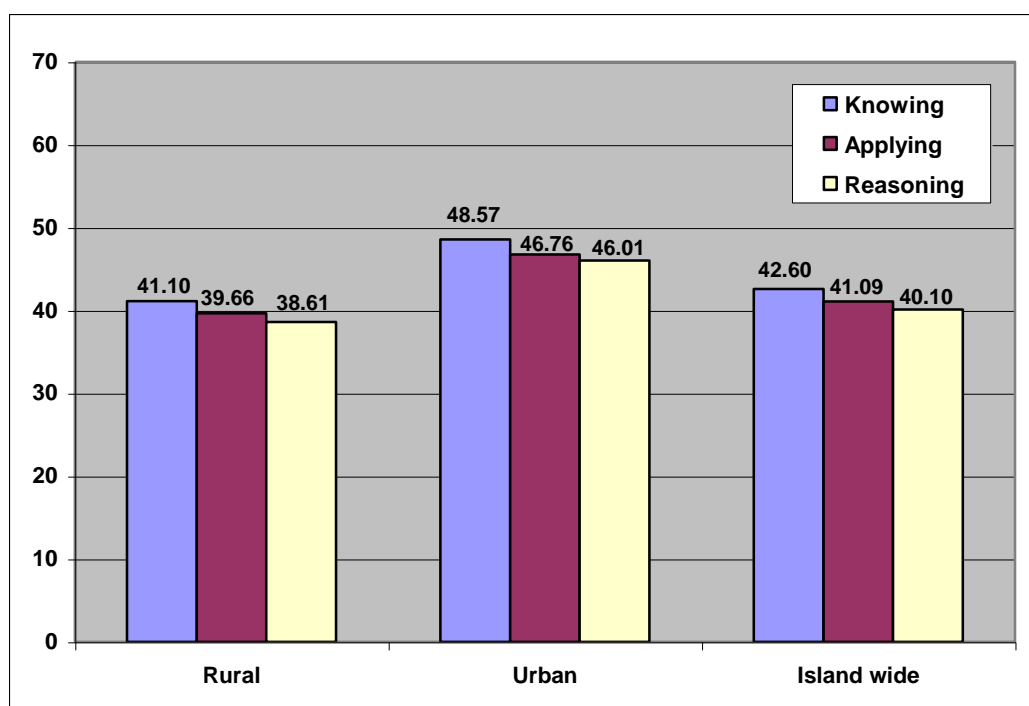

Figure 5.9: All Island skill analysis for TIMSS by location - 2009

Urban students' average achievement is higher than the rural, as well as the All Island average. The same pattern of scoring highest in "Knowledge" domain questions can be seen in both the urban and the rural students' performance. There is not much difference in the mean scores between urban and rural students in relation to "applying" and "reasoning".

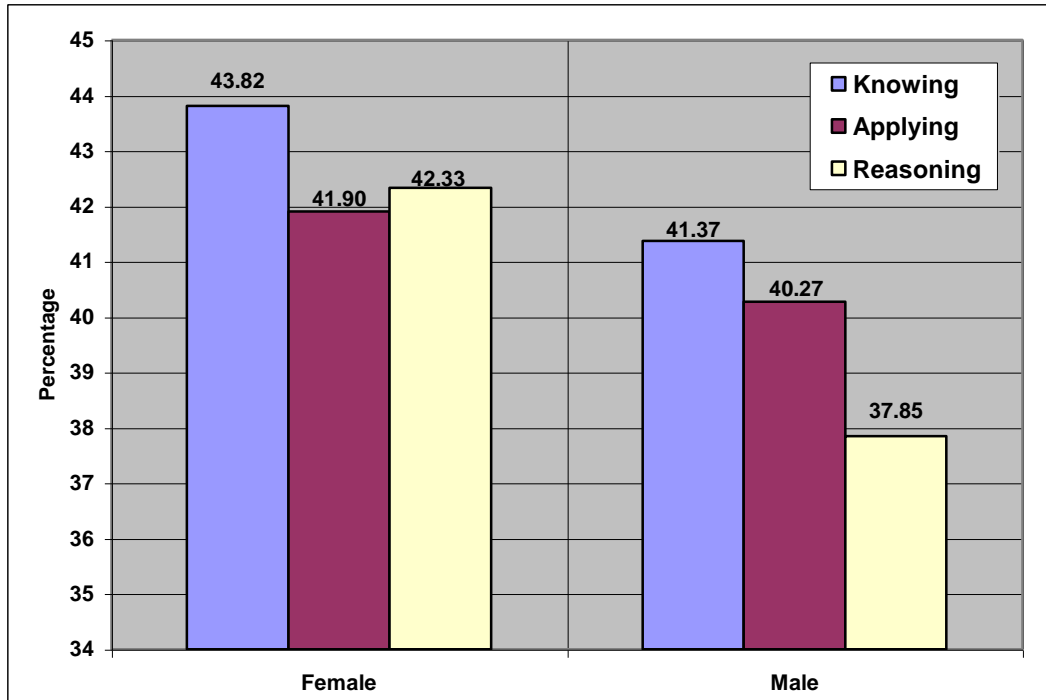## 5.3.5 All Island skill analysis for TIMSS by gender

Figure 5.10: All Island skill analysis for TIMSS by student gender - 2009

Female students have performed better than the male students in achieving all three skill types. The interesting finding is that female students' reasoning skills are slightly higher than the application skills. On the other hand, the male students have scored mostly on knowledge and quite low on reasoning skills.

5.3.6 Summary of achievement of cognitive skills

The discussion in section 5.3 reveals that the achievement of cognitive skills is not very satisfactory. The Sinhala medium students have performed better than the Tamil medium students. While the females' achievement is better than the males, the urban students have performed better. Type 2 schools are the weakest in achieving cognitive skills. Generally, the percentage that has scored on "knowledge" skills is higher than other skills.

5.4   All Island performance in TIMSS by province

Table 5.6: TIMSS statistical interpretation by province

Province	Mean	Std. Deviation	Std. Error of Mean	Skewness	F	Sig.
Central	35.517	21.5383	.1092	.557		
Eastern	32.552	19.8691	.1098	.696		
North Central	42.045	22.7564	.1658	.293		
North Western	45.094	21.8196	.1141	.147		
Northern	37.176	22.2733	.1856	.516	1.3663	.000
Sabaragamuwa	44.726	22.6365	.1363	.223		
Southern	42.051	21.2422	.1107	.244		
Uva	37.607	20.1287	.1370	.454		
Western	42.288	21.1094	.0777	.223		

The interesting finding in relation to the provincial wise distribution of scores is that, the best performance is observed in the North Western province. While the second highest performance is displayed in the Sabaragamuwa province, the Western province which is considered as the wealthiest in terms of resources records the third highest average. It is only these three provinces that have recorded mean scores above the Island mean.
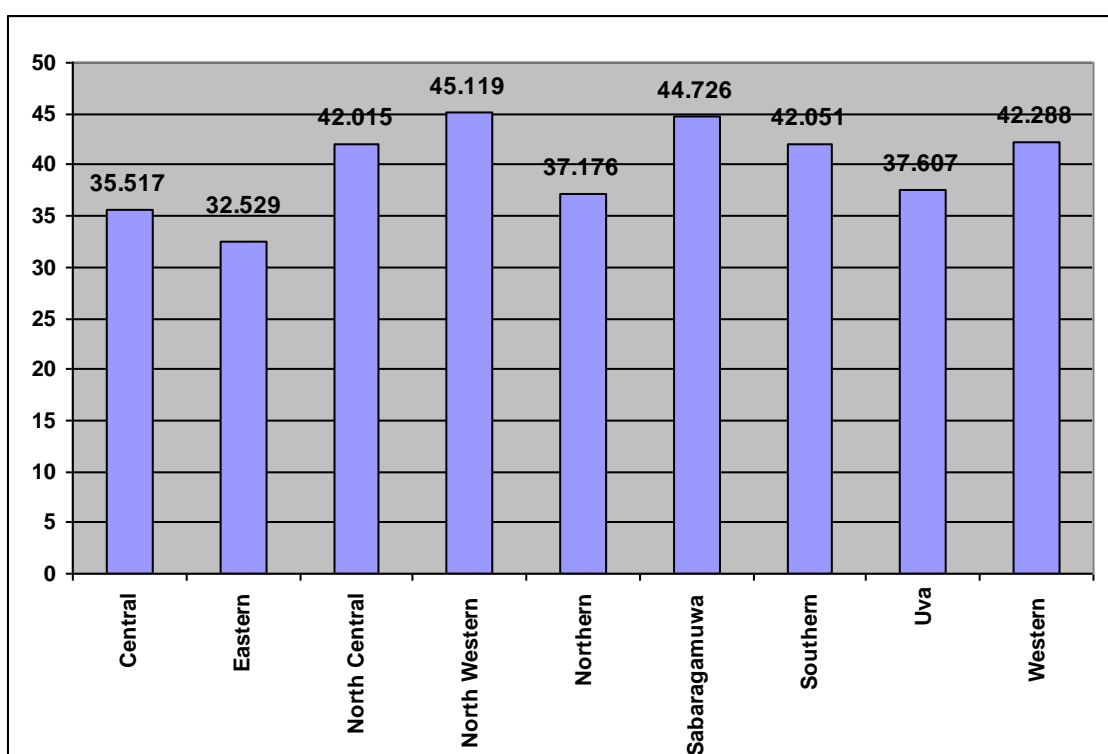

Figure 5.11: Provincial wise mean representation for TIMSS - 2009

5.5 Provincial wise skill analysis for TIMSS

Even though the North Western province recorded the highest mean score, as Table 5.7 and 5.11 display the highest score for the three different cognitive skills are shown by the Sabaragamuwa province.

Table 5.7: Provincial wise skill analysis for TIMSS

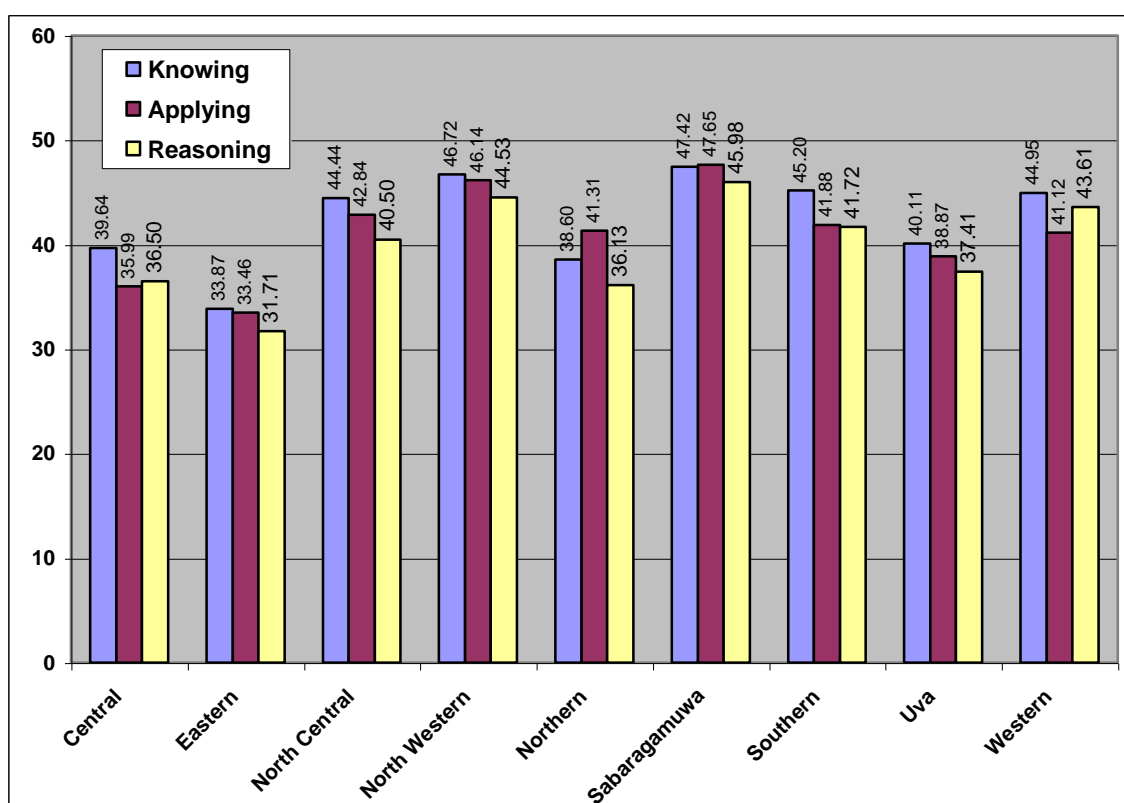| Province	Knowing	Applying	Reasoning
Central	39.64	35.99	36.50
Eastern	33.87	33.46	31.71
North Central	44.44	42.84	40.50
North Western	46.72	46.14	44.53
Northern	38.60	41.31	36.13
Sabaragamuwa	47.42	47.65	45.98
Southern	45.20	41.88	41.72
Uva	40.11	38.87	37.41
Western	44.95	41.12	43.61

Figure 5.12: Provincial wise skill analysis

On the other hand, Eastern province has scored the lowest, in all three skills.

5.6   Overall performance in TIMSS

5.6.1   All Island performance

As Table 5.6 and Figure 5.13 indicate, the majority of the students' marks fall between the range 20 -29, which is not very satisfactory.

On the other hand, 64.1% of the students have scored less than 49 percent. This means that only 36 percent has scored fifty marks or above.

Table 5.8: All Island achievement in TIMSS according to class interval

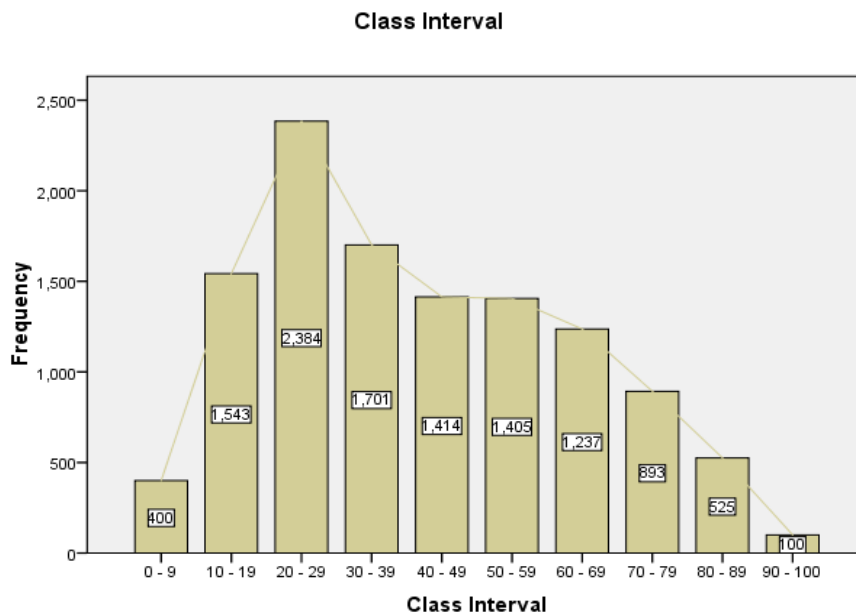|	Frequency	Percent	Cumulative Percent
0 - 9	400	3.4	3.4
10 - 19	1543	13.3	16.7
20 - 29	2384	20.5	37.3
30 - 39	1701	14.7	52.0
40 - 49	1414	12.2	64.1
50 - 59	1405	12.1	76.3
60 - 69	1237	10.7	86.9
70 - 79	893	7.7	94.6
80 - 89	525	4.5	99.1
90 - 100	100	.9	100.0
Total	11602	100.0	

Figure 5.13: Column chart representation for Class Interval

5.6.2 Provincial wise performance

Table 5.9: Provincial wise performance less or greater than 50

| Province	Less than 50	(%)	Greater than 50	(%)	Total
Central	865	70.50	362	29.50	1227
Eastern	1059	78.15	296	21.85	1355
North Central	799	61.18	507	38.82	1306
North Western	761	55.22	617	44.78	1378
Northern	542	66.83	269	33.17	811
Sabaragamuwa	733	54.62	609	45.38	1342
Southern	814	61.53	509	38.47	1323
Uva	867	69.53	380	30.47	1247
Western	1002	62.12	611	37.88	1613
Total	**7442**	**64.14**	**4160**	**35.86**	**11602**
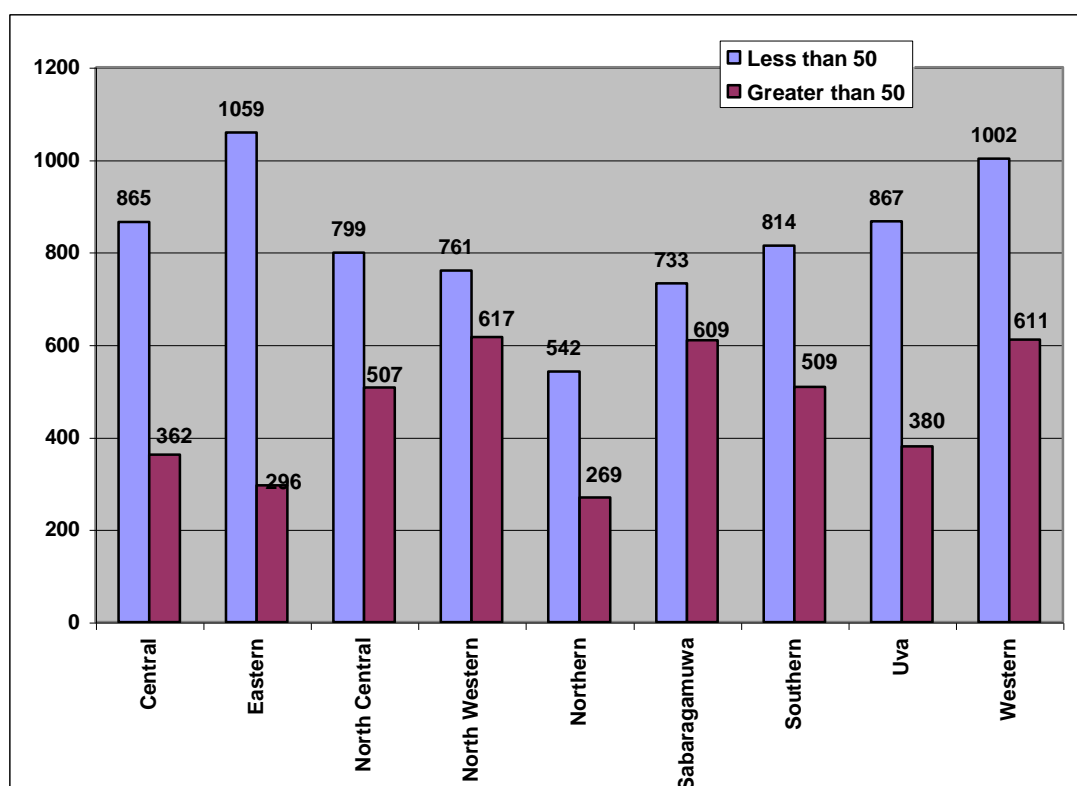
Figure 5.14: Number of students scoring >=50 or less

5.7 Summary

All Island student performance in the "TIMSS", Mathematics paper, administered in 2009 does not reveal a satisfactory level. Only 36% of students Island wide had been able to obtain scores fifty or above.

Provincial wise, Sabaragmuwa province has performed the best with nearly 45% scoring fifty or more marks. This percentage is higher than North Western province and Western province.

Sinhala medium students have performed better than Tamil medium students. While females have performed slightly better than males, the urban students' performance is better than rural students.

The general pattern is that the achievement in knowledge domain questions is higher than in the other two domains.