National Education Research and Evaluation Centre (NEREC)
Faculty of Education, University of Colombo.

National Report

National Assessment of Achievement of Grade 08 Students in Sri Lanka - 2012

World Bank and Ministry of Education Assisted Publication


Ministry of Education


Faculty of Education
University of Colombo


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Principal Writer: Marie Perera

Data Analysis: P.K.J.E. Nonis
R.D.C. Niroshinie
Gayathri Abeygunasekara (Department of Examinations)

Data Processing: Nayanie Gamaethige
M.H.S.F. Mahsanie
Nadee Gamaethige
K.P. Ganga Udeshika
Anuradha S. Seneviratne
Chathuri Weerasinghe
Varuni Gurugamage
K.M. Kanishka Karunanayake
Jayathu Amarasinghe
Dinupa Thennakoon
Kanthi Amarasinghe
W.C. Gamlath

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Prof. M. Karunanithy
Director
National Education Research and Evaluation Centre (NEREC)

Research Team

M. Karunanithy

Marie Perera

W. Chandradasa

P.K. J.E. Nonis

Kapila Bandara

R.D.C. Niroshini

Jeevani Herath

Lalitha Kumari

Sulochana Neranjani

Test Construction Team

Overall coordination - W. Chandradasa

Mathematics

Prasadi Jasinghe	-	University of Colombo
M.N.P. Peiris	-	Dept. of Mathematics, National Institute of Education
N.W.P. Mala Irangani	-	St. Pauls Grils School, Milagiriya
P.M. Walpita	-	Sirimavo Bandaranaike Vidyalaya, Colombo 07

Science

Kumudu Seneviratne	-	University of Colombo
L.K. Waduge	-	Dept. of Science, National Institute of Education
A.W.A. Siriwardana	-	Retired ISA
D.S. Gamage	-	Ananda Balika Vidyalaya, Pitakotte

English

Marie Perara	-	University of Colombo
E. Sulochana Neranjani	-	University of Colombo
N.D. Karunaarachchi	-	RESC, Bolawalana

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Executive Summary

National Assessment of learning outcomes has become an important component of education policy analysis and programme monitoring in Sri Lanka. The National Education Research and Evaluation Centre (NEREC) of the Faculty of Education, University of Colombo has been the forerunner in conducting these assessments.

NEREC has conducted National Assessment of Learning Outcomes both at primary as well as at secondary level. At secondary level National Assessment of learning outcomes were conducted at Grade 8 in 2005 and 2008. This report presents the findings of a National assessment conducted in grade 8 for English, mathematics and science in the year 2012.

The national assessment of learning outcomes of 2012 used new instruments to test cognitive skills in English, mathematics and science in keeping with the new competency based curriculum which was introduced in 2009 in grade 8. Therefore, there is a need to find out whether the introduction of the new curriculum had an impact on the learning outcomes.

However, it is not possible to compare the findings of this assessment with the previous assessments as new test items have been constructed. Instead, the 2012 national assessment will serve as the baseline for monitoring the level and distribution of learning outcomes overtime.

The national assessment covered the entire country and the sample was drawn to enable analysis by province, type of schools, gender and medium of instruction. It also collected information pertaining to correlates of achievement through administering questionnaires to students, teachers, principals and parents. However, this report will be restricted only to the analysis of the achievement of learning outcomes related to cognitive skills. The background information would be discussed in a separate report.

Patterns in learning achievement was discussed using measures of central tendency -Mean and median, Skewness values of the distribution, cumulative percentages

and percentile ranks. In addition, graphs – frequency polygon and box plots were also used

Data gathered through the achievement tests were analyzed on a national and provincial basis in relation to medium of instruction, school type, and gender.

The findings revealed that there is disparity in achievement in all three subjects in relation to provincial performance, school type, gender and medium of instruction.

It was also revealed that the competency based curriculum needs to be revisited.

Chapter One

Introduction to the Study

1.1 Background

A world wide emphasize on the need for timely and credible data on student learning, that may inform the design of effective mechanisms to improve educational outcomes, rather than only on education inputs could be seen. Consequently there is a dramatic and global growth in the use of learning assessments (Kamens & McNeely, 2010).

This shift from an emphasis on education inputs to assessment of quality was influenced by the Jomtien Declaration (*World Declaration on Education for All* 1990). Article 4 of the Jomtien Declaration states that the focus of basic education should be "on actual learning acquisition and outcome, rather than exclusively upon enrolment, continued participation in organized programs and completion of certification requirements" (*World Declaration on Education for All* 1990,p. 5). Another reason for this shift in focus was the Dakar Framework for Action (UNESCO 2000), which also highlighted the importance of learning outcomes. One of its goals was, by 2015, to improve "all aspects of the quality of education . . .especially in literacy, numeracy, and essential life skills" (UNESCO 2000, iv, 7).

As a member country agreed on the World Declaration on Education for All, Sri Lanka strived to enhance the quality of education by implementing procedures that will provide information on students' learning. One such measure adopted was monitoring student achievement through national assessments at different Grade levels conducted by the National Education Research and Evaluation Centre (NEREC). A national assessment "is designed to describe the achievement of students in a curriculum area aggregated to provide an estimate of the achievement level in the education system as a whole at a particular age or grade level" (Kellaghan, Greaney and Murray. 2009, p.xi).

The purpose of a national assessment is not only to provide information on the state of education, but also that information should lead to improvement in student achievement by systematically feeding into decision making.

Promoting "Equity" and "excellence" and reducing disparities in the education system is one of the main focuses of the Government of Sri Lanka. In this regard a comprehensive medium term Education Sector Development Framework and Programme (ESDFP) from 2006–2010 was developed. This "framework incorporates a blend of bottom - up and top – down supportive planning process for the development of the primary and secondary education system" (Pg.2) One of the Major areas identified in this Framework is "improving the quality of basic and secondary education" and "increasing equitable access to basic and secondary education" (p.2) This Framework further emphasizes that equitable access means that "each child can access an education appropriate to his /her individual learning potential and needs" (Pg.4). The plan for the second stage of the ESDFP for the period 2012 -2016. The ESDFP (2013 -2017) is an extension of the second stage policy framework and comprises three policy themes as follows.

Theme 1: Increase equitable access to basic and secondary Education
Theme 2: Improve the quality of primary and secondary education
Theme 3: Strengthen governance and service delivery of education

In addition it provides a foundation theme and a crosscutting activity to ensure the achievement of policy themes related results and outcomes.

The foundation : Overarching education sector development rolling plan : and
Crosscutting activity : Results – based monitoring and evaluation. (p.1)

Under theme 2 – Improving Quality of primary and secondary Education, National Assessment of Learning Outcomes are expected to be utilized for program development.

1.2 National Assessment Studies conducted in Sri Lanka

National Assessment of Learning Outcomes has become an important component of education policy analysis and programe monitoring in Sri Lanka. The National Education Research and Evaluation Centre (NEREC) of the Faculty of Education, University of Colombo has been the forerunner in conducting these assessments.

NEREC has conducted National Assessment of Learning Outcomes both at primary as well as at secondary level. At primary level, assessments were conducted at Grade 4 in 2003, 2007 and 2009 respectively. At secondary level National Assessment of Learning Outcomes were conducted at Grade 8 in 2005 and 2008. The results from these studies, it is claimed provide "useful information for analysis of policy and the monitoring of the progress of the education system" (Aturupana, 2009, p.31).

1.3 Rationale for the present study

This report presents the findings of a National Assessment conducted in grade 8 for English, Mathematics and Science.

A national assessment has multiple purposes. According to Kellaghan and Greaney 2000), all national assessments seek answers to one or more of the following questions:

- How well are students learning in the education system (with reference to general expectations, aims of the curriculum, preparation for further learning, or preparation for life)?
- Does evidence indicate particular strengths and weaknesses in students' knowledge and skills?
- Do particular subgroups in the population perform poorly? Do disparities exist, for example, between the achievements of (a) boys and girls, (b) students in urban and rural locations, (c) students from different language or ethnic groups, or (d) students in different regions of the country?
- What factors are associated with student achievement? To what extent does achievement vary with characteristics of the learning environment (for example, school resources, teacher preparation and competence, and type of school) or with students' home and community circumstances?

- Are government standards being met in the provision of resources (for example, textbooks, teacher qualifications, and other quality inputs)?
- Do the achievements of students change over time? This question may be of particular interest if reforms of the education system are being undertaken. Answering the question requires carrying out assessments that yield comparable data at different points in time
  (Kellaghan and Greaney, 2008, p.9).

The national assessments conducted in grade 8 in 2005 and 2008 reveal that on average there is an improvement in achievement levels of Grade 8 students in Science and Mathematics. The achievement of the English language, which is the second language of the students was not assessed. While there was an improvement in the achievement of learning outcomes it was also revealed that there are inequalities in provision of education in relation to provinces, gender, medium of instruction and locality (NEREC, 2008).

Although there is a substantial increase in achievement over the period, the need "for these findings to be supported by further national assessments in the future, in order to reach a reliable and robust conclusion about the magnitude of improvement" (Aturupane, 2009, p.33) has been stressed.

On the other hand, in 2007, a new competency based curriculum was introduced at grade 6 and in 2009 in grade 8. Therefore, there is a need to find out whether the introduction of the new curriculum had an impact on the learning outcomes.

1.4 National Assessment of Learning Outcomes- 2012

The National Assessment of Learning Outcomes of 2012 used new instruments to test cognitive skills in English, Mathematics and Science in keeping with the new curriculum. Therefore, it is not possible to compare with the previous assessments. Instead, the 2012 National Assessment will serve as the baseline for monitoring the level and distribution of learning outcomes overtime.

The national assessment covered the entire country and the sample was drawn to enable analysis by province, type of schools, gender and medium of instruction. It also collected information pertaining to correlates of achievement through administering questionnaires to students, teachers, principals and parents. However, this report will be restricted only to the analysis of the achievement of learning outcomes related to cognitive skills. The background information would be discussed in a separate report.

Chapter 2 of this report will discuss the methodology of the study. Chapters 3-5 will present the findings pertaining to the achievement of cognitive skills in Mathematics, Science and English respectively. The final chapter will discuss the lessons to be learnt and the way forward.

1.5 Summary

A worldwide concern regarding the need to achieve "Education for All" is evident. The challenge before all nations is to ensure that increased access to education is delivered in association with improvements in the conditions of schooling and student achievement levels.

Sri Lanka being a member country that has agreed to the World Declaration on Education for All, has conducted two national assessments of achievement of learning outcomes of grade 8 students with the aim of monitoring and evaluating the quality of its education systems.

Results of the second study show substantial improvements in achievement, while there are still disparities in achievement inter and intra wise provincial level. A new competency based curriculum had been introduced in 2009. Therefore, it is necessary to assess student achievement in order to find out the impact of the new curriculum reforms as well as to provide a baseline for future studies.

Chapter Two

Methodology

2.1 Introduction

As mentioned in chapter 1, the National Assessment of Achievement of Grade 08 Pupils in Sri Lanka was conducted in 2012.

This chapter elaborates the methodology adopted in the 2012 study which was slightly different to the two previous studies conducted in 2005 and 2008.

2.2 Objectives of the study

In accordance with the Education Sector Development Framework Programme (ESDFP) and the Development of Education plan through sector wide approach, two main objectives were identified.

- Assess the performance of students completing Grade 08 in the year 2012 in Sri Lanka.
- Identify the background information which correlates with students' performance.

2.2.1 Specific objectives of the study

I. Assess the extent to which the expected learning outcomes have been achieved by students.
II. Identify the areas of strengths and weaknesses of students' achievement in relation to subject content and related skills.
III. Examine whether disparities prevail in achievement in relation to provinces, school type, medium of instruction, and gender.
IV. Investigate background factors that correlate with achievement levels of students.

In section 2.3, the sampling methodology will be discussed.

2.3 Sampling methodology

The sampling methodology used for this study, was based on an instructional manual designed by the Statistical Consultation Group, Statistics Canada in Ottawa. It has been recommended by the World Bank in its series, *Assessment of Educational Achievement in Developing Countries* and has been used for evaluation purposes since 2007 in international studies such as the IEA Study of Reading Literacy, the IEA Progress in International Reading Study (PIRLS), and Trends in International Mathematics and Science Study (TIMSS).

In the previous grade 08 studies the sampling methodology was based on SAMDEM (Sample Design Manager), designed by the UNESCO International Institute for Educational Planning. However, in this methodology the demarcation between implicit and explicit strata was not very clear.

Further, in using SAMDEM the cluster size was 20 per school. When the number of students in a class was less than twenty, pseudo schools were used in the sample. Pseudo schools were formed by joining two schools where number of students was greater than 10 but less than 20 and geographically closed to each other. In the 2012 study, after excluding the extremely small schools (as explained in 2.3.3) intact classes have been used irrespective of the number of students in the class.

Selection of the sample of schools and the sample of students will be discussed next.

2.3.1 Desired target population

The target population of the study has grade-based definition. Therefore, students who have completed eighth grade in the education system of Sri Lanka in the year 2012 were considered as the desired target population of this study.

2.3.2 Sampling frame and elements of the sampling frame

Sampling frame is the list of ultimate sampling entities. Latest updated school database available at the Ministry of Education-Sri Lanka (the school database for the year 2010 June) was the sampling frame used for the study.

Although private schools also provide primary and secondary education they are not controlled by the government. In addition, there are a few international schools which also provide primary and secondary education. However, these two categories of schools are not included in the sampling frame. Accordingly, as Table 2.1 indicates the desired target population of the study was 308498 pupils who completed grade eight in 2012 from 5766 government schools that were listed in the sampling frame.

However, in selecting the final sample certain schools and consequently number of students had to be excluded from the population.

2.3.3 School level exclusions

Extremely small size :

The schools that consist of less than 10 students in grade 06 of the available MOE database (2010 June) was considered as extremely small size schools. Such schools had been excluded from sample in the previous study as well. Most of these schools belonged to Type 3 and even if there were classes up to grade 8 in these schools multi grade teaching took place. Table 2.1 illustrates school level exclusions by provinces.

As a result of the exclusion of 3.4% of extremely small schools from the desired target all island *school population*, 1.4% of the desired target all island *student population* was also excluded.

Table 2.1: School level exclusions by Provinces

Province	Number of Schools			Number of Students		
	Desired target Population	excluded	% excluded	Desired Target Population	excluded	% excluded
1. Western	935	17	1.82	73704	594	0.81
2. Central	814	36	4.42	39424	619	1.57
3. Southern	695	13	1.87	38872	388	1.00
4. Northern	437	15	3.43	19940	401	2.01
5. Eastern	618	38	6.15	32023	993	3.10
6. North Western	738	9	1.22	36806	170	0.46
7. North Central	433	15	3.46	18816	204	1.08
8. Uva	511	28	5.48	21169	493	2.33
9. Sabaragamuwa	585	25	4.27	27744	526	1.90
All island	5766	196	3.40	308498	4388	1.42

2.3.4 Defined target population

After excluding schools from the desired target population, remaining schools can be defined as the "Defined Target Population".

Table 2.2: Illustrates the defined target population by provinces

Province	Defined Target School Population	Defined Target Student Population
1. Western	918	73110
2. Central	778	38805
3. Southern	682	38484
4. Northern	422	19539
5. Eastern	580	31030
6. North Western	729	36636
7. North Central	418	18612
8. Uva	483	20676
9. Sabaragamuwa	560	27218
	5570	304110

2.3.5 Sample design – procedure

The sample procedure has a multi stage approach. Multi stage sampling is a strategy whereby the final sample is derived through a series of stages.

In the first stage, schools were selected for the sample. Schools were selected within strata with Probability Proportional to Size, without replacements. *Probability Proportional to Size Sampling* (PPS) is a sampling technique, commonly used in multistage cluster sampling, in which the probability that a particular sampling unit will be selected in the sample is proportional to some known variable (Ross, K.,2004). Then in the second stage a group of students was selected from the sampled schools. Cluster sampling approach was the strategy used for selection of students from the grade 08 classes. This means that an entire grade 04 class from each sampled school was selected.

In selection of the sample, the present study as in the two previous studies, the province was taken as the main stratum (explicit stratum). The rationale for selecting the province as the explicit stratum is that in the Sri Lankan context education being a devolved subject the Provincial Education Ministries have a key role in planning, implementing and monitoring educational plans. Medium of instruction (Sinhala and Tamil) and type of school have been considered as implicit strata, because in Sri Lanka it is used to report students' achievement by medium of instructions and type of school. Accordingly results will be reported for provinces.

Table 2.3 illustrates student sample and school sample per province with other important values which decide the size of sampling error, such as roh and ESS and design effect. Design Effect is the ratio of the variance of the sample mean for a complex sample design to the variance of a simple random sample.

Table-2.3: Calculated student sample and school sample per province

PROV	Data	Total	MOS (average class size)	roh	Design effect	ESS=178 student sample calculated	school sample
Western	students	73110	34.89	0.25	9.47	1686	49
	classes	2095					
Central	students	38805	28.85	0.25	7.96	1417	49
	classes	1345					
Southern	students	38484	30.64	0.25	8.41	1497	49
	classes	1256					
Northern	students	19539	27.79	0.25	7.69	1370	49
	classes	703					
Eastern	students	31030	29.58	0.25	8.14	1450	49
	classes	1049					
North Western	students	36636	30.05	0.25	8.26	1471	49
	classes	1219					
North Central	students	18612	28.28	0.25	7.82	1392	49
	classes	658					
Uva	students	20676	27.56	0.25	7.64	1360	49
	classes	750					
Sabaragamuwa	students	27218	29.71	0.25	8.17	1456	49
	classes	916					
Total						13099	441

Table-2.4 illustrates calculated student sample, allocated student sample and achieved student sample by provinces.

Table 2.4: Calculated, allocated and achieved student sample per each province

Province	Calculated Student Sample	Allocated Student Sample as MOE Student Database	Achieved Student Sample			
			TIMSS	Science	Mathematics	English
Western	1686	1849	1488	1496	1491	1491
Central	1417	1643	1414	1413	1367	1361
Southern	1497	1812	1504	1515	1504	1503
Northern	1370	1384	1281	1269	1288	1291
Eastern	1450	1584	1343	1344	1344	1344
North Western	1471	1663	1465	1471	1434	1437
North Central	1392	1659	1425	1426	1452	1454
Uva	1360	1613	1355	1352	1361	1364
Sabaragamuwa	1456	1778	1580	1588	1573	1572
	13099	**14985**	**12864**	**12874**	**12814**	**12817**

The sampling frame was explicitly stratified by province. With stratification, sample student size can be calculated in advance of sampling procedure so that it will meet the desired level of precision, by each stratum. This ensures that the target population is represented adequately in the sample. Study team was satisfied with 178 as Effective Sample Size (ESS). This would be an accuracy of plus or minus 7.5% at the error limit at the province level. Rate of homogeneity, (roh) 0.25 was calculated from the previous grade 4 assessment study data. Maximum value of roh at the province level was taken for the calculation of the student sample for each province. Assigning a weight to each sampled unit was calculated within the explicit strata.

2.4 Framework for the National Assessment

Four achievement tests were used in this study, as instruments to assess student achievement.

The construct assessed in these studies were the competency levels that were expected to be achieved by grade eight students. Based on these competency levels Table of specifications, similar to Table 2.5 was prepared for each subject to maintain content validity.

Table 2.5: The Content of Achievement Tests and their distribution in the papers

Competency	Competency Level	Content domain	Cognitive domain	Question numbers

In addition to mathematics, science and English language an additional paper was constructed using 40 items selected from the 2011 version of the Third International Mathematics and Science Study (TIMSS) framework. However, the construction and analysis of student performance in the Sri Lankan version of TIMSS would be included in a separate report.

2.5 Achievement tests

The tests in mathematics, science and English Language were designed based on the framework for each subject.

Originally three papers were designed for each subject. These three papers were pre tested in 10 schools.

After the item analysis, one paper for each subject was designed selecting items within the facility values ranging from .4-6.5.

Structure and the number of test items for each paper depended on the subject. While the Mathematics paper consisted only selective type questions, the English language and science papers consisted of both selective and supply type items.

Mathematics test consisted of 40 multiple choice questions with four options. The English Language paper consisted of 40 items of different types such as multiple choice, matching activities, completion of sentences and writing simple sentences.

The Sri Lankan version of TIMSS consisted of 40 items of multiple choice questions and short answer response questions.

2.6 Procedures in administration of the National Assessment 2012

National Assessment of Grade 08 students were administered island wide on 4th and 5th of December, 2012. However in some schools because of the principals' strike, examination scheduled on 4th was conducted on 06th of December. Out of 441 schools,

two schools in Uva Province and one school in Eastern Province did not participate in the test.

Test coordinators

Coordinators to administer the test and collect background information from sample schools were appointed from among Lecturers of the Faculty of Education and students who follow Master of Philosophy, Master of Education and Post Graduate Diploma in Education courses, lecturers and trainee teachers from Colleges of Education and Project officers from National Institute of Education. To assist them, experienced teachers from the same schools were appointed with the consent of principals. Coordinators' contribution in the process of test administration and other activities involved were very much appreciated.

Training workshop for coordinators

Training workshop for coordinators was organized in two phases. A team representing NEREC visited the provinces such as North Central, Northern and Eastern and conducted workshops at Anuradhapura Polonnaruwa, Vavuniya, Killinochchi and Trincomalee zonal offices and Colleges of Education Jaffna and Batticaloa. Test papers and other relevant documents were handed over to all coordinators with necessary instructions.

The second phase of the training workshops was organized at the NEREC on 28th, 29th and 30th of November, 2012. Coordinators from Central, Southern, Western, North Western, Subragamuwa and Uva Provinces participated in these sessions. Test papers and other relevant documents with necessary instructions were handed over to them.
All coordinators were advised to meet the principals and the school coordinators of sample schools on 3rd of December to do necessary prior arrangements with regard to test administration and to distribute parents' questionnaires. Background information in relation to teachers, students and parents were collected on 4th and 5th.

Given below are some of the measures that were adopted in the 2012 study which were expected to increase the reliability of the assessment.

- The tests were administered on two week days.
- In order to better monitor the administering of the tests, in the 2012 study 438 independent coordinators were appointed to the 438 examination centers.
- As mentioned above, the coordinators had to complete a journal in which they had to provide information regarding the conduct of the examination and the collection of other relevant background information.

Return of answer scripts and other documents

Coordinators from Central, Southern, Western, North Western, Subragamuwa and Uva Provinces handed over the answer scripts and other documents at the NEREC from 08th to 20th December. A team from NEREC visited the North Central, Northern and Eastern provinces to collect answer scripts and other documents from 18th to 23rd December.

2.7 Analysis of data

Data gathered through the achievement tests were analyzed on a national and provincial basis. In order to minimize the effect of the discrepancy between the expected and the achieved sample, data was weighted.

Patterns in learning achievement was discussed using Measures of central tendency (Mean, Standard Deviation and median) error of mean, Skewness, cumulative percentages and percentile ranks. In addition, graphs – frequency polygon and box plots were also used.

2.8 Summary

The National Assessment of Achievement of grade 08 pupils of Sri Lanka in the year 2012 was conducted with the main objective of examining how far equity is promoted in the country by enabling all children to access and complete basic education.

This chapter elaborated the specific objectives of the study, sampling procedures and the frame work of the assessment.

The next three chapters will present the data pertaining to student achievement in relation to the three subjects – mathematics, science and English language.

Introduction to Chapters 3 – 5

In chapters 3-5 data pertaining to achievement of learning outcomes in relation to mathematics, science and English language would be presented. In each chapter the main objective would be to identify patterns in achievement in relation to providing equal opportunities in Education.

The patterns in achievement will first be presented at all island level to get an overview of the students' achievement in the relevant subject. As discussed in Chapter 2, the explicit strata in the 2012 study is the province. The implicit stratum are the gender, school type and medium of instruction. Thus, Student achievement will next be presented in relation to province. This would be followed by achievement in relation to gender, school type and medium of instruction.

In order to discuss the distribution of achievement at National level, three indicators are used. They are:

- Measures of central tendency -mean and median
- Skewness values of the distribution
- Measures of relative position -cumulative percentages and percentile ranks,
- Graphs – frequency polygons and box plots

The nature of the distribution of scores provincial wise reveals certain patterns. These patterns are discussed using the following indicators,

- Measures of central tendency -mean and median
- Skewness values of the distribution
- Measures of relative position - cumulative percentages and percentile ranks,
- Measures of variability – range and standard deviation
- Graphs – frequency polygons, box plots and whiksper chart

In the final section of each chapter student achievement would be presented in relation to the competency levels identified for the particular subject

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.

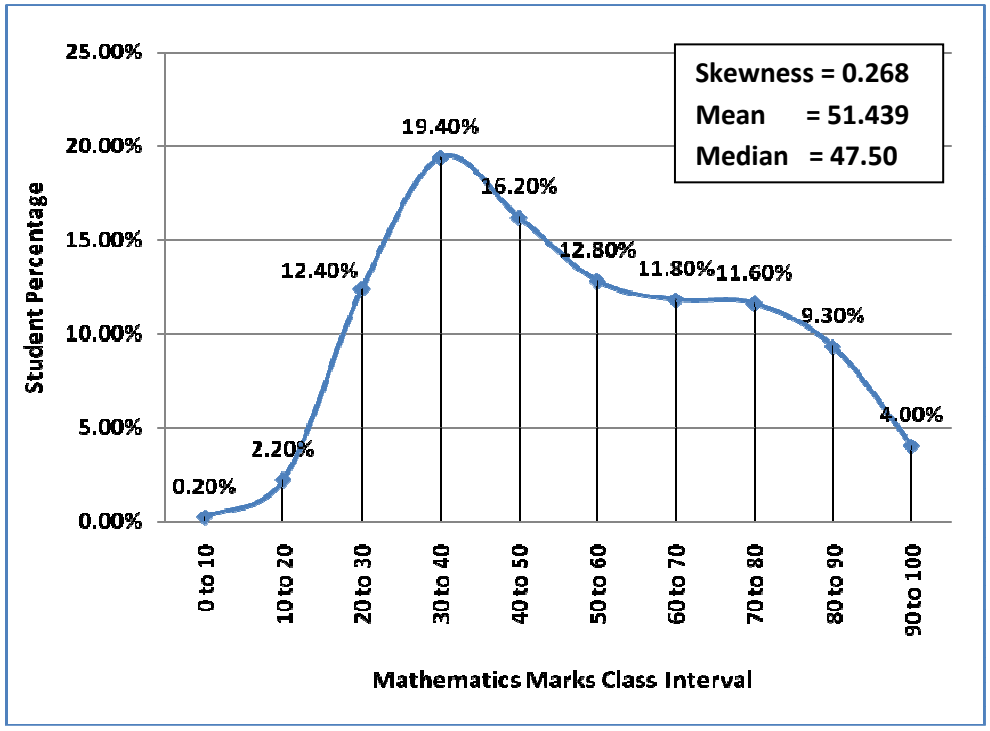


Fig. 3.1: All island achievement in Mathematics 2012 – dispersion of marks

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.

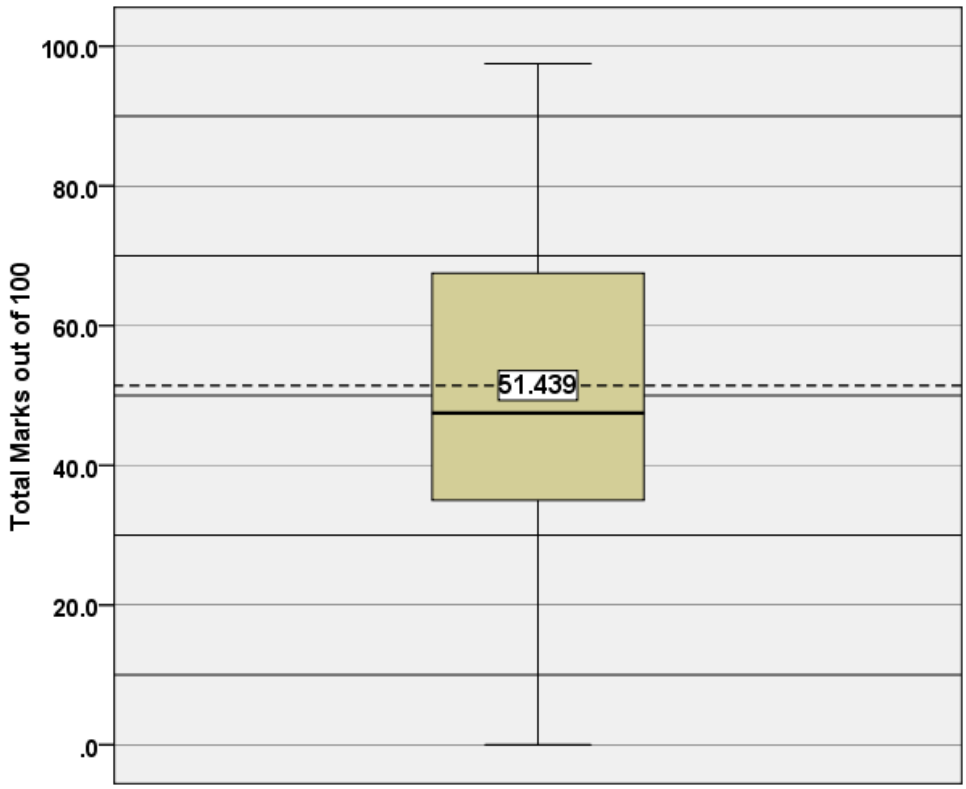


Fig. 3.2: All island achievement in mathematics 2012 – boxplot

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 24.39 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.

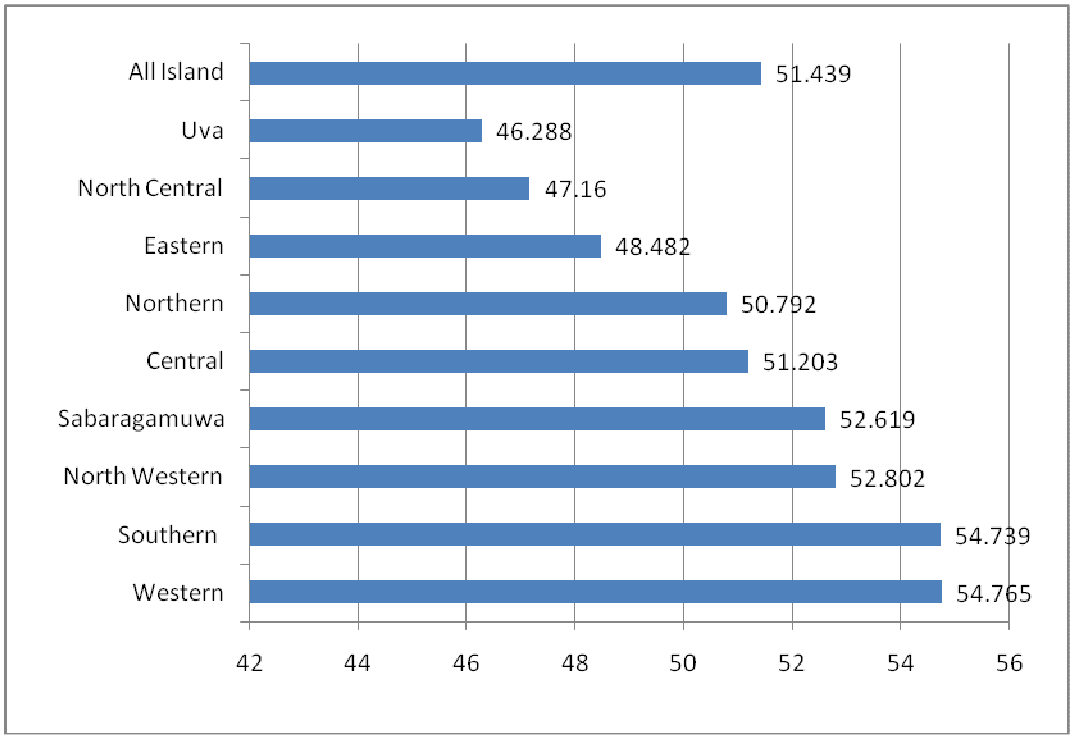


Fig. 3.3: Bar chart to represent mean among the provinces - Mathematics

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

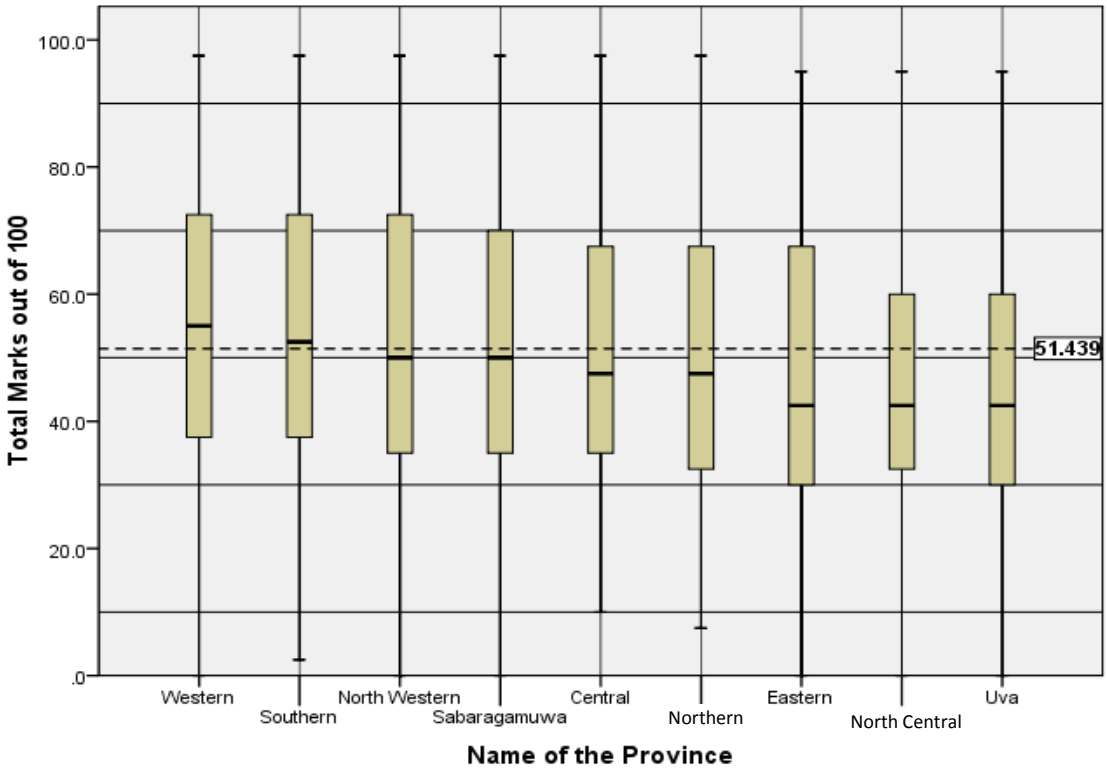


Fig. 3.4: Box plot chart representing all island mathematics achievement

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.

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 3.3: 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 3.3 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. 5.5.

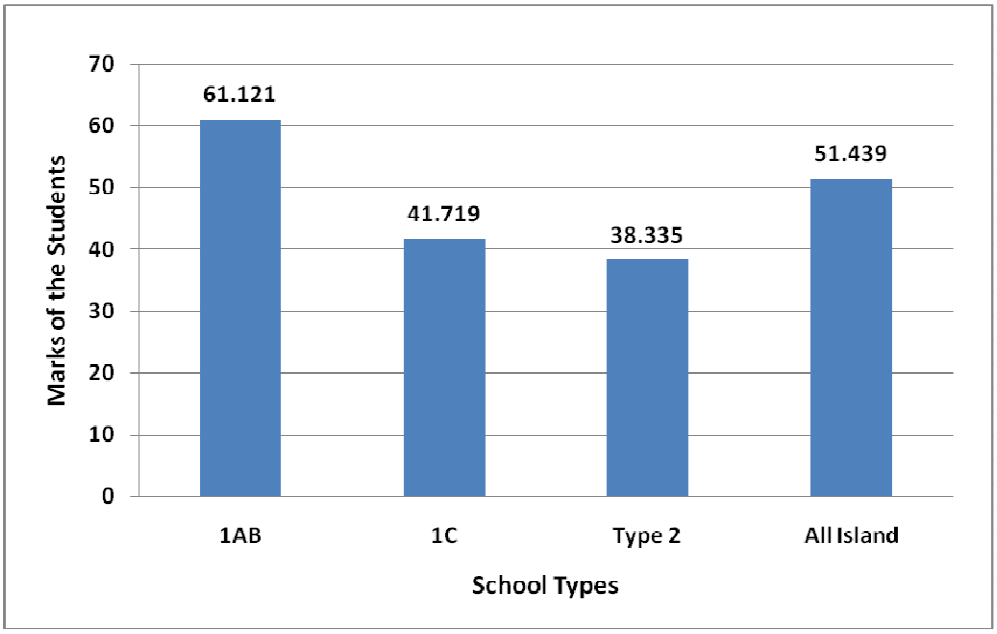


Fig. 3.5: Bar chart representing the mean values according to school types - Mathematics

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 3.3 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 in1AB schools is less than 1C and Type2 schools.

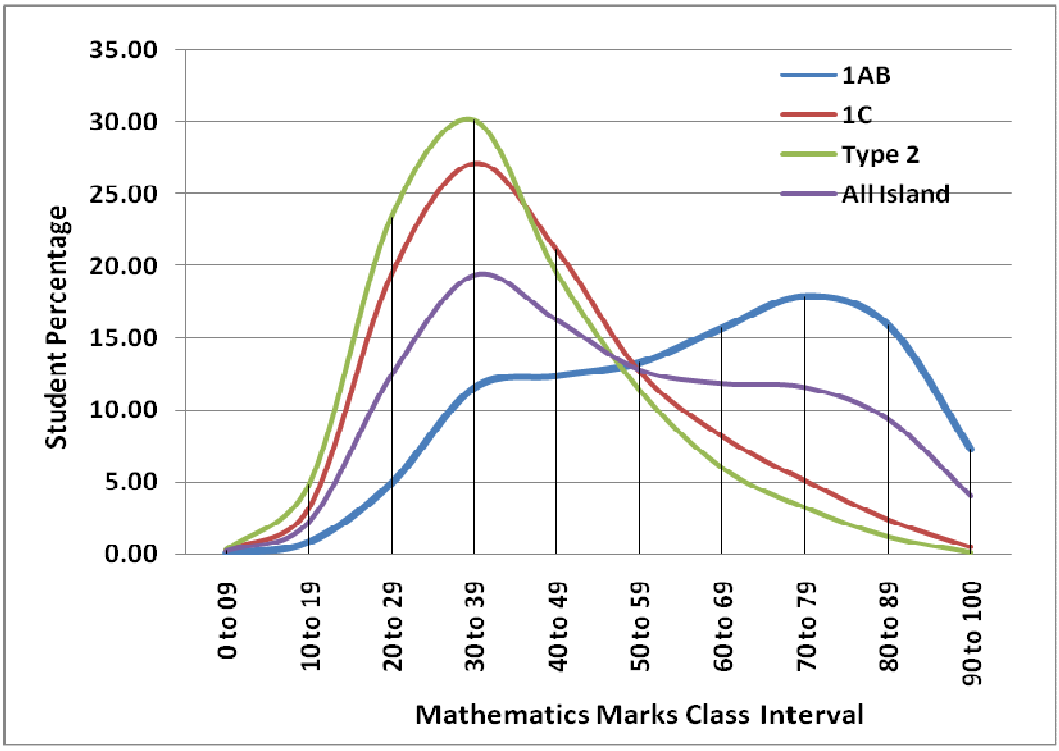


Fig. 3.6: Dispersion of marks by school type - Mathematics

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 3.4 giving the cumulative percentage of students' performance.

Table 3.4: 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 3.4, 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.

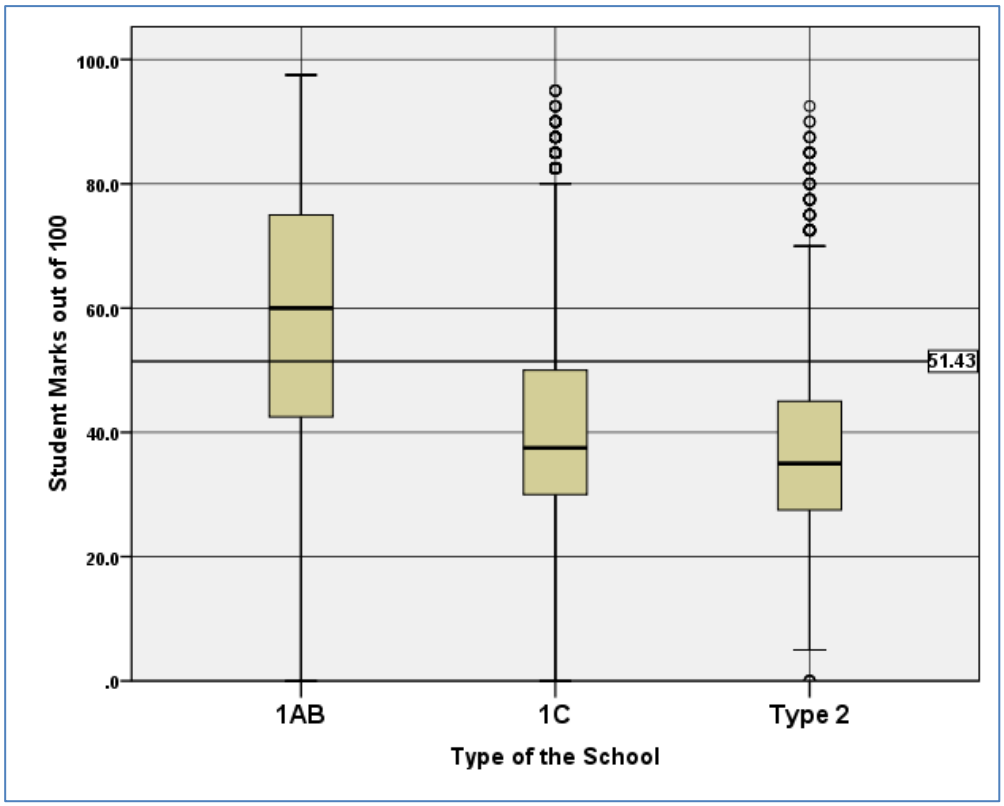


Fig. 3.7: Mathematics marks according to the school types using Box plot and whiksper plot

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 3.5: 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 3.5 indicates, male performance is also lower than the all island mean score.

These differences could also be seen in Fig. 3.8

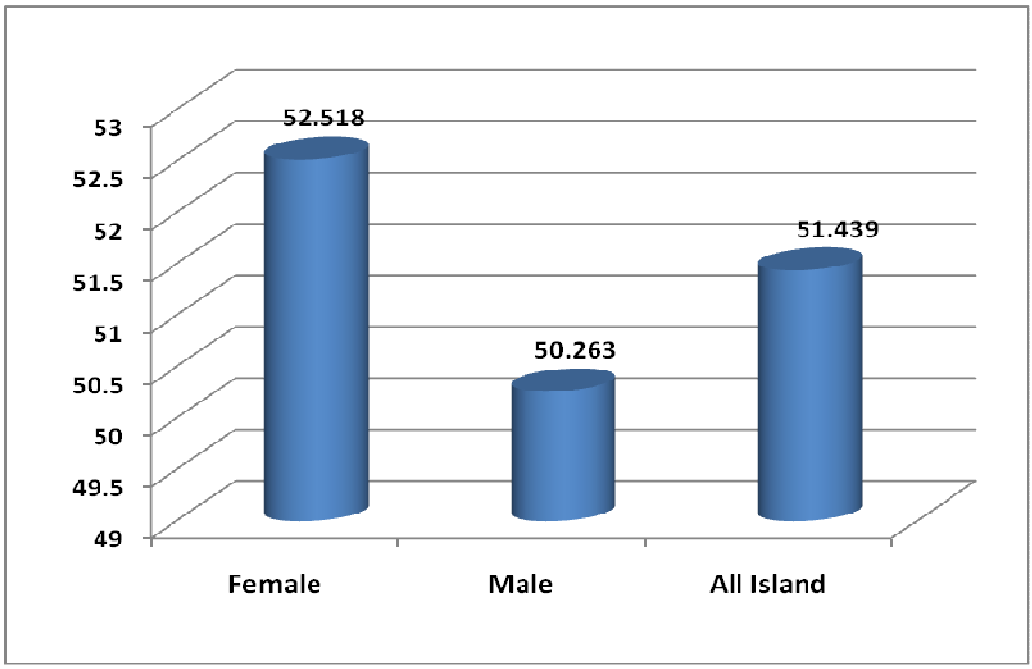


Fig. 3.8: Bar chart representing mean values according to gender

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.

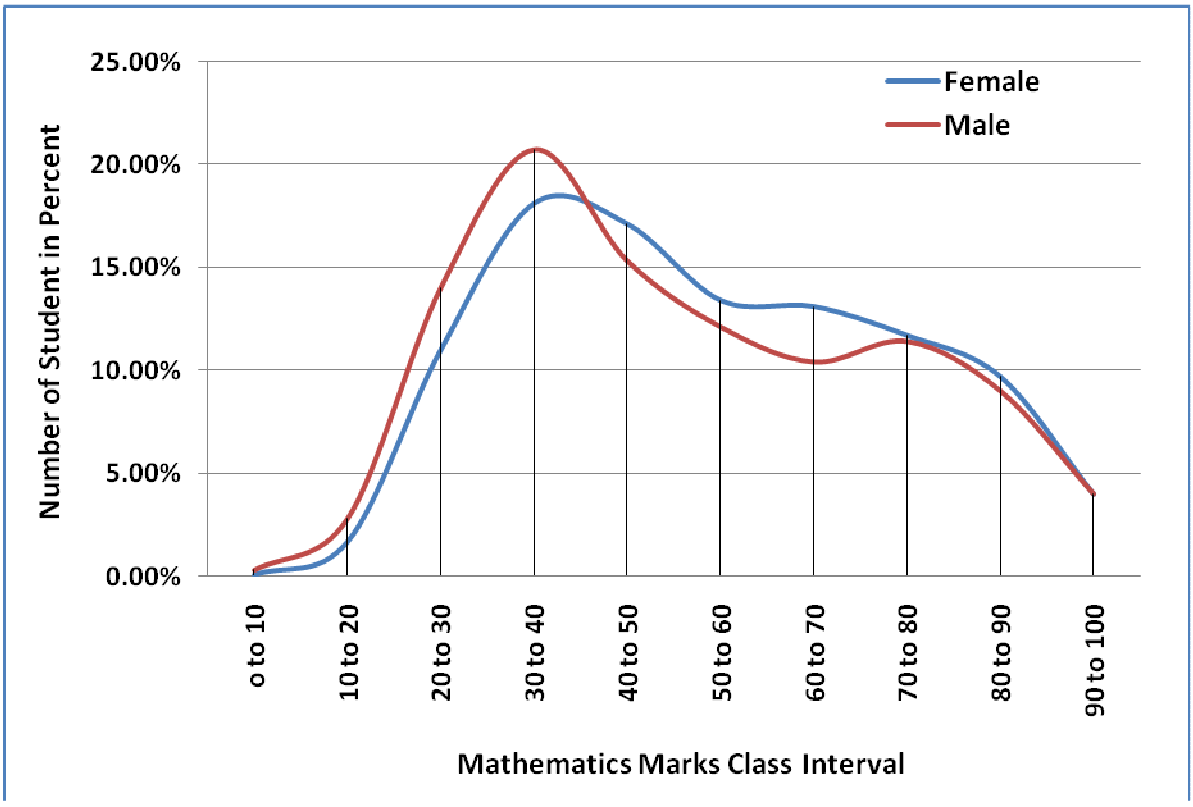


Fig. 3.9: Dispersion of marks by gender

Fig. 3.9 displays two curves which are both positively skewed. However, as Table 3.5 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 3.6, 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 3.6: 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 3.6 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.

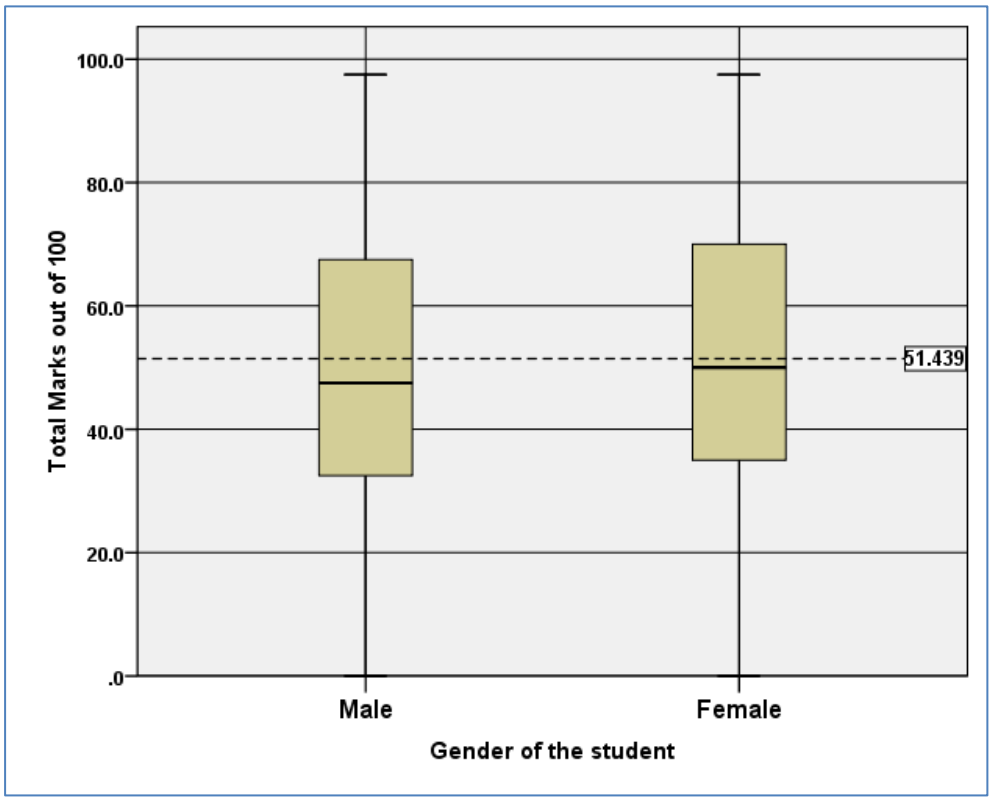


Fig. 3.10: Box plot and whiksper plot representing gender wise mathematics marks

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 18.14% of girls have scored below 40, the male is 20.7%
- Equal percentage of males and females have reached the higher mark range - 70-100.

3.6 Achievement levels by medium of instruction

Table 3.7: 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)
Bilingual	69.173	16.6879	0.1797	-0.564	57.5	72.500	82.5
Sinhala	50.118	20.3762	0.0984	0.354	32.5	47.500	65.0
Tamil	45.160	19.4672	0.1571	0.596	30.0	40.000	57.5
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 closer to the all island mean value, bilingual students' mean achievement is exceptionally high. On the other hand, the Tamil medium students' mean achievement is below the national mean average and is the lowest.

These disparities are further highlighted through the bar chart given in Fig. 3.11.

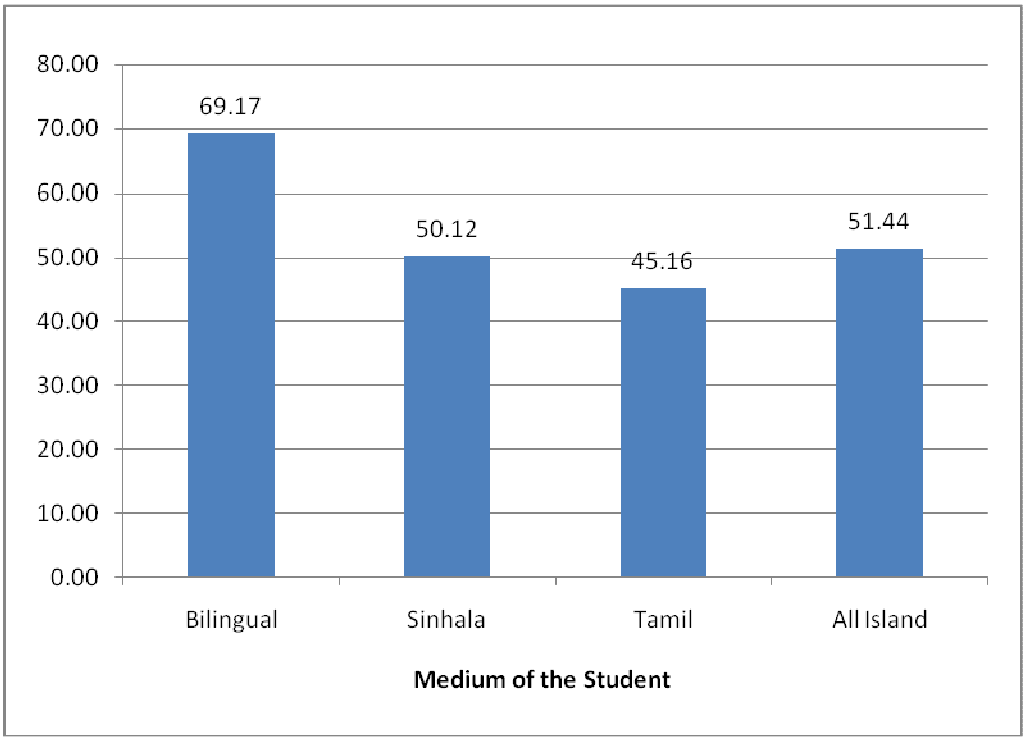


Fig. 3.11: Bar chart representing mean values according to medium of instruction - Mathematics

Sinhala medium students' performance is equal to all island performance with respect to the median value. This means that 50% of Sinhala medium students as well as all island students score equal or above 47.5%. Comparison using median value also reveal same exceptional pattern observed in the bilingual students achievement. Their median value being 72.5, the gap between the Sinhala medium as well as all island performance is 25. On the other hand, the differences between bilingual and Tamil Medium is 32.50. Bilingual medium students' 25th percentile is equal to Tamil medium students' 75th percentile value. Sinhala Medium students' 75th percentile is less than the bilingual students' 50th percentile value.

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

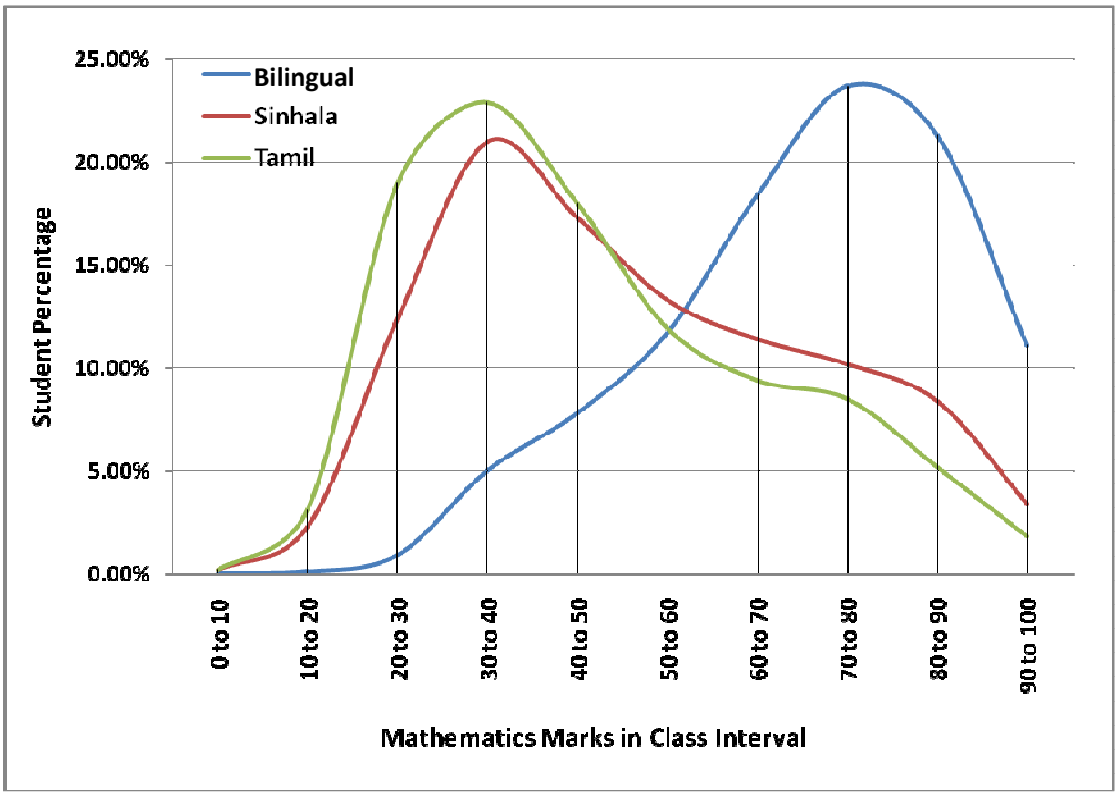


Fig. 3.12: Dispersion of marks by medium of instruction - Mathematics

The disparity discussed using the mean and the median is also visible through the frequency distribution graph. While the bilingual students' curve is negatively skewed the other two curves are positively skewed.

Bilingual medium students' curve peaks at the higher mark ranges, Tamil and Sinhala medium students' curves peak at the lower mark intervals.

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

Table 3.8: Medium wise cumulative percentage table - Mathematics

Marks Interval	Bilingual	Cumulative Percentage	Sinhala	Cumulative Percentage	Tamil	Cumulative Percentage
90 to 100	11.10	100.00	3.40	100.00	1.80	100.00
80 to 89	21.30	88.90	8.40	96.60	5.20	98.20
70 to 79	23.70	67.60	10.20	88.20	8.50	93.00
60 to 69	18.40	43.90	11.40	78.00	9.40	84.50
50 to 59	11.70	25.50	13.30	66.60	11.90	75.10
40 to 49	7.80	13.80	17.30	53.30	18.00	63.20
30 to 39	5.00	6.00	21.10	36.00	22.90	45.20
20 to 29	0.90	1.00	12.40	14.90	19.00	22.30
10 to 19	0.10	0.10	2.30	2.50	3.10	3.30
0 to 9	0.00	0.00	0.20	0.20	0.20	0.20

With respect to the performance of bilingual students, among the first class interval there is no single student, but Sinhala and Tamil medium there is 0.20 percent of students. When 5th class interval (40 to 49) is considered, only 13.80 percent of bilingual students are below this level,

Considering the pass mark as 40, only 6.0% of bilingual students are below that range. On the other hand, 36% of Sinhala medium and 45.20% of Tamil medium students have scored below the pass mark.

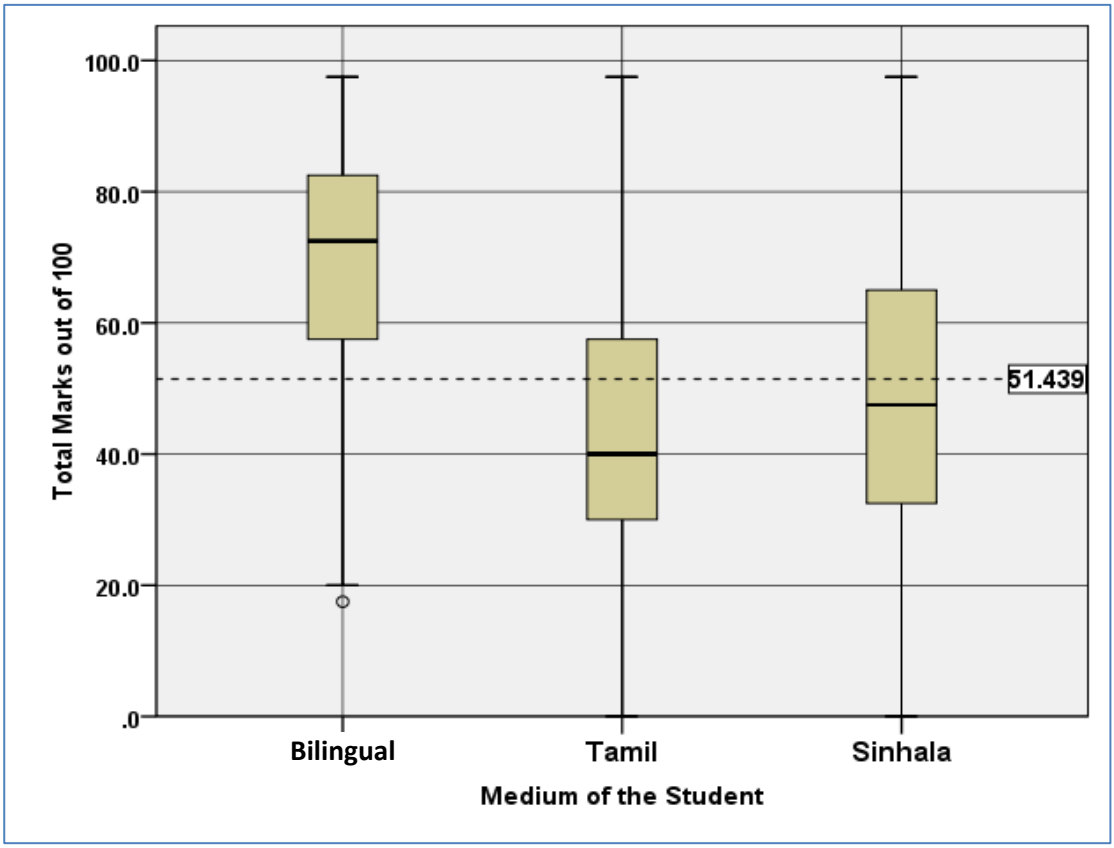


Fig. 3.13: Box plot for medium wise achievement - Mathematics

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

A remarkable feature of this box plot is that even though the bilingual students' achievement is exceptionally high there is one outlier. That is, this student's marks fall outside the box plot indicating s/he had scored very low marks.

There are several co relates which could contribute to the exceptionally good performance of the bilingual students. It is claimed that usually the bilingual students are a selected group based on their academic proficiency. Therefore, it is not possible to draw conclusions regarding the bilingual students' achievement, only considering the test scores. A more in depth analysis may be possible when the background information is analyzed.

Summary

- There is wide disparity among students belonging to different medium of instruction.
- The Sinhala medium students' mean score is equal to the national mean. Bilingual students mean is higher than 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 3.9

Table3.9: 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 3.9 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

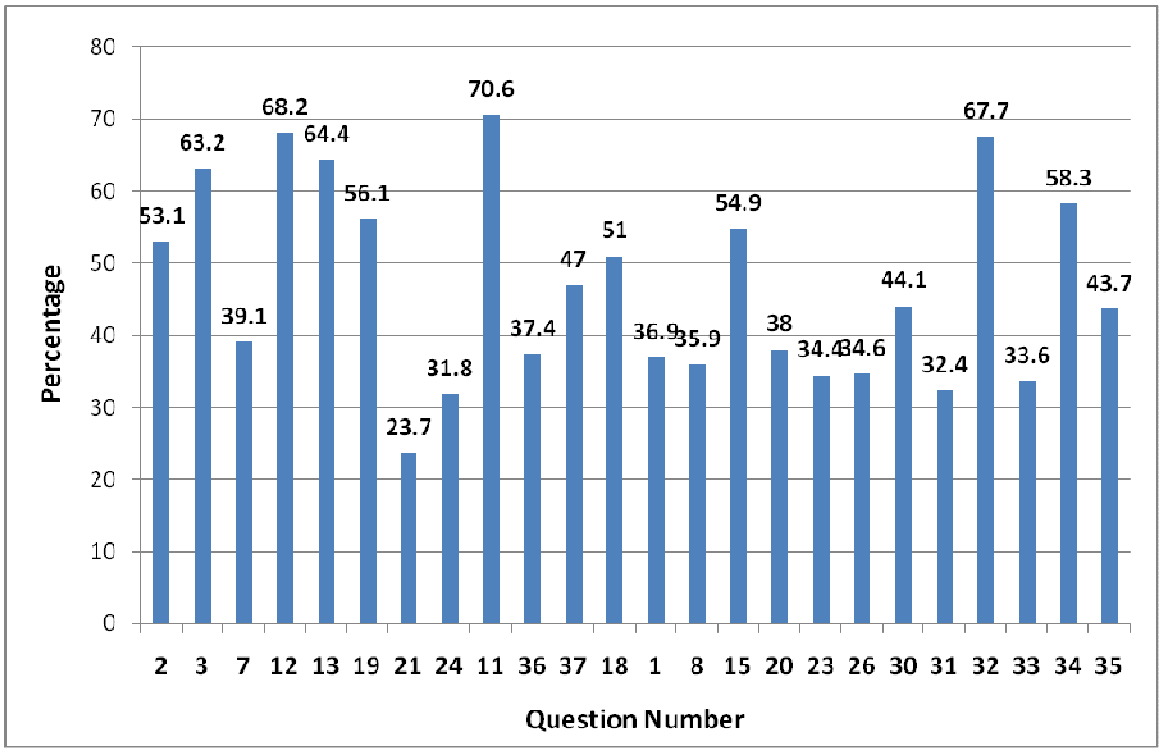


Fig. 3.14: Achievement of competency levels related to knowledge and skills

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 3.10

Table 3.10 indicates the achievement of competency levels related to communication.

Table 3.10: 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 3.10 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.

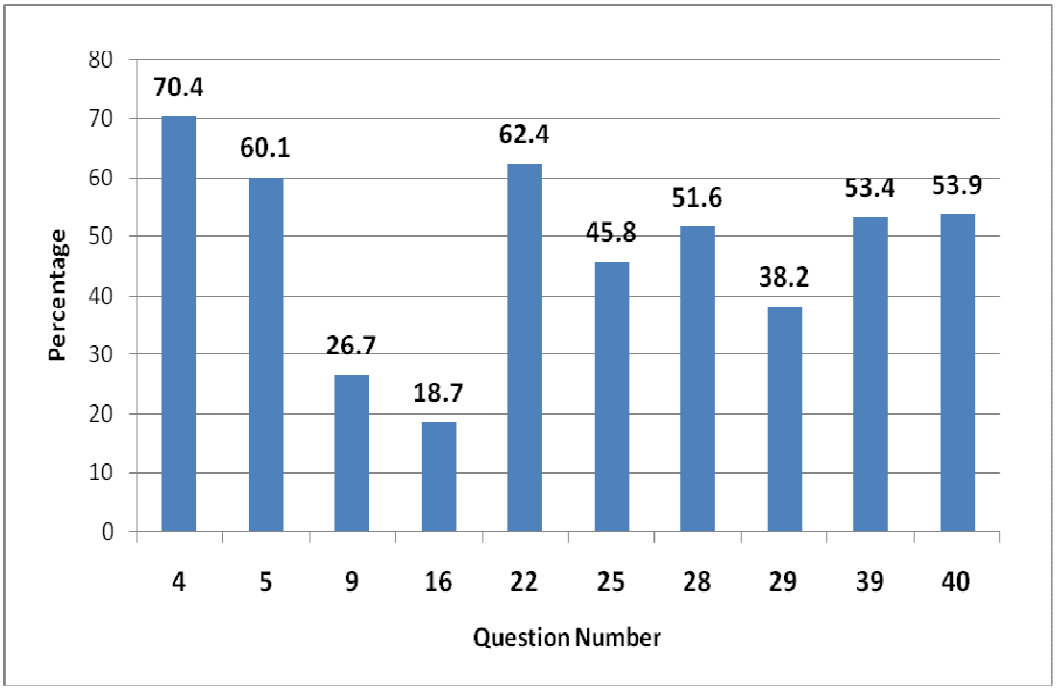


Fig. 3.15: Achievement of competency levels related to communication

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

Table 3.11 indicates achievement of competency levels related to Connections, Reasoning and problem solving

Table 3.11: 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 3.11 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.

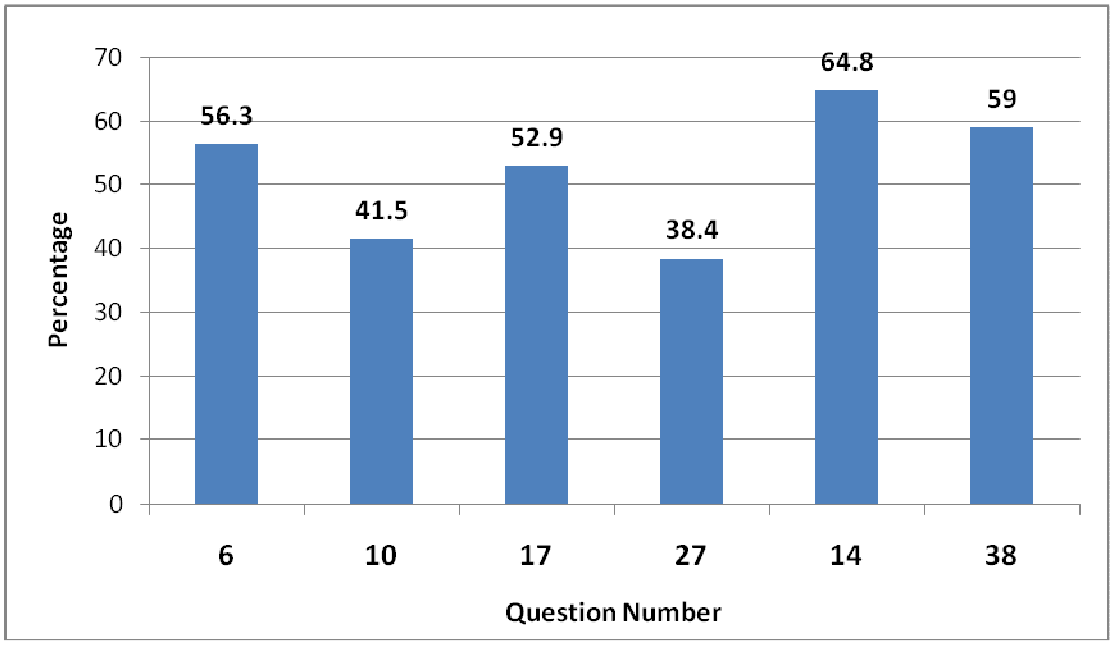


Fig. 3.16: Achievement of competency levels related to connections, reasoning and problem solving

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.

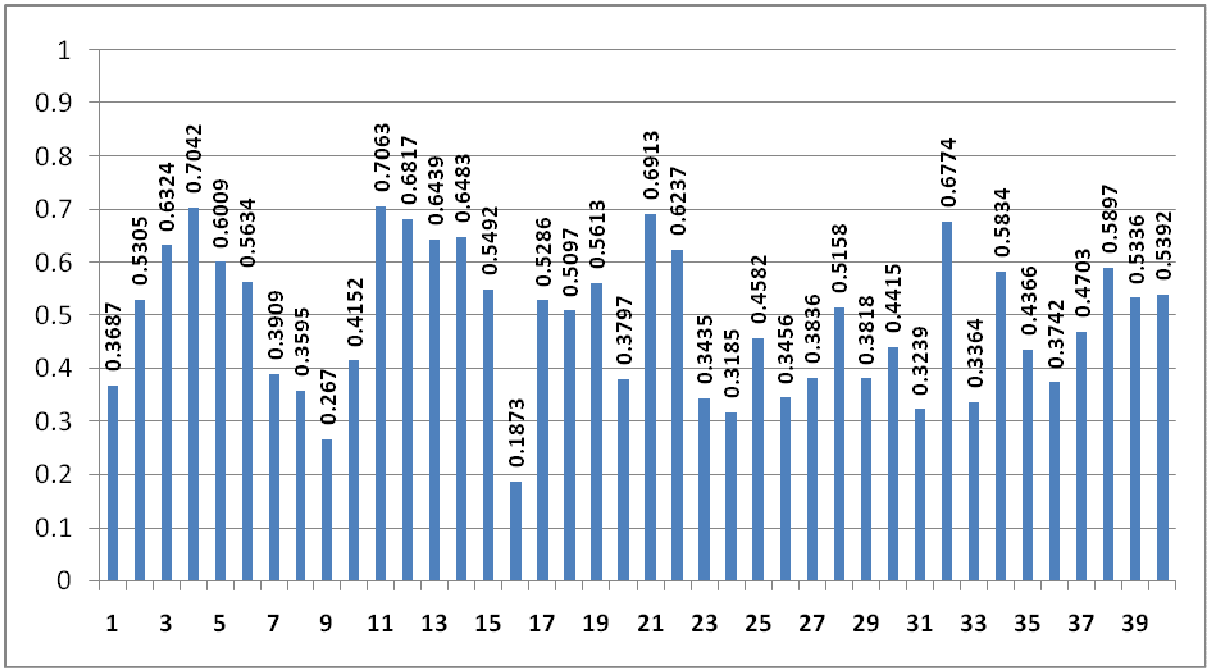
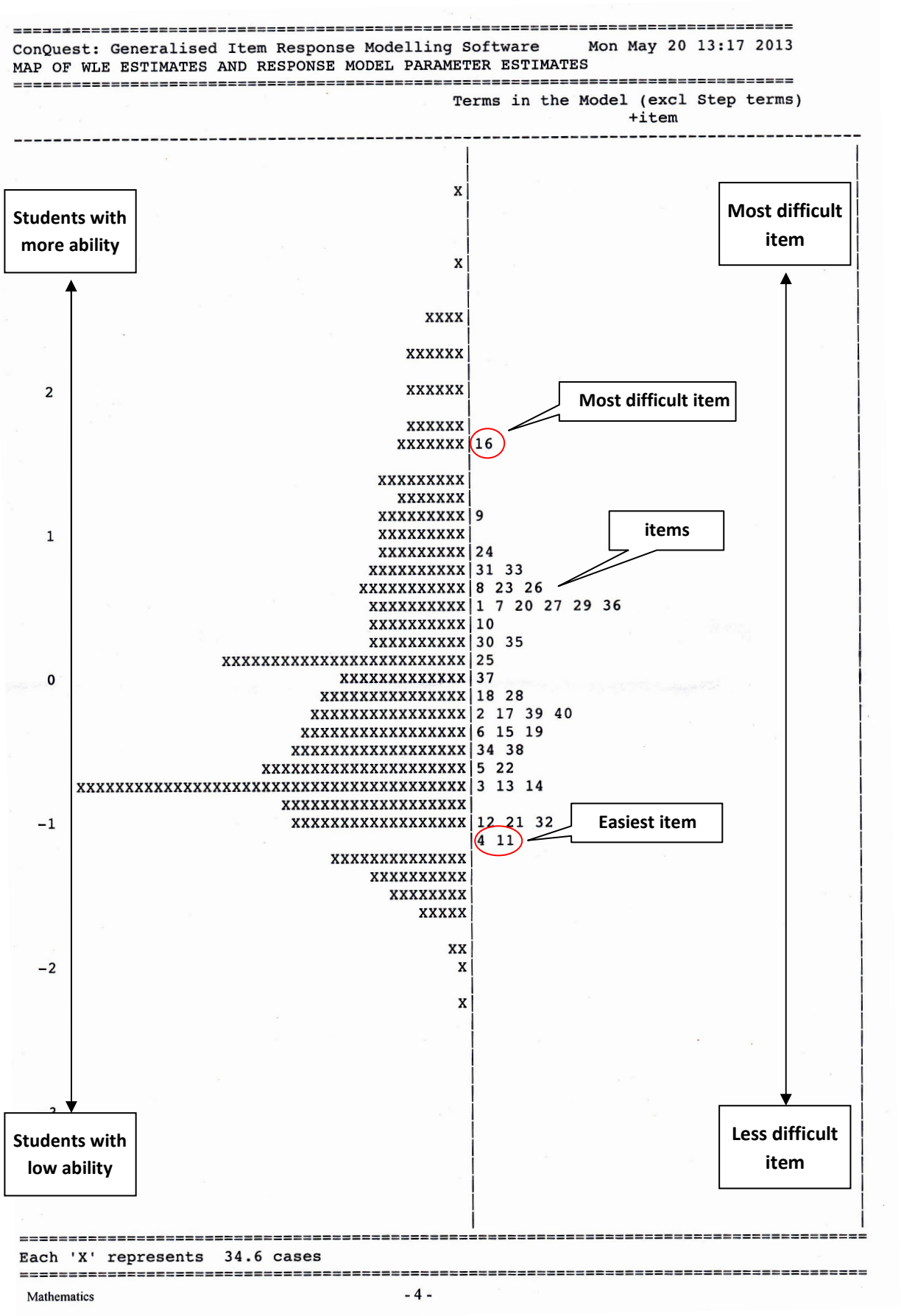


Fig.3.17: Facility index value for mathematics

According to Fig. 3.17 the facility values ranges from 0.1873 to .7042.

Disparity in achievement seen through item analysis

The Item Person Map (IRT) given on pg. 50 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.

Chapter Four

Patterns in Achievement – Science 2012

4.1 Introduction

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

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

4.2 Patterns of achievement at National Level

National level student achievement would be discussed in relation to student performance pertaining to science.

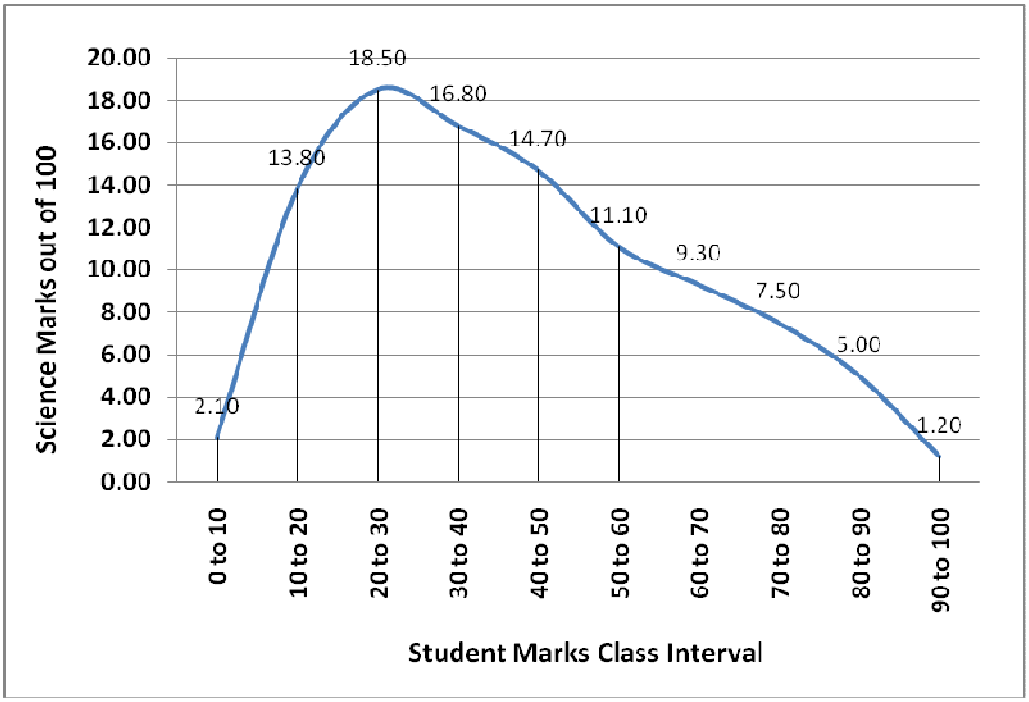


Fig. 4.1: All island achievement in science 2012 – dispersion of marks

The frequency polygon shown in Fig. 4.1 outlines the total picture of the distribution of marks of grade 08 students in science.

Fig. 4.1 depicts a positively skewed distribution of marks. This indicates that there is a higher percentage of students with low marks.

Fig. 4.2 illustrates student achievement patterns further.

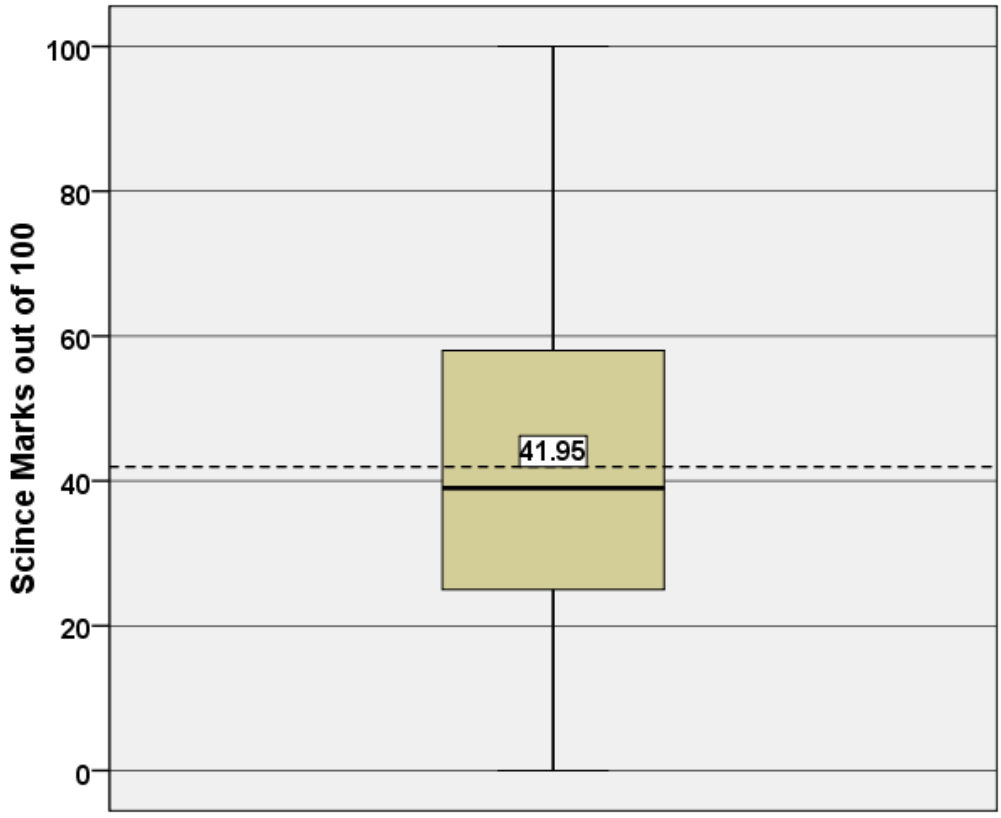


Fig. 4.2: All island achievement in science 2012 – box plot

The all island ***median*** is 39. Hence, 50% of the students in the sample has scored higher than or equal to 39 mark points. On the other hand the **mean** of the distribution which is the arithmetic average of the scores is 41.95.

This situation is further illustrated through the cumulative percentages given in Table 4.1.

Table 4.1: All island achievement in science 2012 – cumulative percentages

Marks Interval	Student Percentage	cumulative Percentage
90 to 100	1.2	100
80 to 89	5	98.8
70 to 79	7.5	93.8
60 to 69	9.3	86.3
50 to 59	11.1	77
40 to 49	14.7	65.9
30 to 39	16.8	51.2
20 to 29	18.5	34.4
10 to 19	13.8	15.9
0 to 9	2.1	2.1

All island science marks corresponding to the class intervals indicate that 51.2 cumulative percentage of students score less than the pass mark (40%). On the other hand, the percentage of students scoring above 70%, is only 13.7%.

The highest percentage of student scores fall between 20-30 class interval.
These differences emphasize the disparity that prevails in achievement of learning outcomes, even though the mean score is relatively satisfactory.

Summary of National Level achievement

- The national level mean score is 41.95, while the median is 39.
- Disparity in achievement prevails with 51.2 of the national sample scoring less than 34% and 13.7% scoring above 70%.
  Since the mean is 41.95, it could be said that the majority of the students have scored low marks.

Provincial wise student achievement will be discussed next.

4.3 Provincial wise student achievement

Table 4.2: Provincial achievement in science 2012 – Summary statistics

Province	Mean	Rank	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
Southern	47.4	1	21.786	0.226	0.233	30	45	65
Western	44.01	2	21.113	0.207	0.348	27	41	59
Sabaragamuwa	42.79	3	21.21	0.233	0.419	26	41	57
North Western	42.37	4	21.309	0.242	0.515	25	38	58
Central	41.39	5	21.542	0.252	0.494	24	37	57
North Central	40.75	6	19.974	0.234	0.540	25	37	55
Eastern	38.15	7	23.21	0.295	0.549	18	33	57
Northern	37.82	8	19.81	0.284	0.612	22	34	53
Uva	37.36	9	20.273	0.269	0.611	21	34	50
All Island	**41.95**		**21.431**	**0.083**	**0.447**	**25**	**39**	**58**

As Table 4.2 indicates, based on provincial wise mean achievements Southern Province ranks first. This ranking is important as in the previous studies it was the Western Province that had ranked first.

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. Central North and Central provinces cluster in the middle, while Eastern, Northern 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, 4.3

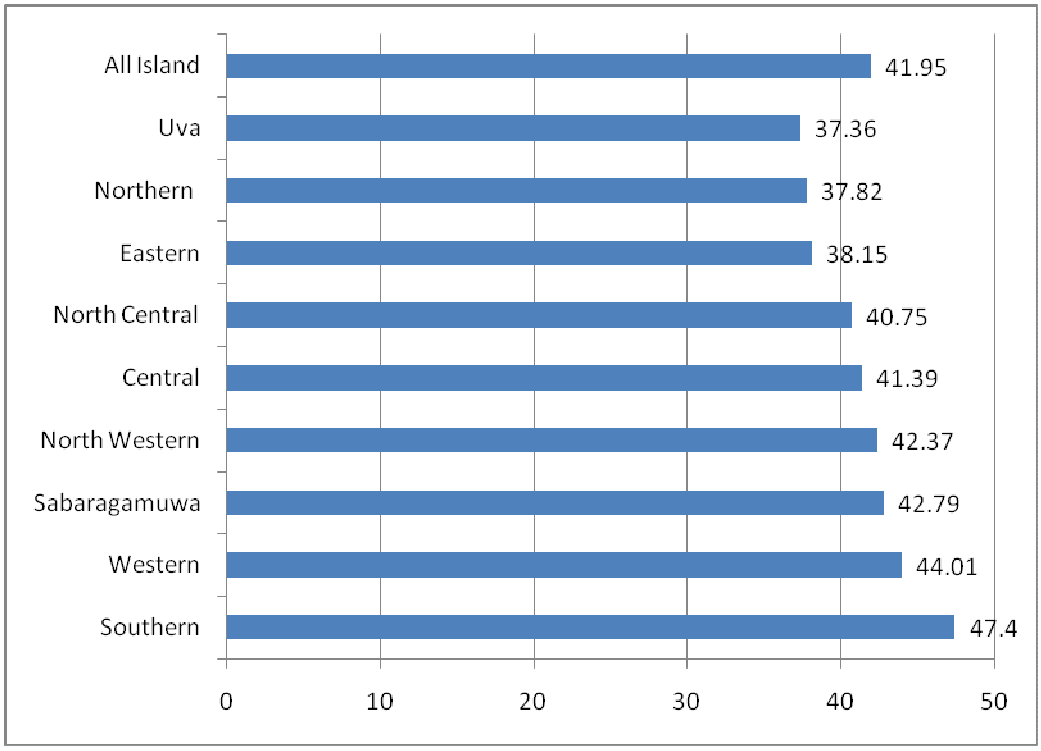


Fig. 4.3: Bar chart to represent mean among the provinces - Science

Another pattern of 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 and Sabaragamuwa Provinces fall into category 1 with 50% of the students scoring higher than or equal to 41 marks. Central and North Central fall into category 2 with 50% of the students scoring higher than or equal to 37 marks.

Northern and Uva Provinces fall into category 3 with 50% of the students scoring higher than or equal to 34 marks.

In addition to these three groups, the Southern Province records the highest median while the Uva Province records the lowest with a median value of 33.

4.3.1 Variation among students

According to Table 4.2, all the standard deviation values lie between 19 to 23 ranges. However, in most of the provinces marks deviation from the mean is similar with an SD of 21.

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 wider variation among student achievement in this province.

Uva, North Central and Northern 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. Skewness values of Southern and Western Provinces are relatively lower than in the other provinces.

On the other hand, in most of the provinces the skewness is higher due to majority of student marks falling among low scores. They are higher than the all island mean as well. The majority of the provinces having low achievers has impacted on making the all island SD higher.

These provincial wise disparities in achievement is further illustrated graphically through the box plot (Fig.4.4).

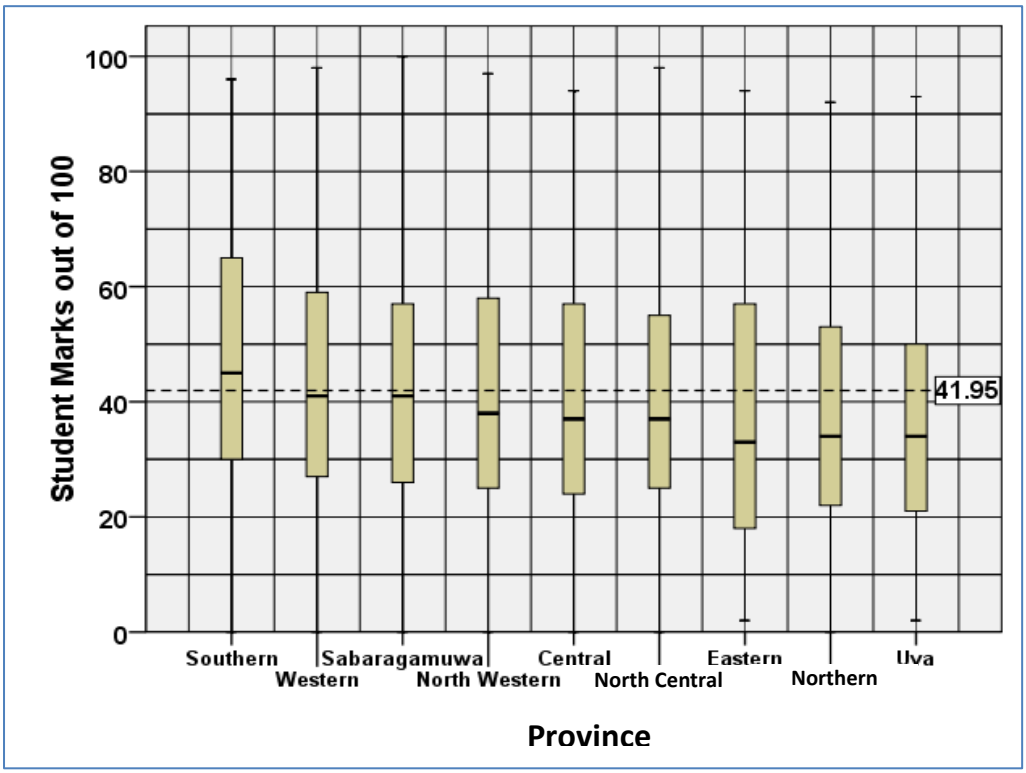


Fig. 4.4: Provincial wise achievement in science 2012 – box plot

Southern Province clearly stands out from the other provinces with a high mark range between P25 and P75. On the other hand, Eastern Province also has a high mark range. However its P25 is lower than the other provinces. Therefore, in the Eastern Province there are many low achievers.

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

Summary of Provincial Level analysis

- Achievement wise the provinces fall into three categories.
  Category 1 –Southern, Western and Sabaragamuwa with mean scores above the national mean (>41.95)
  Category 2 –Central and North Western Provinces cluster in the middle.
  Category 3 – Eastern, North Central and Uva.
- Disparity of marks within a province is highest in the Eastern Province.
- 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.

4.4 Achievement levels by type of school

Table 4.3: Science marks achievement according to the school type

School Type	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
1AB	51.15	21.383	0.114	0.012	34	51.00	68
1C	33.07	16.326	0.113	0.734	21	30.00	43
Type 2	29.10	15.623	0.149	0.951	17	26.00	38
All Island	41.95	21.431	0.083	0.447	25	39.00	58

As Table 4.3 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 17.48, the difference between 1AB and Type2 is 22.05. These differences are very high between school types. 1AB students' performance appears to very strongly affect to increase the all island science mean statistics. 1AB schools and all island mean difference is closer to 10 marks, whereas 1C type schools' mean value is 8 marks below that of the all island mean value. Type 2 performance is even worse, but more closer to Type 1C. The gap in achievement among the school types is highlighted in Fig 4.5

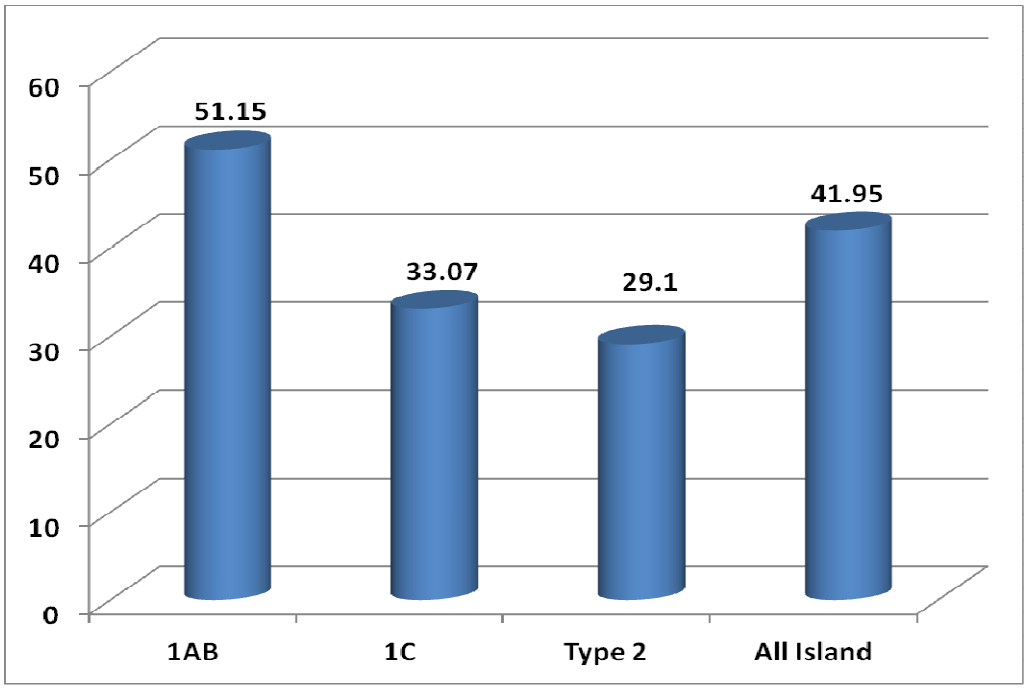


Fig. 4.5: Bar chart representing the mean values according to school types - Science

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 51 mark value in the 1AB schools. On the other hand, in 1C and Type 2 schools 50% of students are scoring below the pass marks. In fact, in 1AB schools even the bottom 25% is scoring more than the 50% in 1C and Type 2 schools.

Variation among students

Variation among student achievement in science is high throughout the island. As shown in Table 4.4 the all island standard deviation is 21.431. The SD of the 1AB schools is quite high and all most equal to the all island value. Therefore, the performance of the1AB schools has largely contributed to the all island SD. The SD of the 1AB schools is more than half of the mean value. On the other hand, the deviation from the mean in the other two school types is less. Therefore, relatively achievement differences among students' in 1AB schools is more than in 1C and Type2 schools.

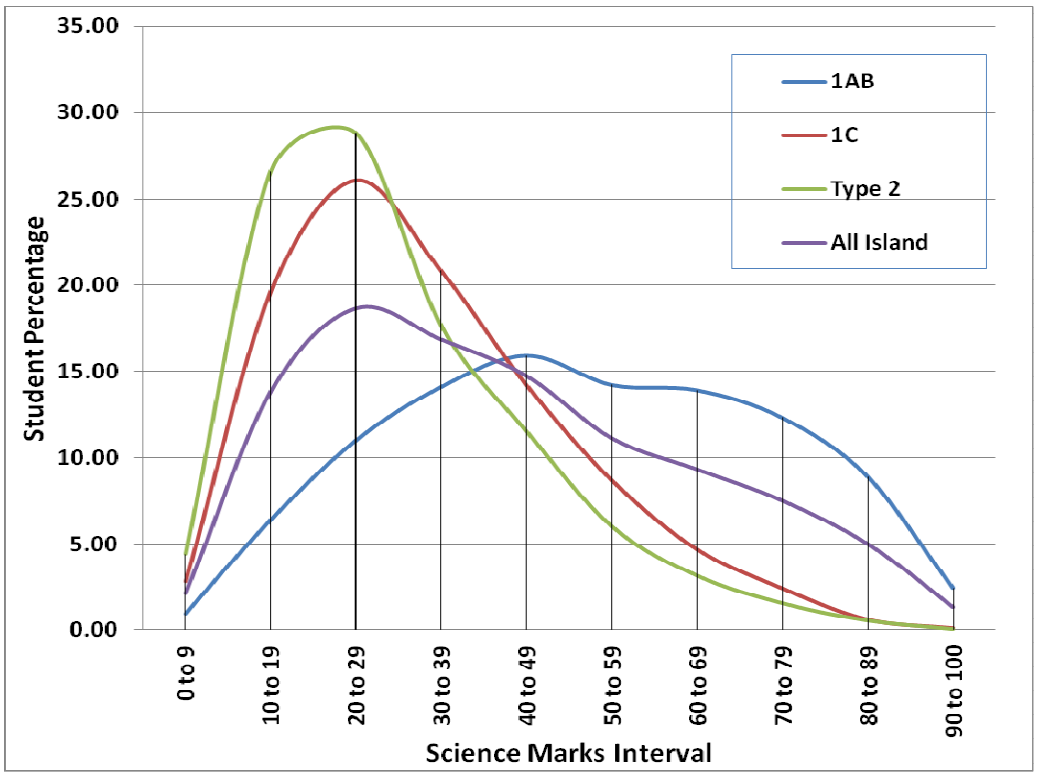


Fig. 4.6: Dispersion of marks by school type - Science

Disparity in achievement

Fig. 4.6 depicts four curves of which two are quite similar. Of these the curves for the Type 1C and Type 2 are quite similar and distinctly positively skewed. As indicated in Table 4.3, the skewness values are .734 and .951 respectively. On the other hand, the curve representing the dispersion of marks for the 1AB school type is more similar to a normal curve with a value of .012. Therefore, while the Type 1C and Type 2 schools have a larger percentage of low achievers in the 1AB schools there appears to be almost equal percentage of low and high achievers. The combination of the impact of Type1C and Type2 schools and the 1AB schools have impacted on the all island curve. Hence, its skewness value is higher than that of the 1AB schools but lower than the other two types of schools.

The shape of the curves are further explained through the Table 4.4.

Table 4.4: Cumulative student percentages according to the school type - Science

Class Interval	1AB Student (%)	Cumulative (%)	1C Student (%)	Cumulative (%)	Type 2 Student (%)	Cumulative (%)
90 to 100	2.4	100	0.1	100	0	100
80 to 89	8.9	97.6	0.6	99.9	0.5	100
70 to 79	12.3	88.7	2.4	99.3	1.5	99.5
60 to 69	13.9	76.4	4.7	96.9	3.1	98
50 to 59	14.2	62.5	8.7	92.2	6	94.9
40 to 49	15.9	48.3	14.2	83.5	11.5	88.9
30 to 39	14.1	32.4	20.8	69.3	17.6	77.4
20 to 29	11	18.3	26.1	48.5	28.8	59.8
10 to 19	6.4	7.3	19.6	22.4	26.6	31
0 to 9	0.9	0.9	2.8	2.8	4.4	4.4

As can be seen from Table 4.4, in 1AB type schools the highest percentage of students' (15.9) scores falls within the class interval 40-49. On other hand, in 1C and Type 2 schools the highest percentage of students' scores (48.5 and 59.8) fall within the class interval 20-29. Further, when considering the 1AB curve it can be seen that 48.3

cumulative percentage of students have scored less than 50% of marks. This means that 51.7 cumulative percentage of students have scored above 50%. Due to this dispersion of marks the curve shown in Fig.4.6 is almost similar to a normal curve as there is not much difference between the percentage of scores that falls on either side of the mean. This is further explained as according to Table 4.3 in 1AB schools mean and the median values are the same. This is a feature of a normal curve.

On the other hand, in 1C and Type 2 schools, the cumulative percentage of scores below 50 is 83.5 and 88.9. Therefore, the two curves representing the dispersion of marks in these two school types are highly positive with majority of the students scoring low marks.

In the 1AB schools those who have scored less than the pass mark is only 20.8%. On the other hand, in 1C and Type 2 schools cumulative percentage is 69.3 and 77.4 respectively.

The dispersion of marks and the shape of the curves representing the dispersion can be further explained using the box plot in Figure 4.7.

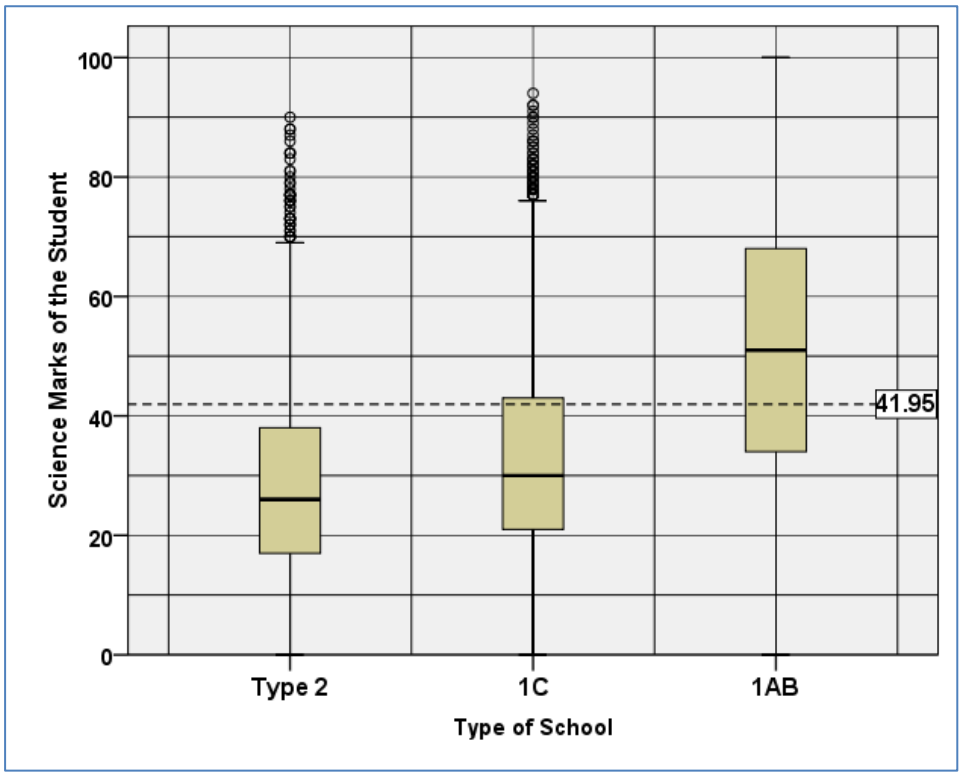


Fig. 4.7: Science marks according to the school types using box plot and whiksper plot

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

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.
- In the 1AB schools the percentage of high achievers are only slightly higher than the low achievers.
- In the 1AB schools those who have scored less than the pass mark is only 20.8%. On the other hand, in 1C and Type 2 schools cumulative percentage is 69.3 and 77.4 respectively.

4.5 Achievement levels by gender

Table 4.5: Science Achievement in summary statistics table

Student Gender	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
Female	43.56	21.102	0.113	0.413	27	41.00	59
Male	40.19	21.648	0.121	0.503	23	36.00	56
All Island	**41.95**	**21.431**	**0.083**	**0.447**	**25**	**39.00**	**58**

There is a slight difference in the achievement of females over males. As Table 4.5 indicates, male performance is also lower than the all island mean score.

These differences could also be seen in Fig. 4.8

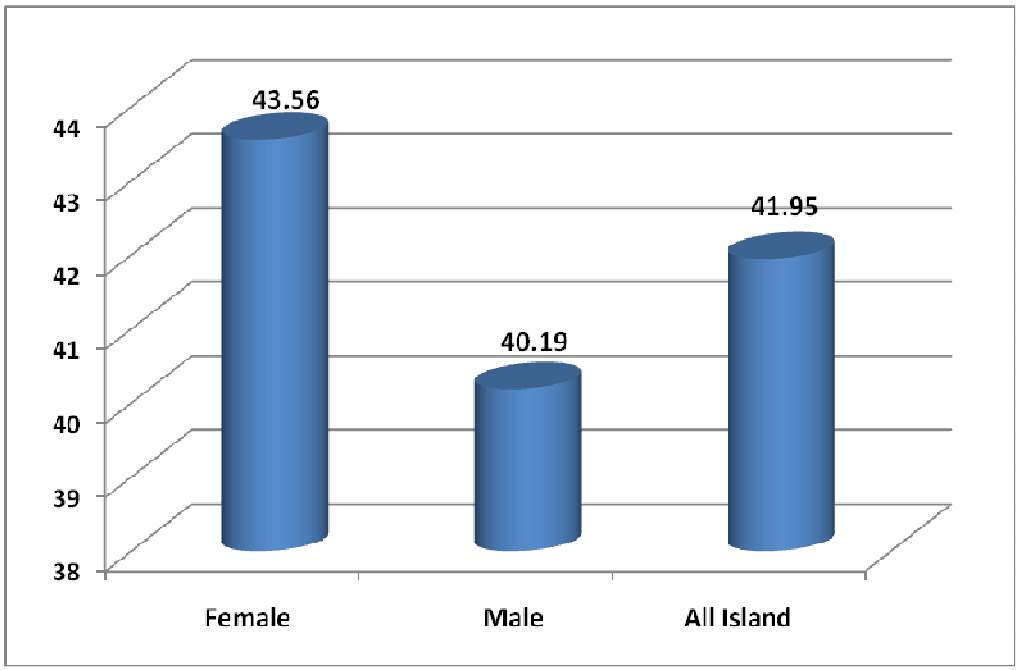


Fig. 4.8: Bar chart representing mean values according to gender

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.

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.

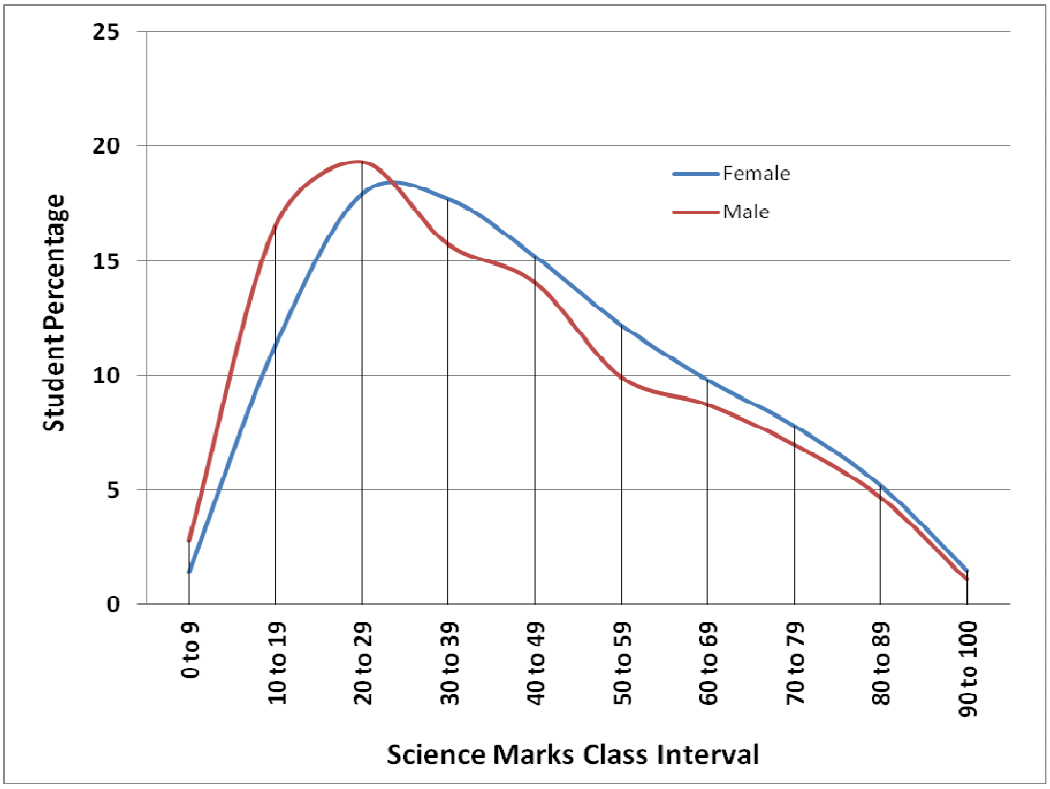


Fig. 4.9: Dispersion of marks by gender

Fig. 4.9 displays two curves which are both positively skewed. However, as Table 4.5 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 and 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 4.6, the highest percentage of student scores falls between the class interval 20-29 both among males and females. However, the percentage is slightly higher among the males. There on the percentages for each class interval decreases among both groups.

Table 4.6: Gender wise Science analysis cumulative table

Class Interval	Female (%)	Cumulative Percentage	Male (%)	Cumulative Percentage
90 to 100	1.50	100.00	1.10	100.00
80 to 89	5.20	98.50	4.70	98.90
70 to 69	7.80	93.30	7.00	94.20
60 to 69	9.80	85.50	8.74	87.20
50 to 59	12.20	75.70	9.95	78.46
40 to 49	15.20	63.50	14.09	68.51
30 to 39	17.70	48.30	15.74	54.42
20 to 29	17.90	30.60	19.34	38.68
10 to 19	11.30	12.70	16.54	19.34
0 to 9	1.40	1.40	2.80	2.80

According to Table 4.6 and Fig. 4.9 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. Among females, 48.30 cumulative percentage has scored below the pass mark, while this percentage increases to 54.42% for males.

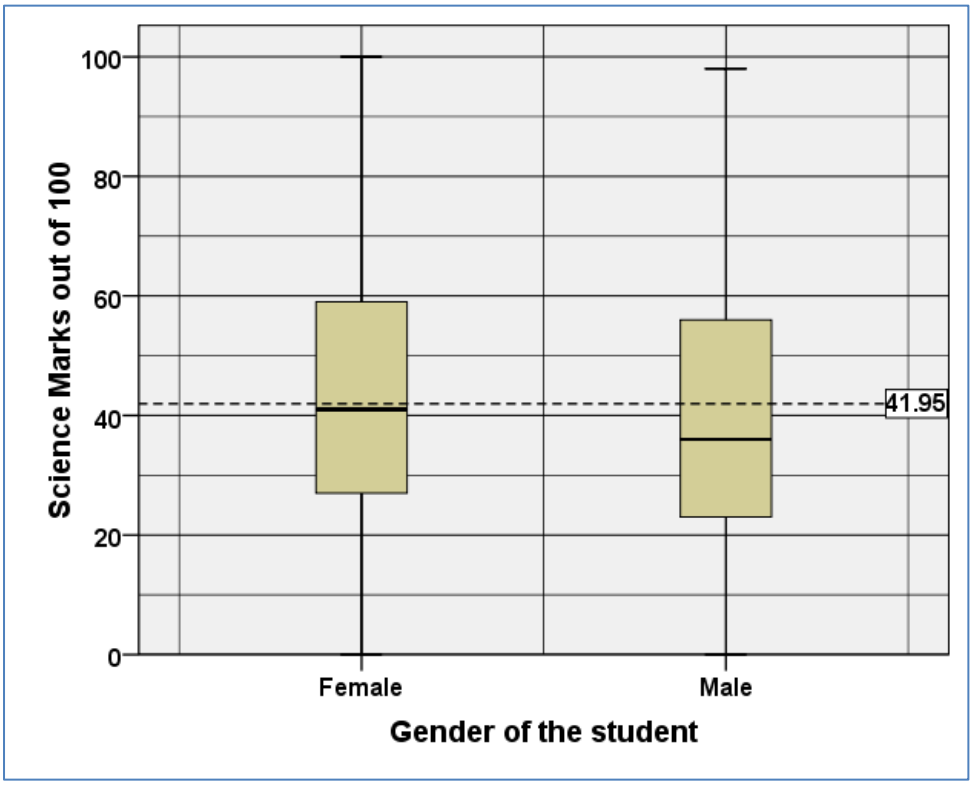


Fig. 4.10: Box plot and whiksper plot representing gender wise Science marks

Box plot for gender wise science achievement graphically shows similarities that has been discussed already. Female student groups start at a slightly higher base and reaches higher mark ranges at a slightly higher mark point. Median of the female students is very close to all island mean achievement, where as the male students median is below the mean indicating that 50% of students are scoring below the all island mean.

Summary

- Female performance is slightly better than all island and male performance.
- While 48.30 of girls have scored below 39%, the male percentage is 54.42.

4.6 Achievement levels by medium of instruction

Table 4.7: Achievement level by medium of instruction - science

Medium of the Student	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
Bilingual	51.75	19.813	0.214	0.072	36	51.00	67
Sinhala	42.51	21.162	0.102	0.459	26	39.00	58
Tamil	34.96	20.625	0.166	0.791	19	30.00	48
All Island	**41.95**	**21.431**	**0.083**	**0.447**	**25**	**39.00**	**58**

There is wide disparity between the students belonging to the different medium of instruction. While the Sinhala medium students' mean achievement is closer to the all island mean value, bilingual students' mean achievement is high. On the other hand, the Tamil medium students' mean achievement is below the national mean average and is the lowest.

These disparities are further highlighted through the bar chart given in Fig. 4.11.

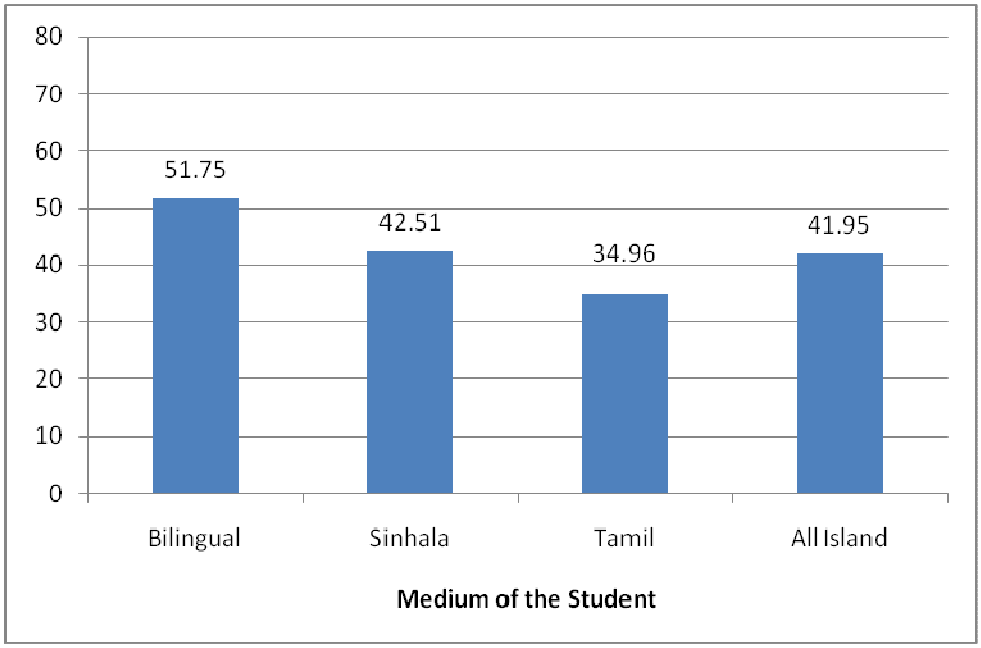


Fig. 4.11: Bar chart representing mean values according to medium of instruction - Science

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

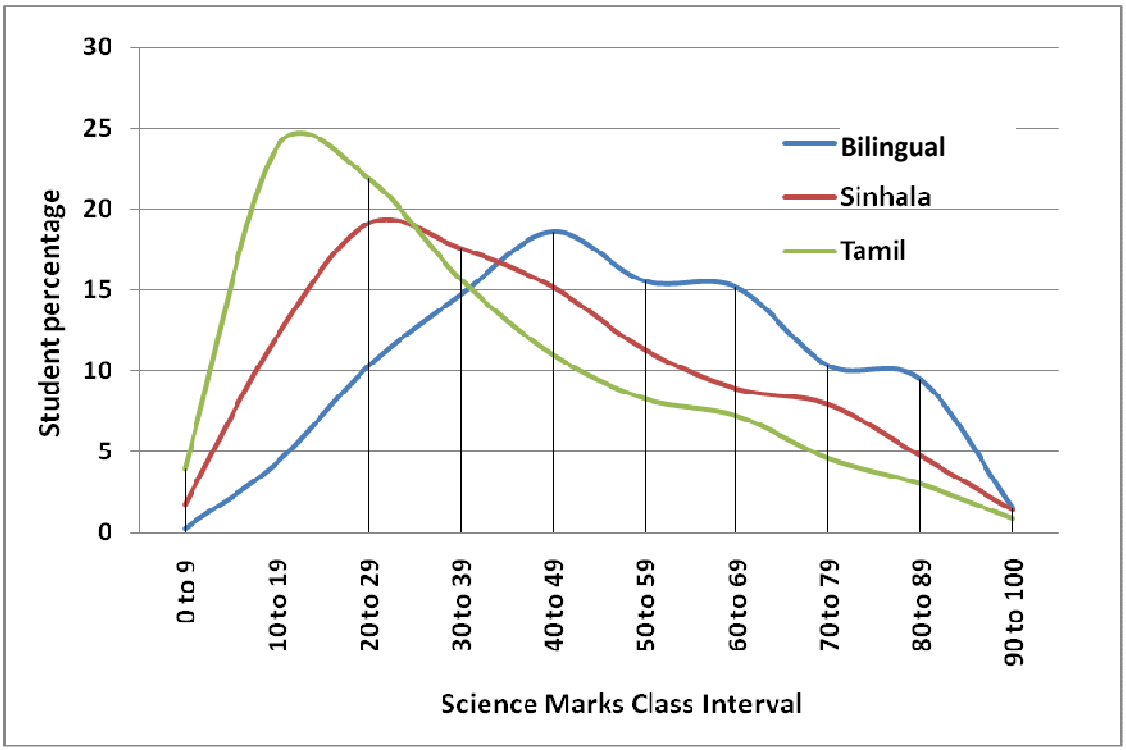


Fig. 4.12: Dispersion of marks by medium of instruction - Science

The disparity discussed using the mean is also visible through the frequency distribution graph. While the bilingual students' curve is negatively skewed the other two curves are positively skewed.

Bilingual medium students' curve peaks at the higher mark ranges, Tamil and Sinhala medium students' curves peak at the lower mark intervals.

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

Table 4.8: Medium wise cumulative percentage table - Science

Marks Interval	Bilingual	Cumulative Percentage	Sinhala	Cumulative Percentage	Tamil	Cumulative Percentage
90 to 100	1.52	100	1.41	100	0.82	100.02
80 to 89	9.45	98.48	4.75	98.59	2.97	99.2
70 to 79	10.3	89.03	7.93	93.84	4.54	96.23
60 to 69	15.14	78.73	8.9	85.91	7.2	91.69
50 to 59	15.52	63.59	11.3	77.01	8.24	84.49
40 to 49	18.58	48.07	15.18	65.71	10.99	76.25
30 to 39	14.68	29.49	17.57	50.53	15.65	65.26
20 to 29	10.28	14.81	19.1	32.96	21.9	49.61
10 to 19	4.29	4.53	12.1	13.86	23.81	27.71
0 to 9	0.24	0.24	1.76	1.76	3.9	3.9

Considering the pass mark as 40, only 29.49 cumulative percentage of bilingual students are below that mark. On the other hand, 50.53% of Sinhala medium and 65.26% of Tamil medium students have scored below the pass mark.

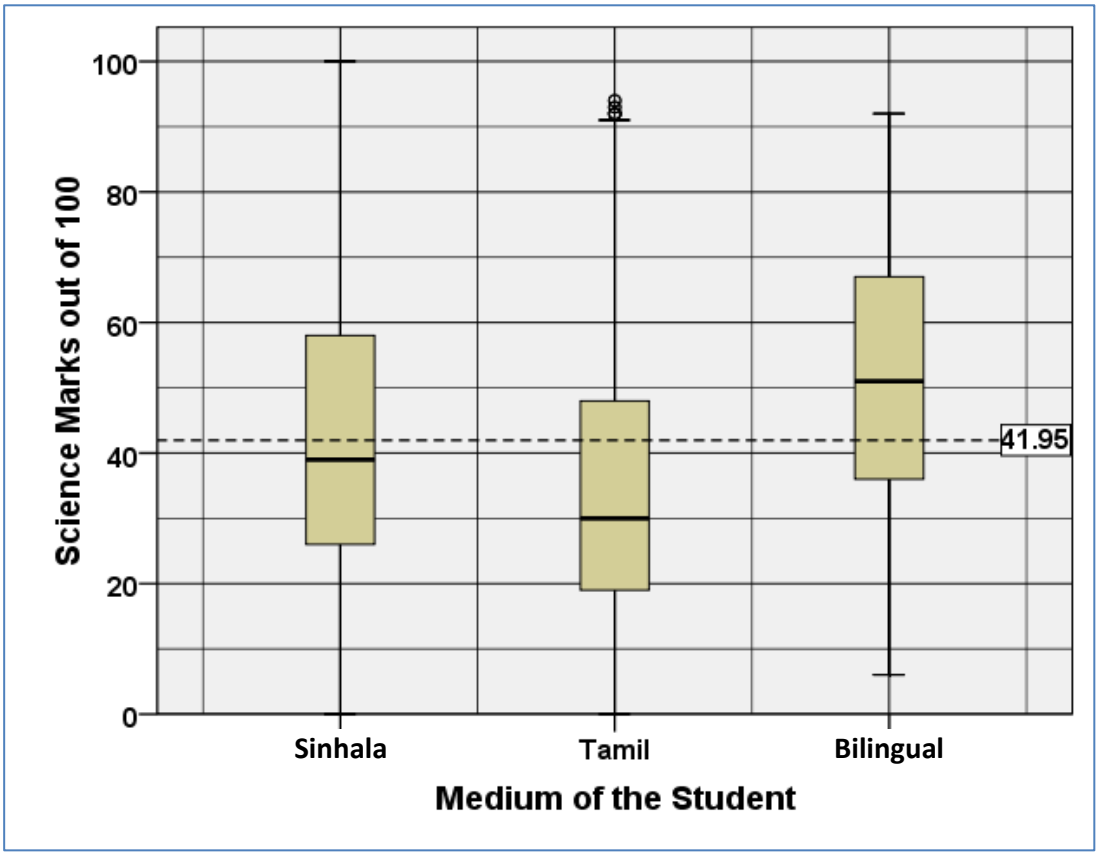


Fig. 4 .13: Box plot for medium wise achievement - Science

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

Sinhala medium students' performance is equal to all island performance with respect to the median value. This means that 50% of Sinhala medium students as well as all island students score equal or above 42.95%. Comparing using median value also reveal same exceptional pattern observed in the bilingual students' achievement. Their median value being 51, the gap between the Sinhala medium as well as all island performance is 12. On the other hand, the difference between bilingual and Tamil Medium is 21.

A remarkable feature of this box plot is that even though the Tamil medium students' achievement is low there are a few outliers.

Summary

- There is disparity among students belonging to different medium of instruction.
- The Sinhala medium students' mean score is closer to the national mean. Bilingual students mean is higher than the national mean, while the Tamil medium students' mean is lower.

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

Therefore, in order to provide equal opportunities there is a need to identify the gaps and facilitate reducing the gaps.

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

4.7 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 science paper was based on four main content areas – Biology, Chemistry, Earth science and Physics. The percentage of students who has answered correctly the questions related to each competency level under the content area of Biology is given in Table 4.9.

Table 4.9: Competency levels in relation to Biology

Content	Competency Level	Percentage
Biology	1.1 Discovers the diversity of the natural environments	46.30%
	1.2 Investigates the advantages/disadvantages of the built environments	46.50%
	1.3 Focuses attention on the venomous animals that are harmful to man	46.50%
	1.4 Acquires the ability to use international scientific symbols	66.60%
	3.1 Observes the interactions based on life cycles	38.15%
	3.3 Explains the importance of use of cultivations under specific conditions	70.10%
	3.4 Investigates the biotic factors affecting the perpetuation of the environment.	40.50%
	6.1 Conducts explorations to identify the morphological diversity of leaves	5.40%
	6.3 Investigates the functions related to the diversity of roots.	35.40%
	6.4 Uses plant related products with a scientific attitude	42.40%

As Table 4.9 indicates the highest percentage of students has achieved competency level 3.3. On the other hand, the lowest percentage of students has achieved competency level 6.1.

The achievement of different competency levels is also graphically shown in Fig. 4.14.

Competency levels related to Biology

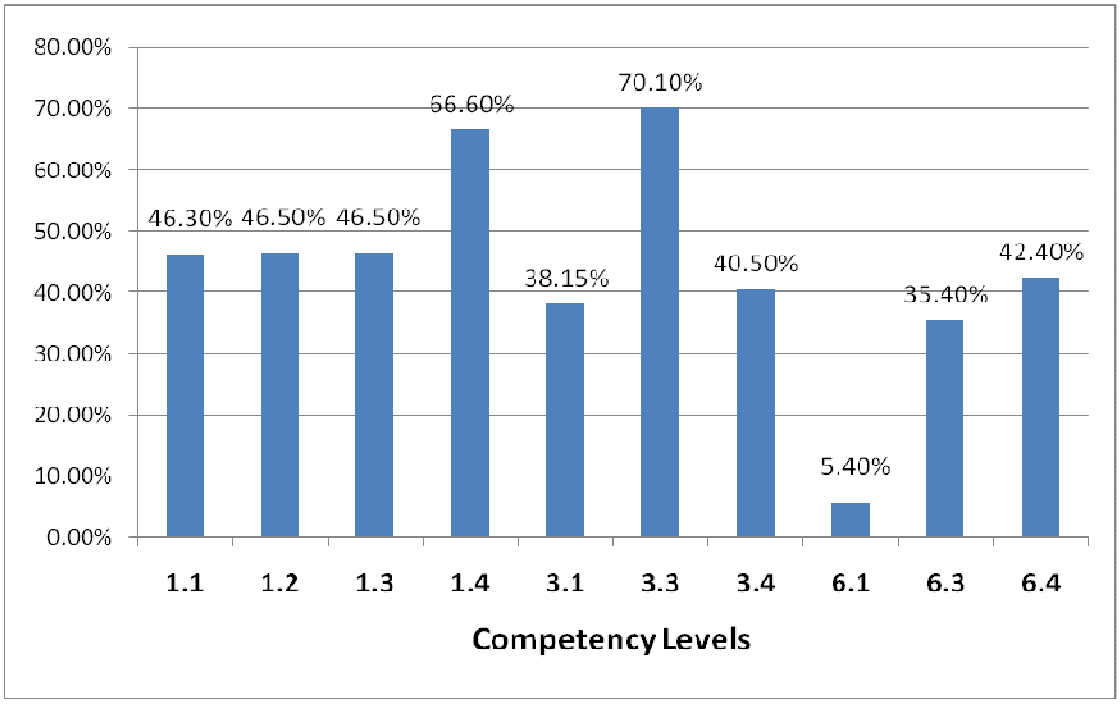


Fig. 4.14: Achievement of competency levels related to Biology

Table 4.10 indicates the achievement of competency levels related to Chemistry

Table 4.10: Achievement of Competency levels related to Chemistry

Content	Competency Level	Percentage
Chemistry	2.1 Inquires into the properties of matter	48.15%
	2.2 Inquires into the standard symbols used for elements	30.80%
	2.3 Display the ability to use the differences in density of substances in day today life.	46.25%
	2.4 Uses the expansion of solids, liquids and gases in day today life effectively.	7.90%
	2.5 Inquires into the usages of compounds according to their properties.	19.90%
	2.6 Inquires into the domestic uses of chemicals	17.90%
	2.7 Uses parallel and serial connections of electrical appliances in human needs.	48.80%
	2.8 Uses magnets in day today life	59%

As Table 4.10 and Figure 4.15 indicates the lowest achievement relates to competency level 2.4. On the other hand, the highest percentage can be seen in relation to competency level 2.8.

When the cognitive level related to these two competency levels are considered the first (2.4) relates to application while 2.8 relates to knowledge. Therefore, it can be inferred that students ability to apply the knowledge is weak.

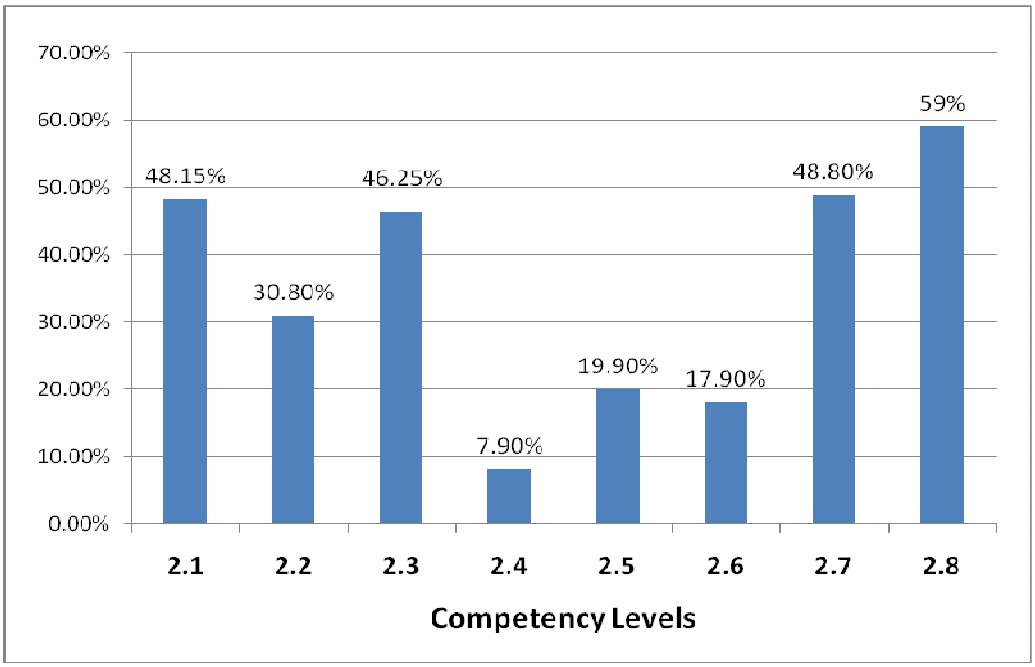


Fig. 4.15: Achievement of competency levels related to chemistry

Next competency levels related to earth science will be analyzed.

Table 4.11: Achievement of competency levels related to earth science

Content	Competency Level	Percentage
Earth science	4.1 Investigates the constituents of the atmosphere	43.55%
	4.2 Acts to maintain optimum composition of the atmosphere	35.20%
	4.3 Uses natural resources obtained form the earth effectively	50.10%

As Table 4.11 and the Figure 4.16 indicates there is more homogeneity in the achievement of these competency levels.

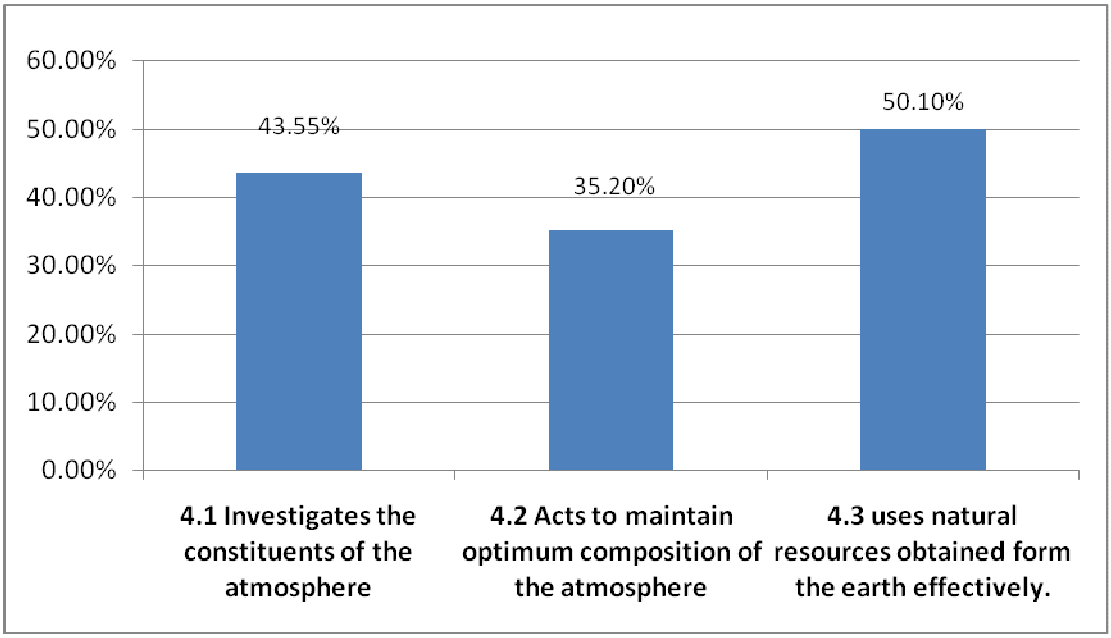


Fig.4.16: Achievement of competency levels related to earth science

Competency levels related to physics would be analyzed next

Table 4.12: Achievement of competency levels related to physics

Content	Competency Level	Percentage
Physics	5.1 Inquires into the application of the concept "pressure" in day today needs	37.40%
	5.2 Inquires into the effect of Center of Gravity on the equilibrium of an object in relation to life experiences	45.70%
	5.3 Uses work, energy and power in human concerns/needs	35.60%
	7.1 Uses properties of light in human needs	19.20%
	7.2 Uses generation and propagation of sound in musical instruments	45.20%
	7.3 Explores the scientific basis of modern communication equipments	39%
	8.1 Contribute to minimize the risks associated with cyclones	51%
	8.2 Contribute to minimize the risks associated with lightning and thunder	52.30%

The lowest achievement in physics relates to competency level 7.1. On the other hand, the highest percentage of students has achieved competency level 8.2

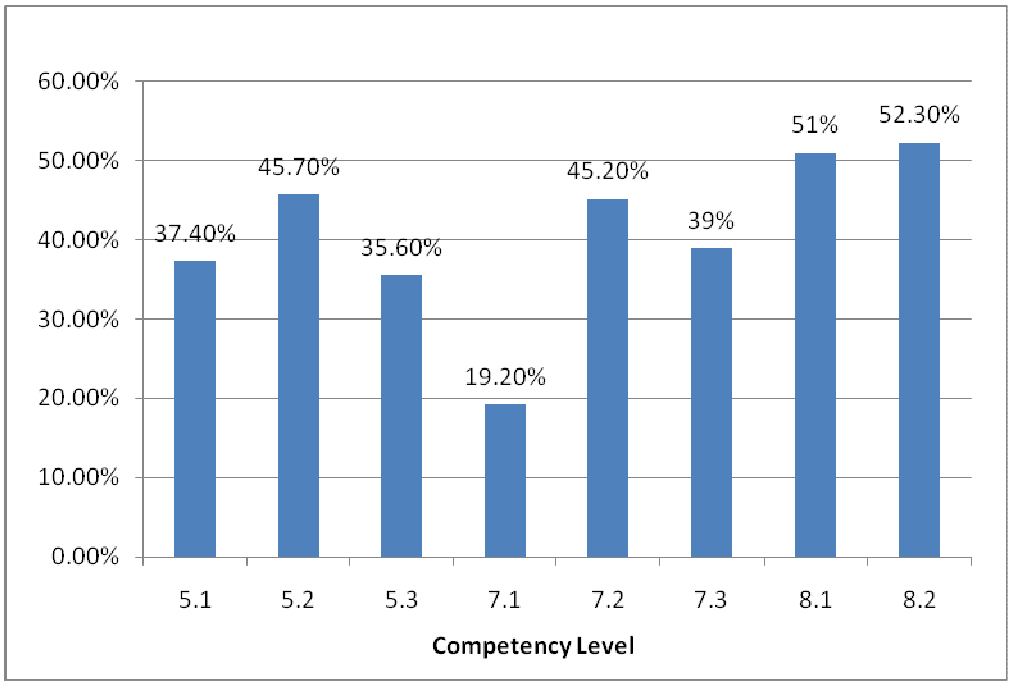


Fig.4.17: Achievement of competency levels related to physics

Facility index values for the science paper

The science paper consisted of three sections. The part 1 contained 20 questions of selection type.

Fig. 4.18 displays the facility values for questions 1-20

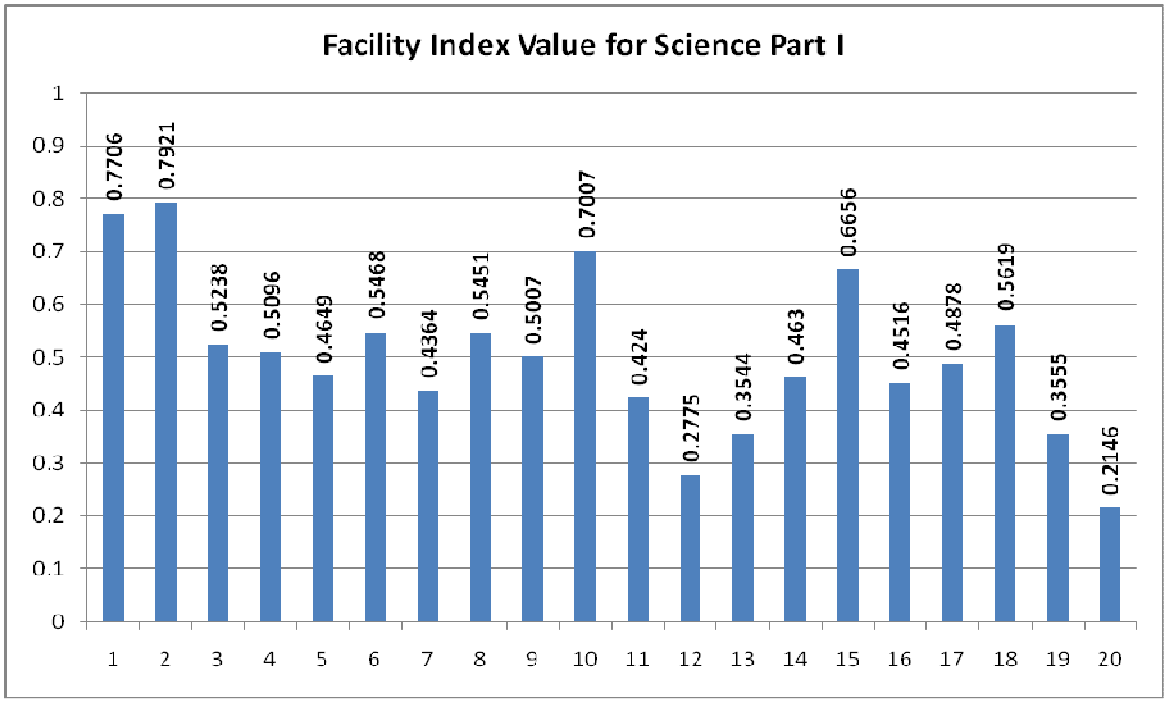


Fig. 4.18: Facility index value for science part I

According to Fig. 4.18 the facility values ranges from 0.2146 to .7921.

Part 2 of the question paper contained 10 questions of supply type. The analysis of section 2 is displayed in Fig 4.19.

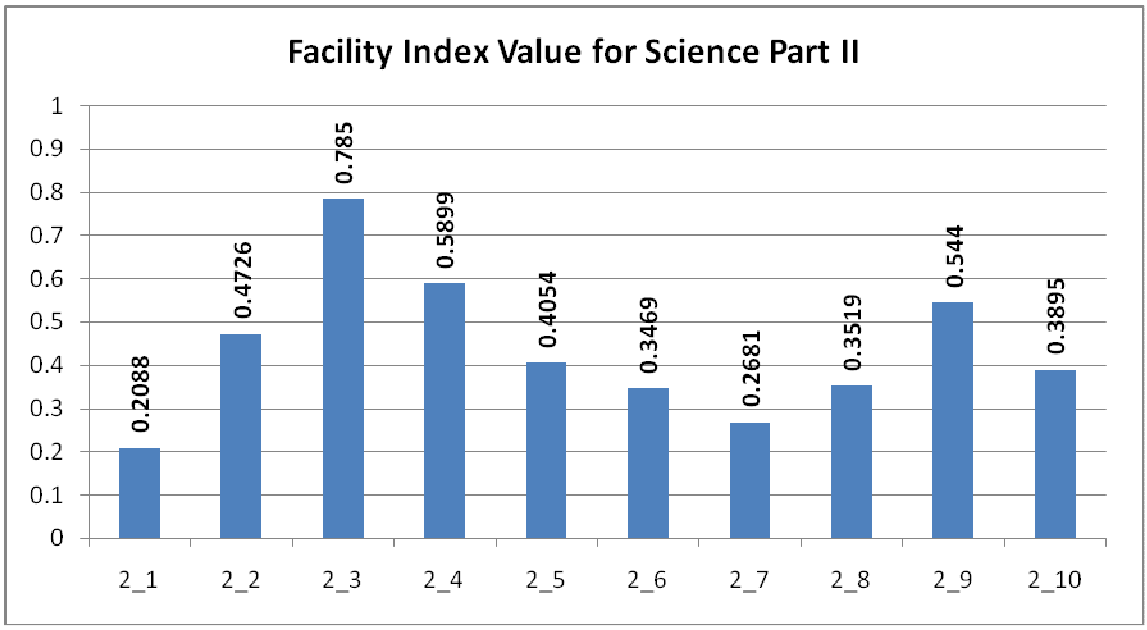


Fig. 4.19: Facility index value for science part II

As Fig. 4.19 indicates the performance is relatively low in part II.

The part III of the question paper contained four questions with six sub parts for each main question.

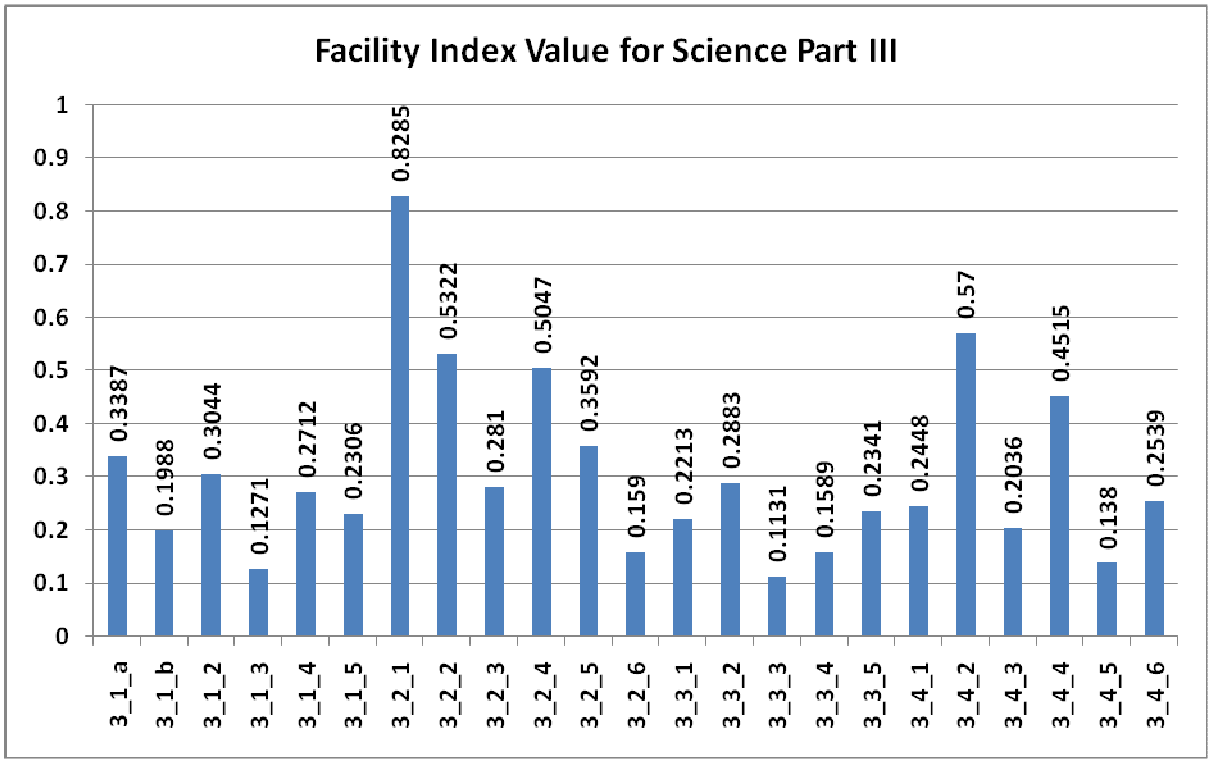
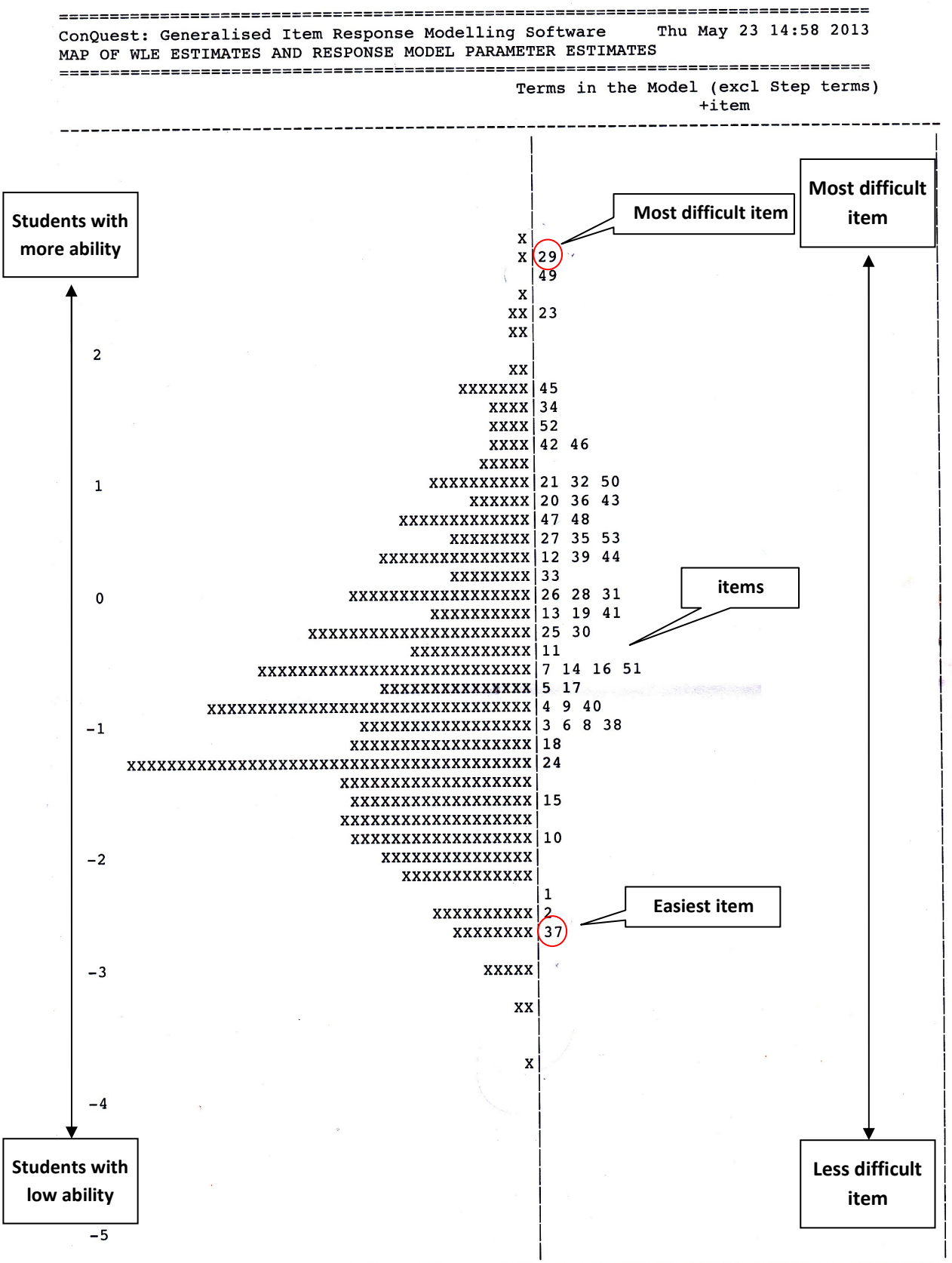


Fig. 4.20: Facility index value for science part III

The performance in part III is relatively better than in part II

Disparity in achievement seen through item analysis

The Item Person Map (IRT) given on pg. 81 displays the range of difficulty of the test items as well as the range in student ability. According to the map there are approximately thirty 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 Thu May 23 14:58 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
-3
-4
-5
29
49
23
45
34
52
42 46
21 32 50
20 36 43
47 48
27 35 53
12 39 44
33
26 28 31
13 19 41
25 30
11
7 14 16 51
5 17
4 9 40
3 6 8 38
18
24
15
10
1
2
37
Each 'X' represents 29.5 cases

4.8 Summary

This chapter discussed students' performance in science 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 the science.

Chapter Five

Patterns in Achievement – English Language 2012

5.1 Introduction

The English language curriculum was also changed to a competency based model in 2007. However, no studies have so far being conducted to monitor its effectiveness. Therefore, the analysis of the National Assessment 2012 will be a benchmark for further studies.

This chapter presents the patterns in achievement of the students in English Language.

5.2 Patterns of achievement at National Level

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

In section 2.3, the sampling methodology will be discussed.

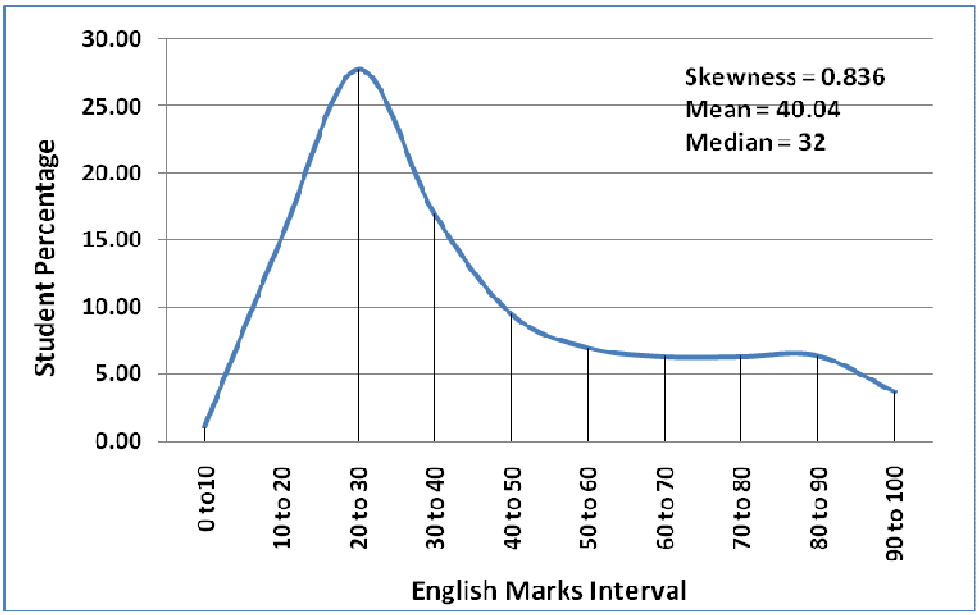


Fig. 5.1: All island achievement in English 2012 – dispersion of marks

The frequency polygon shown in Fig. 5.1 outlines the total picture of the distribution of marks of grade 08 students in English language.

Fig. 5.1 depicts a positively skewed distribution of marks. As can be seen there is a higher percentage of students with low marks and a low percentage of students with high marks. Hence, the curve has a high positive skewness value (0 .836).

Fig. 5.2 illustrates student achievement patterns further.

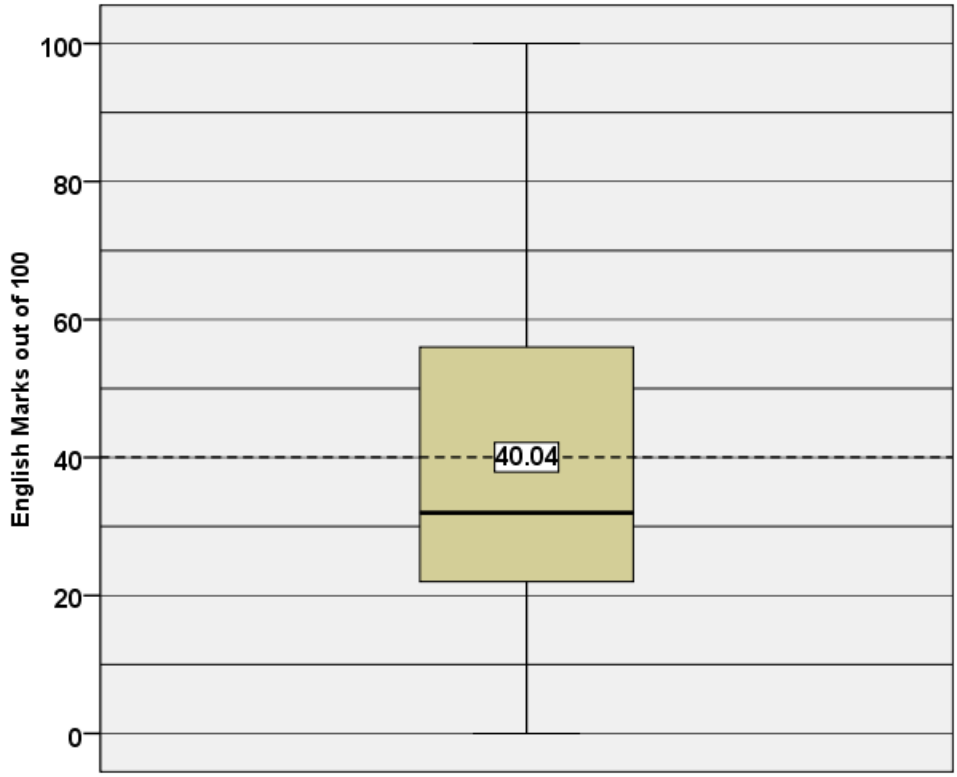


Fig. 5.2: Box plot chart representing all island English achievement

According to Fig. 5.2, 50% of the students have scored 32 percent or above. On the other hand the mean value is 40. This difference is due to high percentage of low achievers.

The dispersion of marks indicated by the graph in Fig. 5.1, can be further elaborated using the cumulative percentages.

Table 5.1: All island achievement in English 2012 – cumulative percentages

Marks Interval	Student Percentage	cumulative Percentage
90 to 100	3.68	100.00
80 to 89	6.36	96.32
70 to 79	6.30	89.96
60 to 69	6.30	83.66
50 to 59	6.97	77.37
40 to 49	9.48	70.39
30 to 39	16.95	60.91
20 to 29	27.76	43.96
10 to 19	15.14	16.20
0 to 9	1.06	1.06

All island English marks corresponding to the class intervals indicate that approximately 61% of students score less than the pass mark. Further, the highest percentage of students' marks are within the range 20-29. Thus it could be concluded that the island wide achievement of learning outcomes for English language is not satisfactory.

However, according to Table 5.1 there are also 16.34% of students scoring above 70%. These differences emphasize the disparity that prevails in achievement of learning outcomes, even though the overall achievement is unsatisfactory.

Summary of national level achievement

- National level mean and median values are 40% and 32% respectively.
- There is wide disparity in achievement pertaining to English language and the overall achievement in English language is not satisfactory.

Provincial wise student achievement will be discussed next.

5.3 Provincial wise student achievement

Table 5.2: Provincial achievement in English 2012 – Summary statistics

Province Name	Mean	Rank	Standard Deviation	Standard Error of Mean	Percentile (p25)=Q1	Median (p50)=Q2	Percentile (p75)=Q3	Skewness
Western	45.25	1	23.062	0.226	26	40	64	0.476
Central	44.42	2	25.323	0.302	22	36	66	0.571
Southern	42.48	3	23.263	0.243	24	36	60	0.619
Sabaragamuwa	42.45	4	25.36	0.279	22	32	60	0.794
North Western	41.37	5	23.941	0.275	22	34	56	0.848
Uva	38.41	6	23.894	0.314	20	30	52	0.948
Northern	36.08	7	21.783	0.31	20	28	46	1.055
North Central	32.55	8	17.475	0.202	20	28	40	1.232
Eastern	31.65	9	18.964	0.241	20	26	38	1.314
All Island	**40.04**		**23.301**	**0.09**	**22**	**32**	**56**	**0.836**

As Table 5.2 indicates based on Provincial wise mean achievements, Western Province ranks first. Central Province is ranked second with only a slightly lower mean value.

Achievement wise the provinces fall into three categories. Western, Central, Southern, North Western and Sabaragamuwa with mean scores above the national mean, fall into the higher category. Uva, North, North Central and Eastern Provinces which are below the national mean fall into the lower category. However, among the lower category there is much variation in achievement than in the higher category. There is a seven point difference between Uva and Eastern Provinces mean scores. Therefore, the lower group can be categorized once again to two groups with Uva and Northern Province falling into the middle group , while North Central and Eastern falling into the lowest group.

Very high difference in mean values (13.6) can be seen between the highest scoring Western and lowest scoring Eastern Provinces.

These disparities are further highlighted through the bar chart given in Fig. 5.3

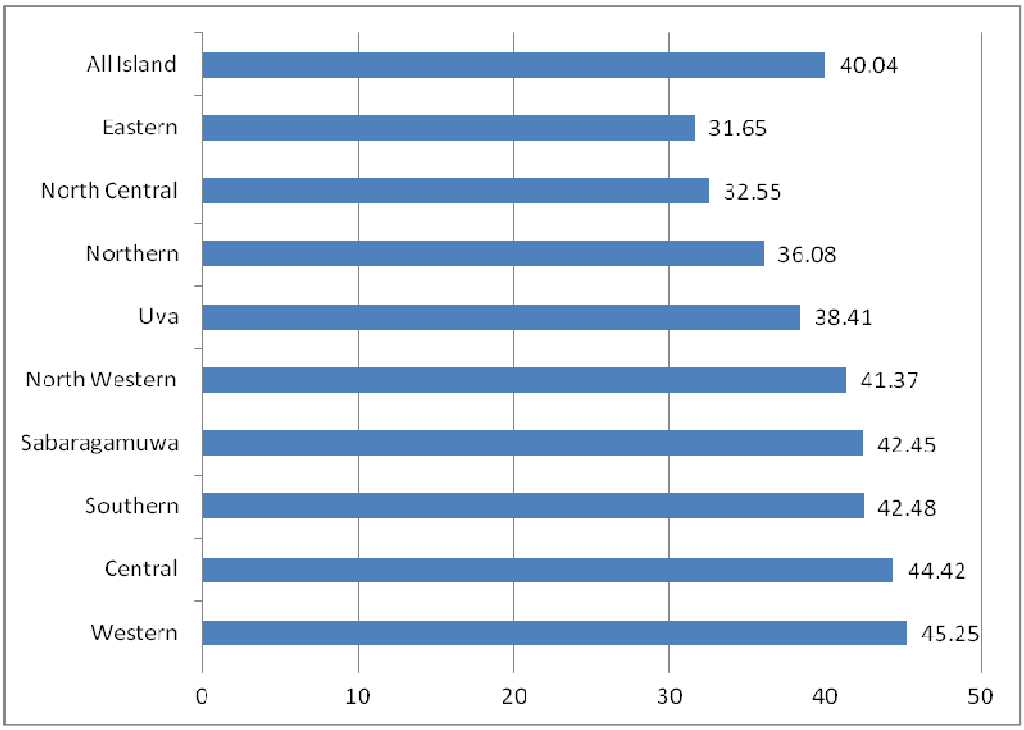


Fig.5.3: Bar chart to represent mean among the provinces- English language

Fig. 5.3 indicates that in provinces like the Eastern, North Central, North and Uva the mean values are below the all island mean value.

Disparity in achievement among Provinces

Although, there are five provinces that have scored above the all island mean, their median values differ. According to Table 5.3, in the Western Province 50% of the students have scored 40 or above marks. However, in all the other provinces 50% of the students have scored less than 40 marks and in the Eastern Province as low as 26. Therefore, it could be concluded that achievement levels in most of the provinces is very low. Further, there is disparity in achievement among provinces, especially between Western Province and the other provinces.

According to Table 5.2, all the standard deviation values lie between 17 to 25 ranges. As discussed, the mean difference between Western and Central Provinces is very little. However, the deviation of marks from the mean in the Central Province is higher compared to the Western Province. Therefore, it could be claimed that the achievement differences among the students in the Central Province is higher than in the Western

Province. The highest SD is seen in the Sabaragamuwa Province. Hence, student diversity is highest in the Sabaragamuwa Province.

North Central and Eastern Provinces obtained lower standard deviations compared to other provinces and below the national SD. 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 values than the other provinces. Therefore, the homogeneity is among the low achievers.

Taken collectively, SD values are very high for English language achievement for all the provinces. All island SD (23.301) value is more representative of seven provinces where SD ranges from 21-25.

In all the provinces, skewness values are positive and at the same time rather high. Western Province skewness value being 0.065 is lower than the values in other provinces. This means that compared to other provinces there are higher number of high achievers. Eastern and Northern Provinces the skewness is higher due to higher number of student marks falling among low score.

Western Province first Quartile (Q1) mark 26 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 64%. The first Quartile in all provinces lie between 20 to 26 and the all island value is 22 which shows that there are some similarities in this mark range among provinces. Further, these performances are similar to all island performance. However, the third Quartile ranges from 40 to 64 marks indicating greater differences among provinces.

These differences are further illustrated through the box plot (Fig. 5.4)

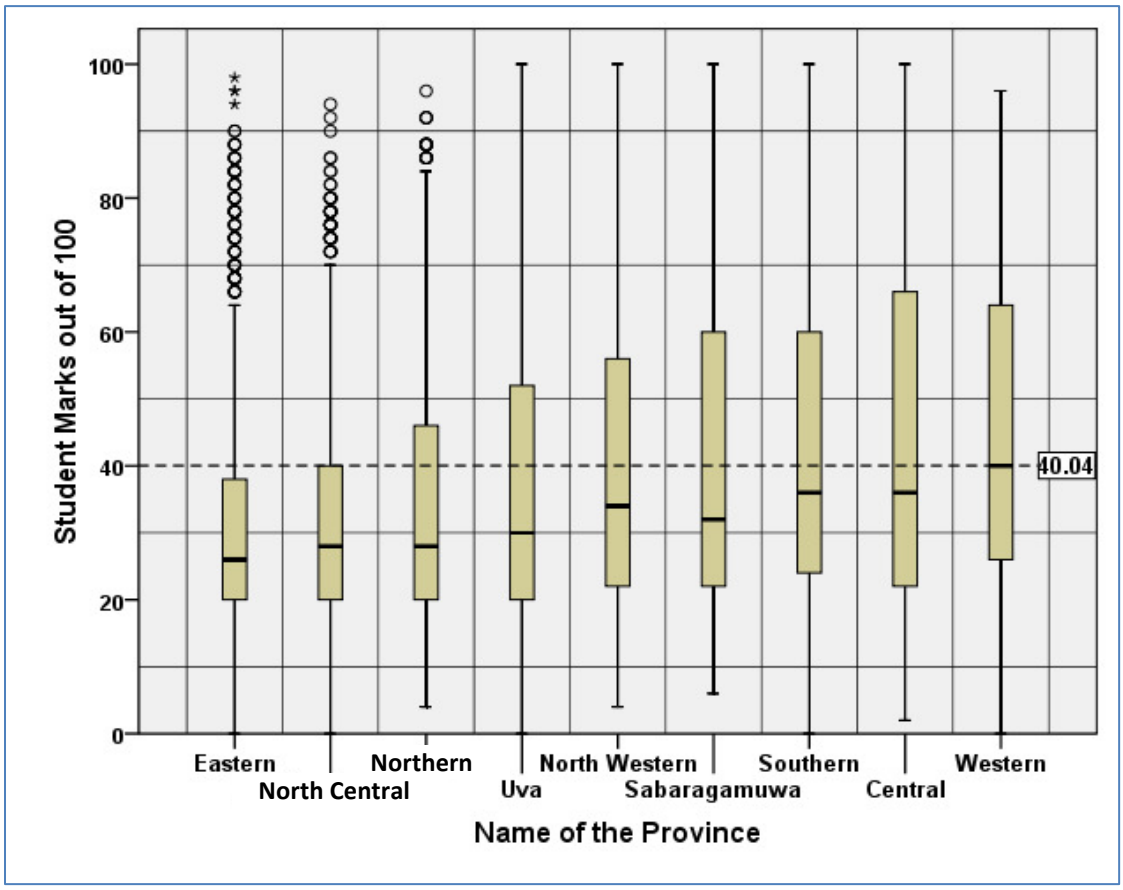


Fig.5.4: Box plot chart representing all island English achievement

There is high variation in achievement among and within provinces. In the Western Province 50% of students have scored 40% or above. Since the all island mean value is 40%, this means that 50% of the students in the Western Province have scored the all island mean value.

On the other hand, in the Central Province even the mark range from the lowest to the highest is more than the Western Province. Yet, its median is lower than the all island mean value. In the Eastern and Northern Provinces even the p75 is lower than the all island mean value.

This box plot confirms, as already discussed that there is not much variation in the lower level marks. However, above the all island mean value, there is greater variation.

A significant feature of the achievement in English language is that in the three provinces with the lowest achievement levels there are outliers. These are the students who have scored very high marks. The most number of outliers are found in the lowest achieving province, that is the Eastern Province. Not only are there very high achievers who have scored above the normal range, there are three students who have scored exceptionally high, even above the high achievers.

Therefore, it could be concluded that there is variation among as well as within the provinces with respect to achievement in English.

Summary

- Achievement wise the provinces fall into two categories.
  Category 1 – Western, Central, Southern, North Western and Sabaragamuwa with mean scores above the national mean (40.04)
  Category 2 –– Uva, North, North Central and Eastern which are below the National mean
- Disparity of marks within the lower group is higher than among the higher group.
- In the three provinces with the lowest achievement levels – Eastern, North Central and the Northern there are a few outliers.

5.4 Achievement levels by type of school

Table 5.3: English marks achievement according to the school type

School Type	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
1AB	51.68	24.445	0.130	0.168	30	49.97	74
1C	27.76	13.012	0.091	1.418	20	24.00	34
Type 2	25.41	11.475	0.110	1.517	18	24.00	30
All Island	**40.04**	**23.301**	**0.090**	**0.836**	**22**	**32.00**	**56**

As Table 5.3 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 23.92, the difference between 1AB and Type 2 is 25.27. 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 12.98 marks below that of the all island mean value. Type 2 performance is even worse, but more closer to Type 1C. Therefore, performance of 1C and Type 2 schools needs to be improved.

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

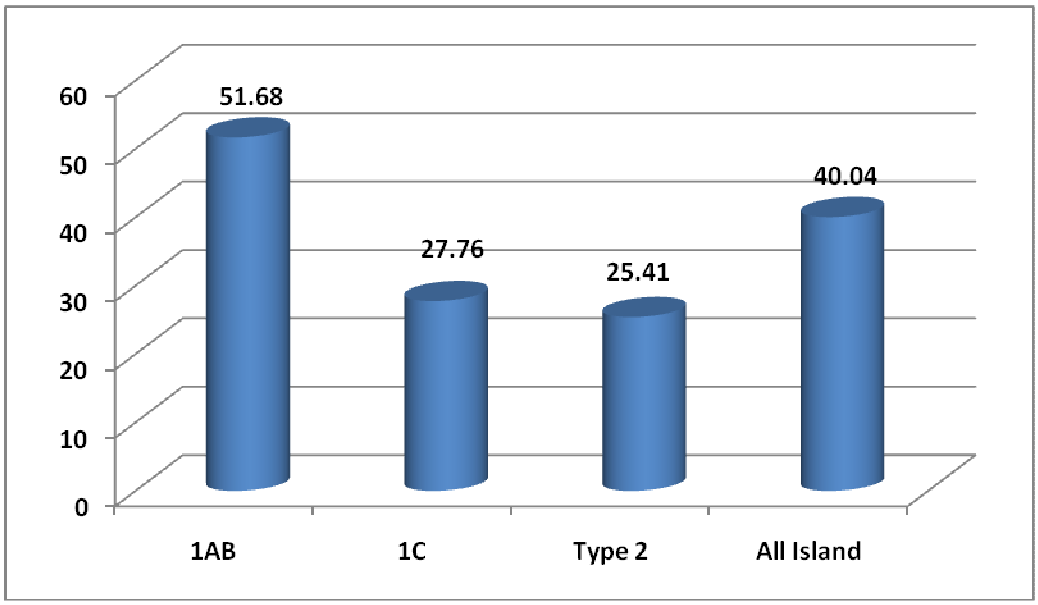


Fig.5.5: Bar chart representing the mean among the school types- English

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 49.97 mark value in the 1AB schools. On the other hand, in 1C and Type 2 schools 50% are scoring below the pass marks. In fact, in 1AB schools even the bottom 25% is scoring more than the 50% in other two school types. The disparity is highest when the P75 is considered. In 1AB schools p75 is more than twice that of the 1C and Type 2 schools.

Variation among student achievement

Although achievement is higher in 1AB schools, variation among student achievements also can be seen. As shown in Table 5.3 the standard deviation of the 1AB schools is quite high and even above the all island SD. The SD of the 1AB schools had significantly contributed to the All Island standard deviation. In all three school types, the SDs are more than half of the mean score. Therefore, there is high variation within all school types. However, when variation among school types is considered, there is little difference in variation with respect to 1C and Type 2 schools.

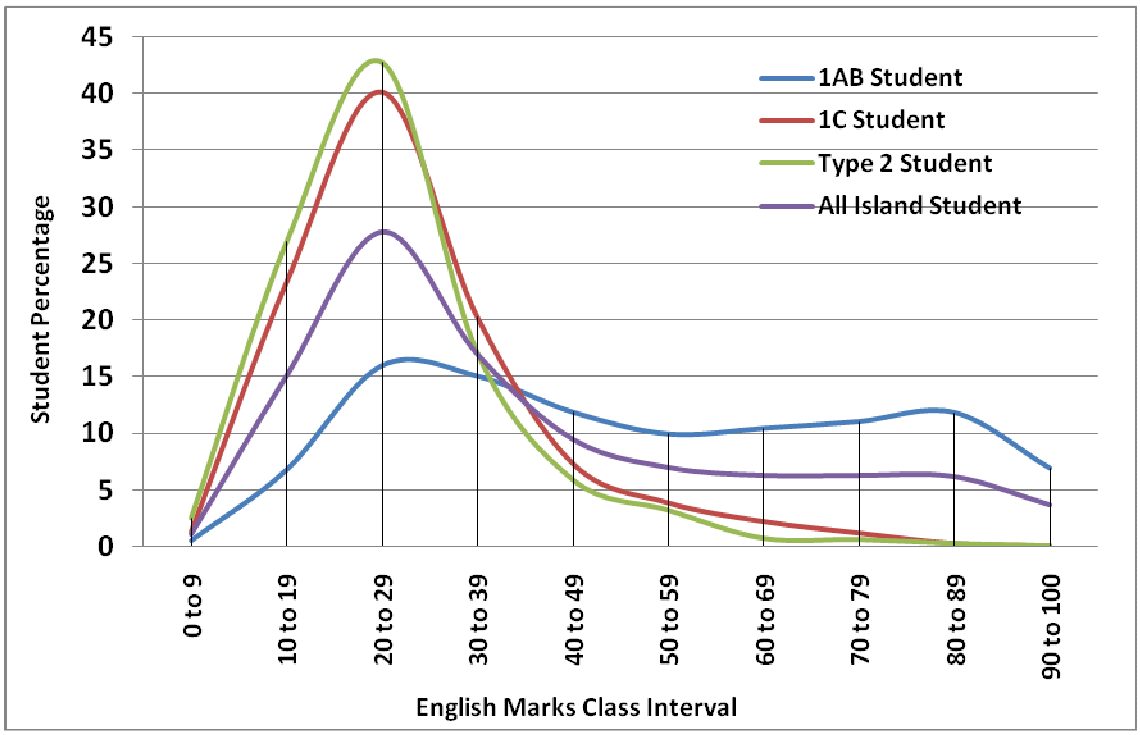


Fig. 5.6: Dispersion of marks by school type – English language

Disparity in marks

All the curves except for 1AB Schools are highly positively skewed indicating that there are large number of students scoring low marks. In these curves the peak corresponds to the class interval 20-29. On the other hand, in the case of 1AB schools, two high peaks can be observed. That is between 20-29 and 80- 89. The all island curve lies between the 1C and 1AB curves, denoting that its positive skeweness is higher than that of the

1AB curve. The high skewness of the 1C and Type 2 schools has directly affected the skeweness of the all island curve.

The skeweness of the curves can be further explained through the cumulative percentages indicated in Table 5.4.

Table 5.4: Cumulative student percentages according to the school type- English

Class Interval	1AB Student (%)	Cumulative (%)	1C Student (%)	Cumulative (%)	Type 2 Student (%)	Cumulative (%)
90 to 100	6.90	100.00	0.07	100.00	0.04	100.00
80 to 89	11.80	93.10	0.28	99.93	0.25	99.96
70 to 79	11.00	81.30	1.20	99.65	0.60	99.71
60 to 69	10.40	70.30	2.22	98.45	0.71	99.11
50 to 59	9.90	59.90	3.87	96.23	3.20	98.40
40 to 49	11.83	50.00	7.34	92.36	5.90	95.20
30 to 39	15.00	38.17	20.24	85.02	17.10	89.30
20 to 29	15.93	23.17	40.14	64.78	42.80	72.20
10 to 19	6.74	7.24	23.34	24.64	26.90	29.40
0 to 9	0.50	0.50	1.30	1.30	2.50	2.50

Fig. 5.6 displayed that in all schools the curves peaked at the 20-29 class interval. However, the Table 5.4, indicates that the percentage scores that fall within this class interval varies among the school types. In the 1AB schools only 15.93% of students' scores fall within this class interval. On the other hand, in 1C and Type 2 schools 40.14% and 42.80% of the students scores fall within this class interval. In addition, in 1AB schools 11.80% of students' scores also fall within the 80-89 class interval. Further, in 1C and Type 2 schools 85.02 cumulative percentages and 89.30 cumulative percentage of students' scores are below 40%. On the other hand, in 1 AB schools, failure percentage is only 38.17% and there are also 22.80% of high achievers scoring above 70%. Therefore, it could be claimed that compared to 1AB schools, the performance of 1C and Type 2 schools' performance is low.

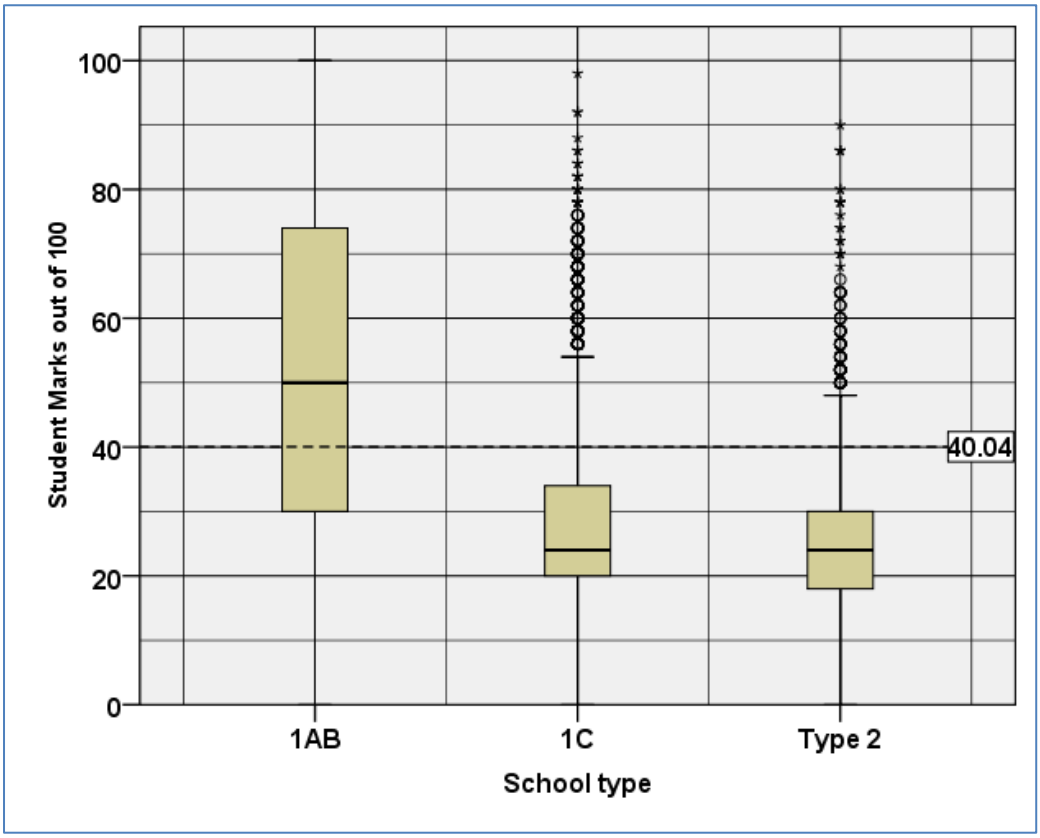


Fig. 5.7: English marks according to the school types using Box plot and whiksper plot

Box plot chart graphically shows students performance in the three school types. The students' achievement in the 1AB schools is evenly spread over 50 Median values. While 50% of the students have scored less than or equal to 50 mark points the other 50% of the students have scored 50 marks or higher. It clearly exhibits that all island mean statistics are highly affected by the low achievement of the 1C and Type 2 schools. All island mean value is not representative either of 1AB mean or the other two school types. According to this, there would be two separate mean calculations, one for 1AB schools and another for 1C and Type 2 schools.

A very obvious characteristics in 1C and Type 2 schools are the outlier (yellow card zone) and extreme (red card zone) values displayed by some students. Those lie beyond the one and a half box lengths (outlier) and three box lengths (extreme). It is not possible to analyze the performance of these students with the available data. They should be studied separately.

Summary

- Compared to 1AB schools, the performance of 1C and Type 2 schools' performance is low.
- However, in1C and Type 2 schools there are outlier (yellow card zone) and extreme (red card zone) values displayed by some students

5.5 Achievement levels by gender

Table 5.5: English Achievement in summary statistics table

Student Gender	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
Female	42.98	23.895	0.128	0.680	24	36.00	60
Male	36.86	22.207	0.124	1.027	20	28.00	48
All Island	**40.04**	**23.301**	**0.090**	**0.836**	**22**	**32.00**	**56**

Female students' English mean (42.98) is relatively higher than the male students' English mean (36.86) achievement. All Island student mean also lies above the male students' mean .Female students' English achievement has very highly affected the all island mean to rise.

Male and female students' 25th percentile difference is not relatively higher than the mean difference. All Island 25th percentile is more representative for both groups, because the values are closer. Male students' 50th percentile (28) is lower than the Female percentile (36). Male and Female students' 75th percentile shows higher difference than the difference in the previous percentiles. All island 75th percentile (56) is more closer towards the male students' value, because a higher student percentages of male students are included.

These differences could also be seen in Fig.5.8

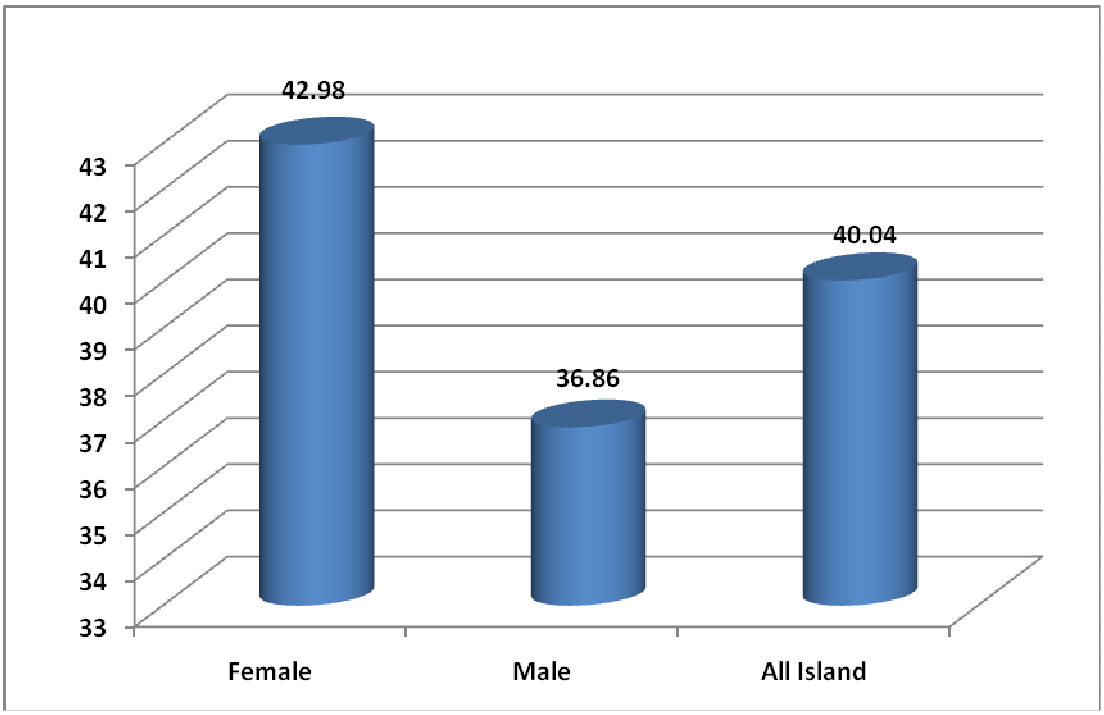


Fig. 5.8: Bar chart representing mean values according to gender - English

Male students' performance is below that of the female students as well as below the all island mean.

Fig. 5.10 explains further this low performance

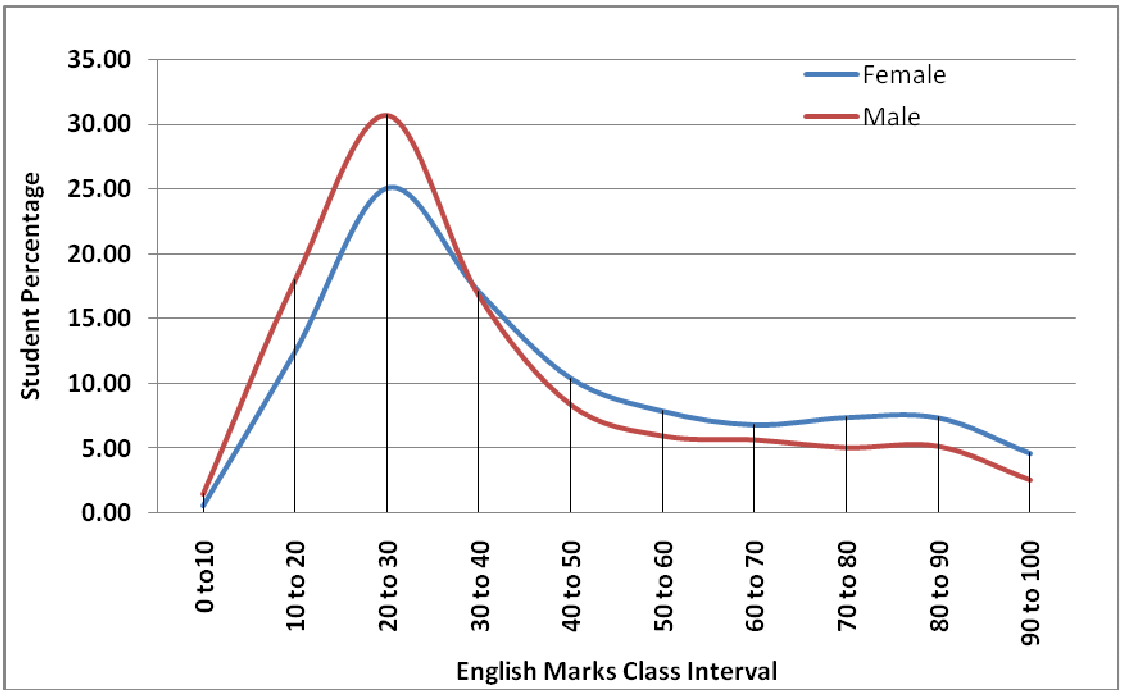


Fig. 5.9: Dispersion of marks by gender - English

Fig. 5.9 displays two curves which are both positively skewed. However, as Table 5.5 indicates the male curve has a higher positive value than the female, as well as the all island value.

The female students' achievement in the higher marks intervals, is slightly ahead of the male students. This indicates that the percentage of high achievers are greater among the females.

This pattern is further illustrated through the cumulative percentage Table.

Table 5.6: Gender wise English analysis cumulative table

Class Interval	Female (%)	Cumulative Percentage	Male (%)	Cumulative Percentage
90 to 100	4.65	100	2.60	100
80 to 89	7.40	95.35	5.20	97.40
70 to 69	7.42	87.95	5.10	92.20
60 to 69	6.85	80.53	5.70	87.10
50 to 59	7.91	73.68	6.00	81.40
40 to 49	10.44	65.77	8.40	75.40
30 to 39	17.11	55.33	16.80	67.00
20 to 29	25.10	38.22	30.70	50.20
10 to 19	12.50	13.12	18.00	19.50
0 to 9	0.62	0.62	1.50	1.50

According to Table 5.6 and Fig. 5.9 it could be concluded that both among females and males, there are a group of low performing students. However, the percentage of low performers among the males is higher than the females. The Female student percentage that falls within the first class interval (0-9) is 0.62. On the other hand, the male student percentage (1.5), is more than double of the Female student percentage. This is a matter of concern with respect to equity. This trend is visible up to the 50th mark point. Thereafter, the performance of both groups declines. The above analysis indicates that among both males and females there is a larger percentage of low achievers. On the other hand, the number of high achievers among both males and females is low.

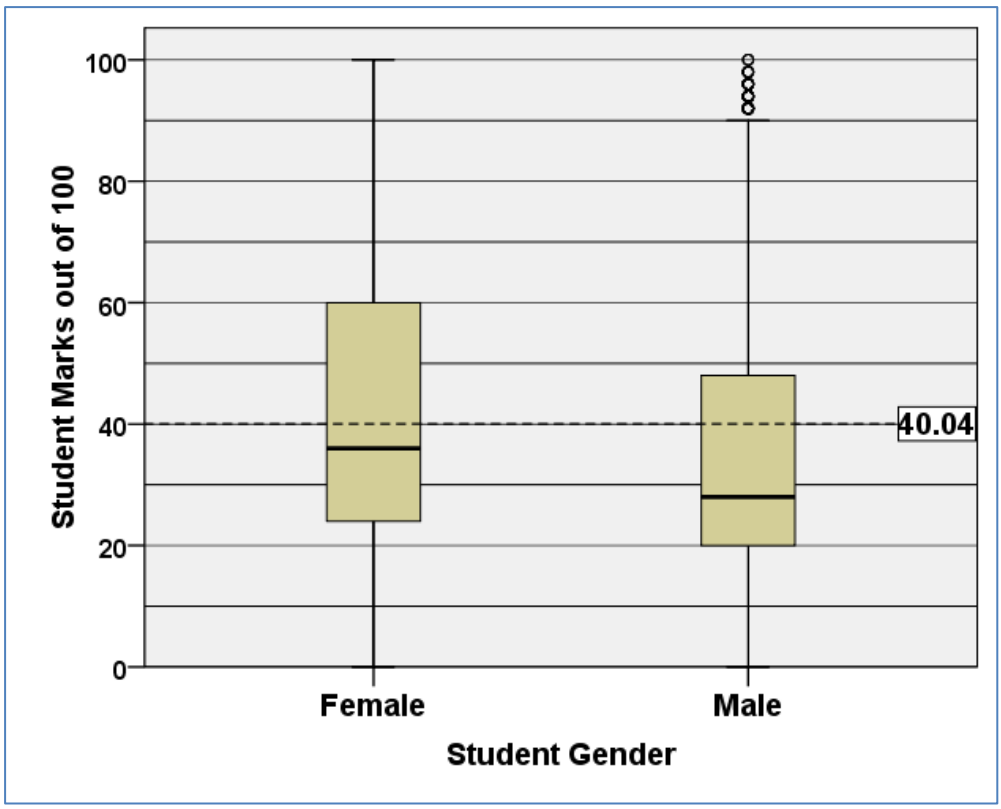


Fig. 5.10: Box plot and whiksper plot representing gender wise English marks

Box plot for gender wise English achievement graphically shows similarities that have been already discussed. In the female box plot, the first quartile (Q1) starts a little ahead of the Male students' first quartile (Q1) and it spreads higher than the male students' marks range. Male students median also lie below the female students' median. Therefore, the all island mean is not a good representative value for either of the groups.

Male students' box plot indicates a few outliers. This is an exceptional situation and needs further investigation.

Summary

- Female performance is higher than all island and male performance.
- Among both males and females there is a larger percentage of low achievers. On the other hand, the number of high achievers among both males and females is low.

5.6 Achievement levels by medium of instruction

Table 5.7: Achievement level by medium of instruction – English language

Medium of the Student	Mean	Standard Deviation	Standard Error of Mean	Skewness	Percentile (p25)	Median (p50)	Percentile (p75)
Bilingual	77.54	14.204	0.153	-0.981	70	80.00	88
Sinhala	36.00	19.278	0.093	1.023	22	30.00	46
Tamil	30.24	16.776	0.135	1.427	20	26.00	36
All Island	40.04	23.301	0.090	0.836	22	32.00	56

There is wide disparity between the students belonging to the different medium of instruction. While the Sinhala medium students' mean achievement is closer to the all island mean value, bilingual students' mean achievement is exceptionally high. On the other hand, the Tamil medium students' mean achievement is below the national mean and is the lowest.

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

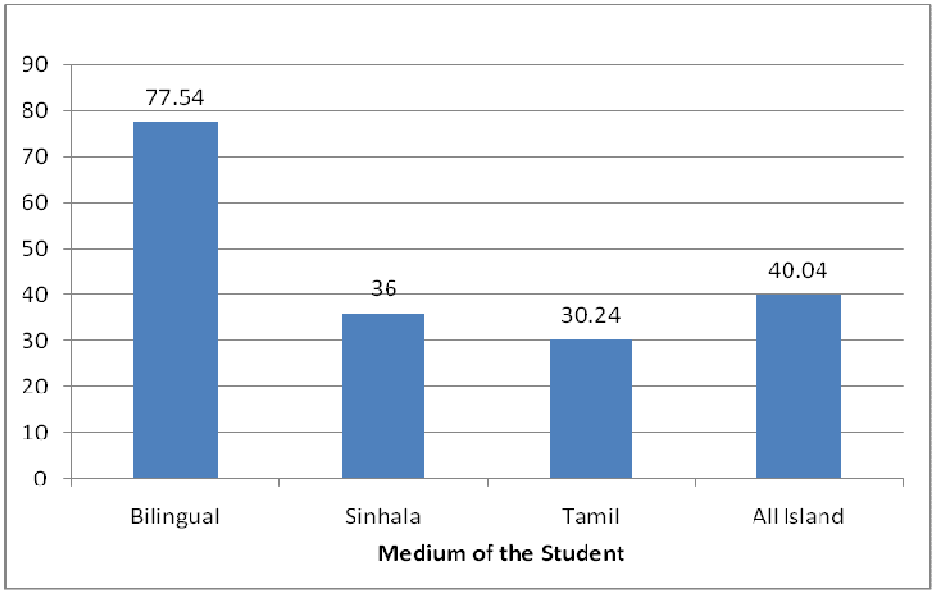


Fig.5.11: Bar chart representing mean values according to medium of instruction – English language

The difference between bilingual students' mean and Sinhala medium mean is 41.54 and bilingual and Tamil medium mean is 47.30. This difference is unusually high. Thus it could be said that all island mean is not a representative value for discussing medium wise marks analysis

Sinhala medium students' performance is equal to all island performance with respect to the median value. This means that 50% of Sinhala medium students as well as all island students score equal or above 47.5%. Comparing using median value also reveal same exceptional pattern observed in the Bilingual students' achievement. Their median value being 72.5. the gap between the Sinhala medium as well as all island performance is 25. On the other hand, the differences between bilingual and the Tamil Medium is 32.50. Bilingual medium students' 25th percentile is equal to Tamil medium students' 75th percentile value. Sinhala medium students' 75th percentile is less than the English medium students' 50th percentile value.

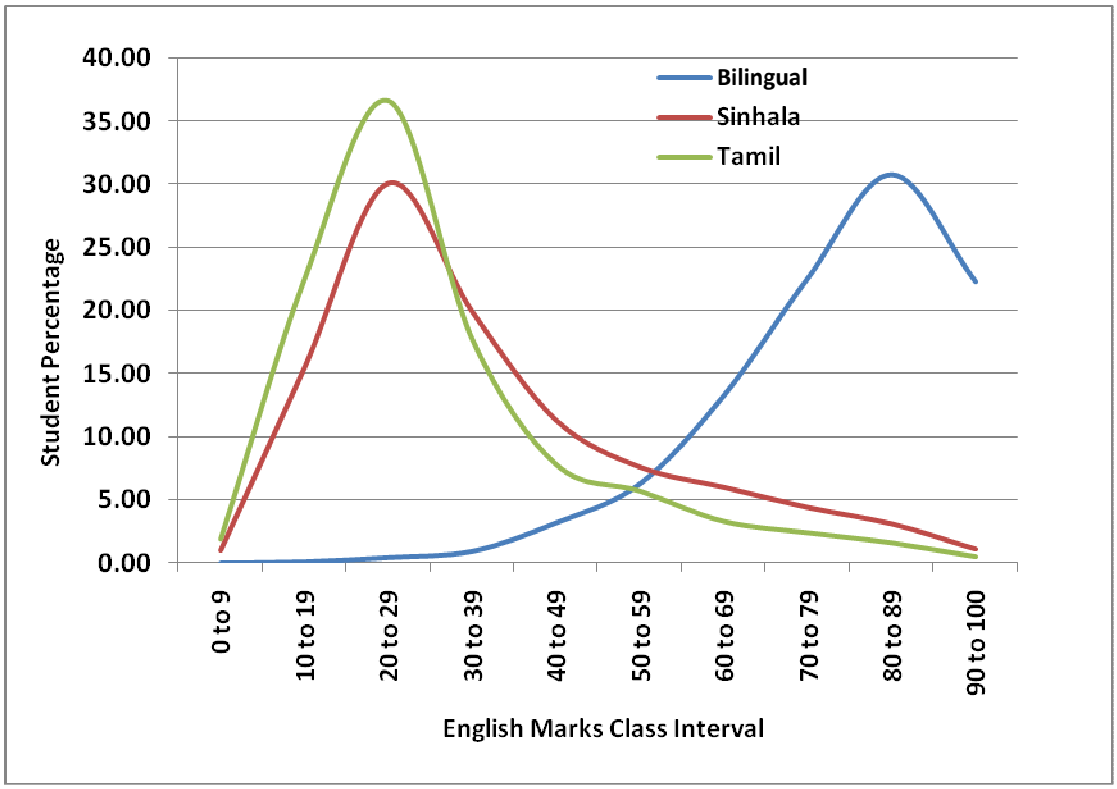


Fig. 5.12: Dispersion of marks by medium of instruction – English language

The disparity discussed using the mean and the median is also visible through the frequency distribution graph. While the bilingual students' curve is negatively skewed the other two curves are positively skewed.

Bilingual medium students' curve peaks at the higher mark ranges, Tamil and Sinhala medium students' curves peak at the lower mark intervals.

Most of the time when theoretically explained, lower standard deviation reveals lower disparity among student achievement, practically there are less chances to observe those characteristics. In this Table, English medium students' standard deviation is exceptionally lower (1/5) compared to other medium and all island values. Sinhala, Tamil and all Island standard deviation shows, that more than half or near higher than to related mean value on respective category. All Island standard deviation is very high. Due to lot of disparity among three medium, it can be expected to represent in such higher value.

Negative skewed value is shown by English medium student achievement curve. It reveals that higher number of student achievement lie among high marks. Sinhala and Tamil medium students' skewness value is positively skewed and greater than one as well. These curves show that higher number of students achievement lie among lower mark ranges. All island value also become positive due to this high number of student belonging to lower marks and mono medium of students have higher marks ranges.

Table 5.8: Medium wise cumulative percentage table – English language

Marks Interval	English	Cumulative Percent	Sinhala	Cumulative Percent	Tamil	Cumulative Percent
90 to 100	22.31	100.00	1.10	100.00	0.50	100.00
80 to 89	30.81	77.69	3.10	98.90	1.60	99.50
70 to 79	22.60	46.88	4.40	95.80	2.40	97.90
60 to 69	13.30	24.28	6.00	91.40	3.30	95.50
50 to 59	6.30	10.98	7.60	85.40	5.70	92.20
40 to 49	3.20	4.68	11.30	77.80	7.80	86.50
30 to 39	0.94	1.48	19.90	66.50	17.70	78.70
20 to 29	0.44	0.54	30.10	46.60	36.60	61.00
10 to 19	0.10	0.10	15.50	16.50	22.50	24.40
0 to 9	0.00	0.00	1.00	1.00	1.90	1.90

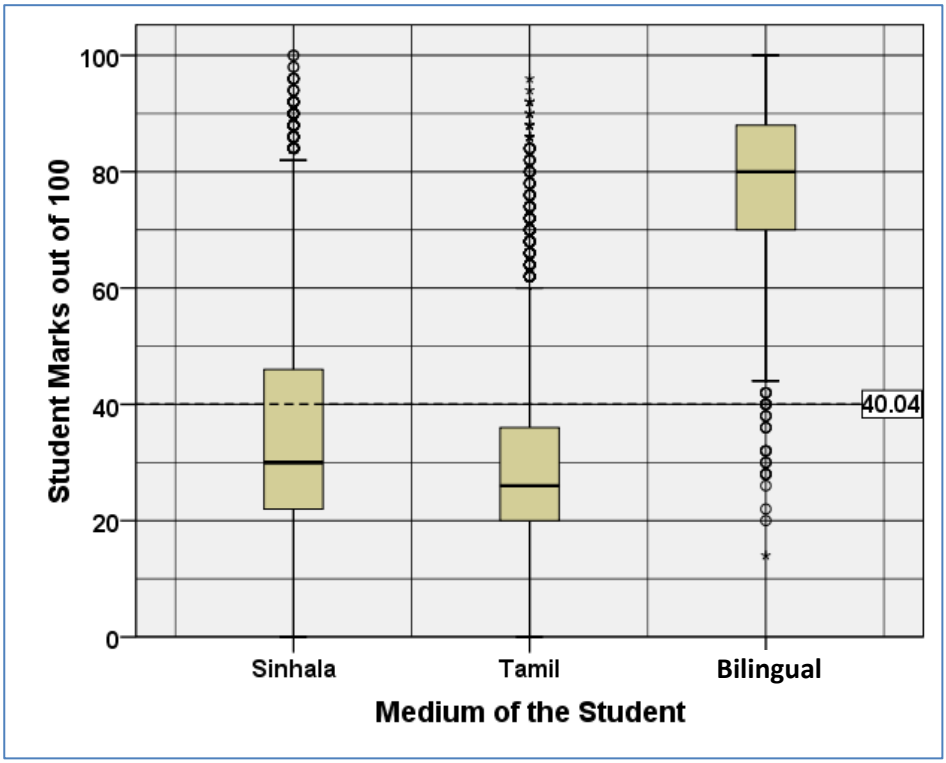


Fig. 5 .13: Box plot for medium wise achievement – English language

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

A remarkable feature of this box plot is that even though the bilingual students' achievement is exceptionally high there are students whose marks fall outside the normal range of marks.

Sinhala medium box plot reveals that there are outliers in higher marks zone. Tamil medium box plot reveals that not only outliers but also extreme values are also available. On the other hand, in the bilingual medium these characteristics lie in opposite direction of the box plot. There are outliers and extreme values in lower marks ranges. This is a surprising finding and needs to be separately examined .

Summary

- There is wide disparity among students belonging to different medium of instruction.

- Sinhala medium students' mean achievement is closer to the all island mean value, bilingual students' mean achievement is exceptionally high.

  The Tamil medium students' mean achievement is below the national mean and is the lowest.

- There are outliers in all three school types. However, while in the Sinhala and Tamil medium schools they have done exceptionally well in the bilingual medium schools these outliers have performed very much lower than the other bilingual students.

5.7 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. In preparing the Table competencies related to oral skills were excluded as they could not be measured through a written test.

Table 5.9: Competencies and competency levels in English

Competency	Competency Level	Percentage
Vocabulary	4.4 Uses English words in the proper contexts	14.60%
	4.5 uses the dictionary effectively	13.40%
	4.6 uses visual clues Contextual clues to derive the meaning of words	12.50%
Reading	5.4. Transfers information into other forms	7.90%
	5.5. Extracts the general idea of a text	6.60%
Grammar	6.2. Analyze the grammatical relations within a sentence	21%
	6.6.Construct complex sentences through the process of subordination	25.60%
Writing	2.4 Uses commas with understanding	31.50%
	7.5. Writes short stories	
	7.6. writes brief notes	

As Table 5.9 Indicates percentage of students who has achieved the different competency levels is not satisfactory. In comparison to the other competency levels students knowledge of

grammar and mechanics of writing (uses commas with understanding is better). However, when the other competency levels related to writing is considered the students' performance is weak.

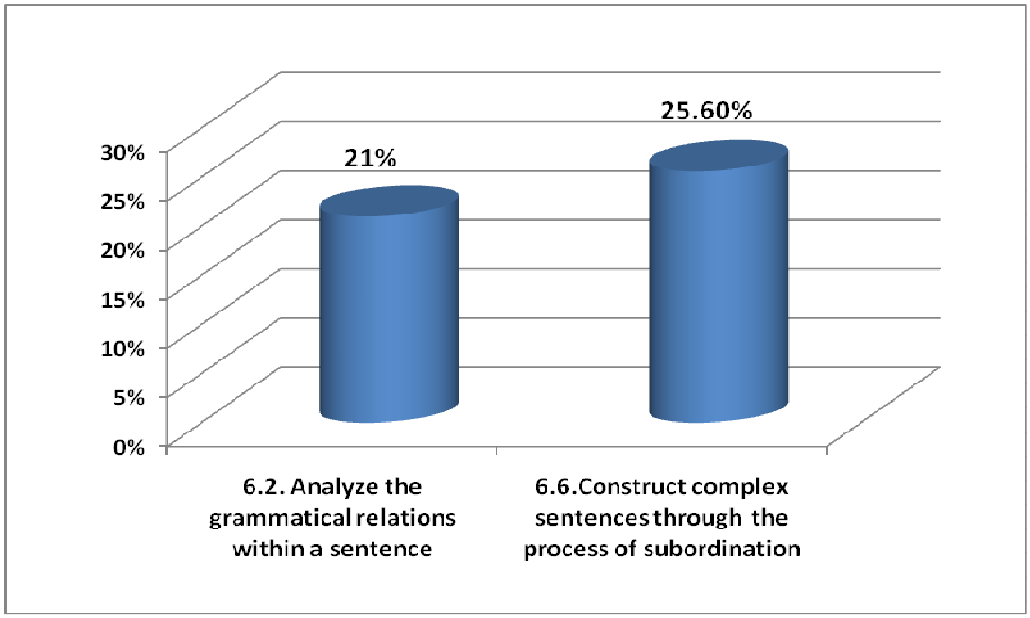
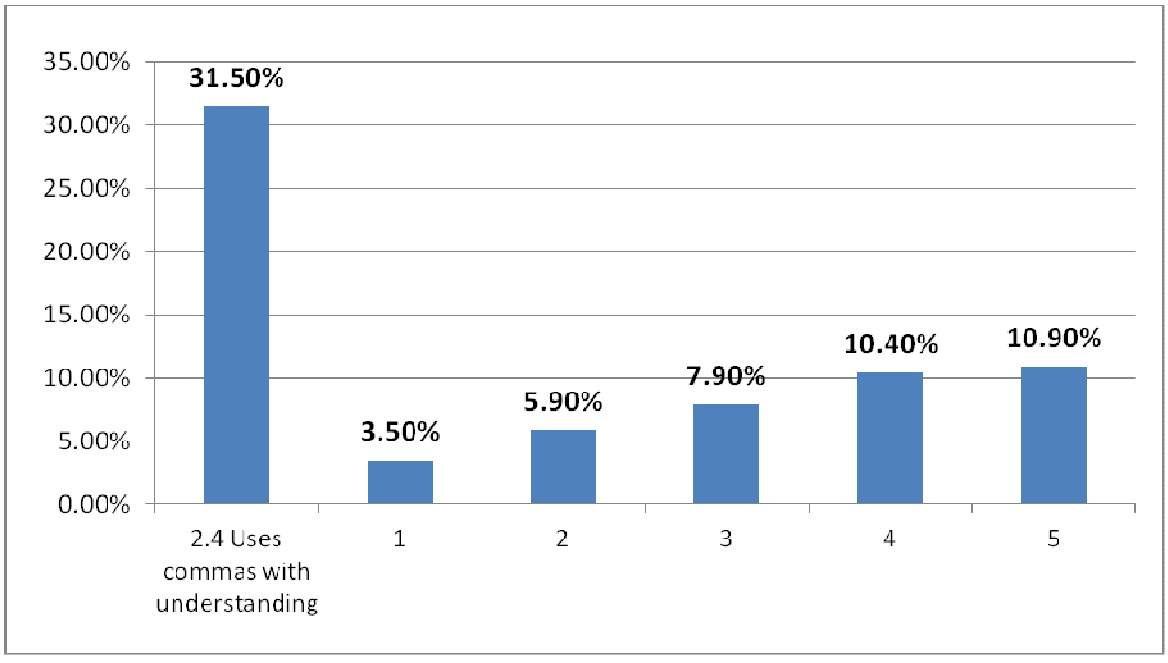


Fig. 5.14: Competency related to grammar



2.4 Uses commas with understanding **7.6. Writes brief notes**

Fig.5.15: Achievement levels in writing brief notes and mechanics of writing

Fig. 5.15 indicates percentage of students who has written perfectly correct sentences in question number 36 – which is to write a brief note.

As the Fig 5.15 indicates only 10.90% of students have written five perfectly correct sentences.

On the other hand, Fig. 5.15 analyzes students' performance in question number 36, where students were asked to complete a story by adding five more sentences.

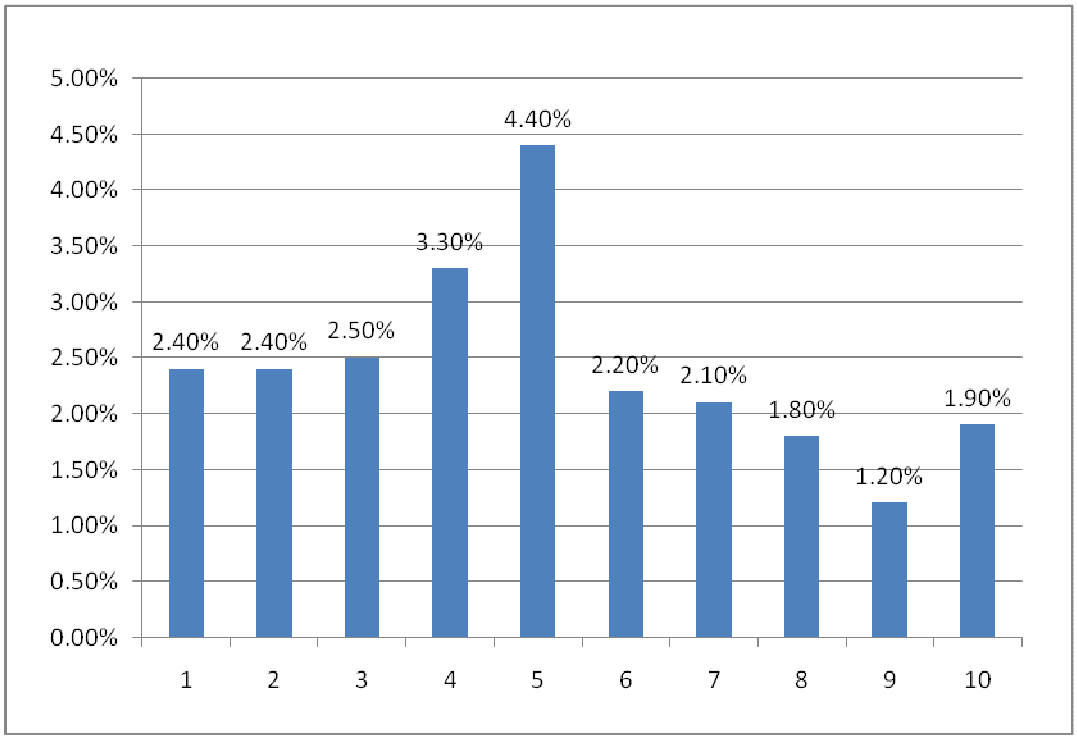


Fig. 5.16: Achievement levels in creative writing

According to Fig. 5.16 only 1.90% of students have been able to write five sentences accurately. On the other hand 4.40 % students have written five sentences but not completely accurate.

This analysis indicates that even though students have the basic understanding of mechanics of writing and grammar they are unable to sythesise and apply this knowledge in writing.

It is also interesting to note that students have performed better in competency level 7.6 than in competency level 7.5.

Competencies related to vocabulary and reading

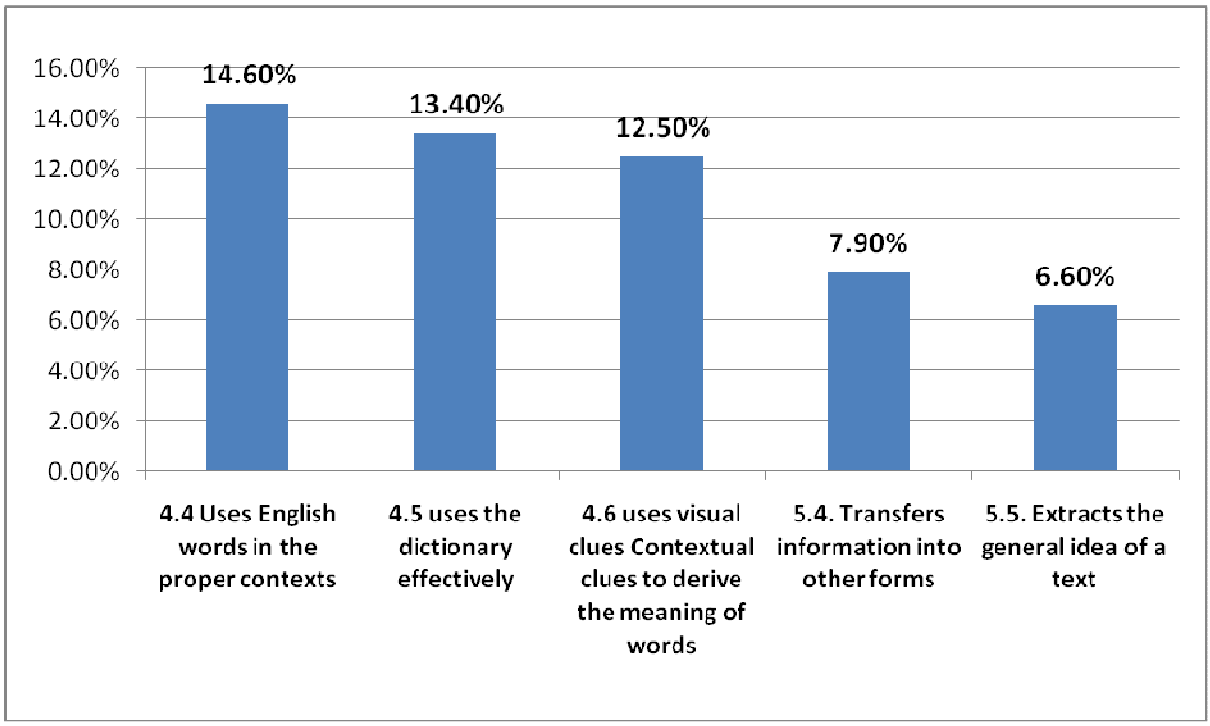


Fig. 5.17: Facility values in the competency levels related to vocabulary and reading

As Fig. 5.17 Displays students achievement in competency levels 4.4, 4.5 and 4.6 relating to vocabulary is better than in competency levels related to reading.

Further, extracting the general idea of a text is the weakest.

Facility index values for the English Language paper

The English Language paper consisted of 37 questions. Of these 35 were multiple choice and the last two were open ended.

Fig. 5.18 displays the facility values for questions 1-34
According to this Figure facility index ranges from 0.1196 to .6642

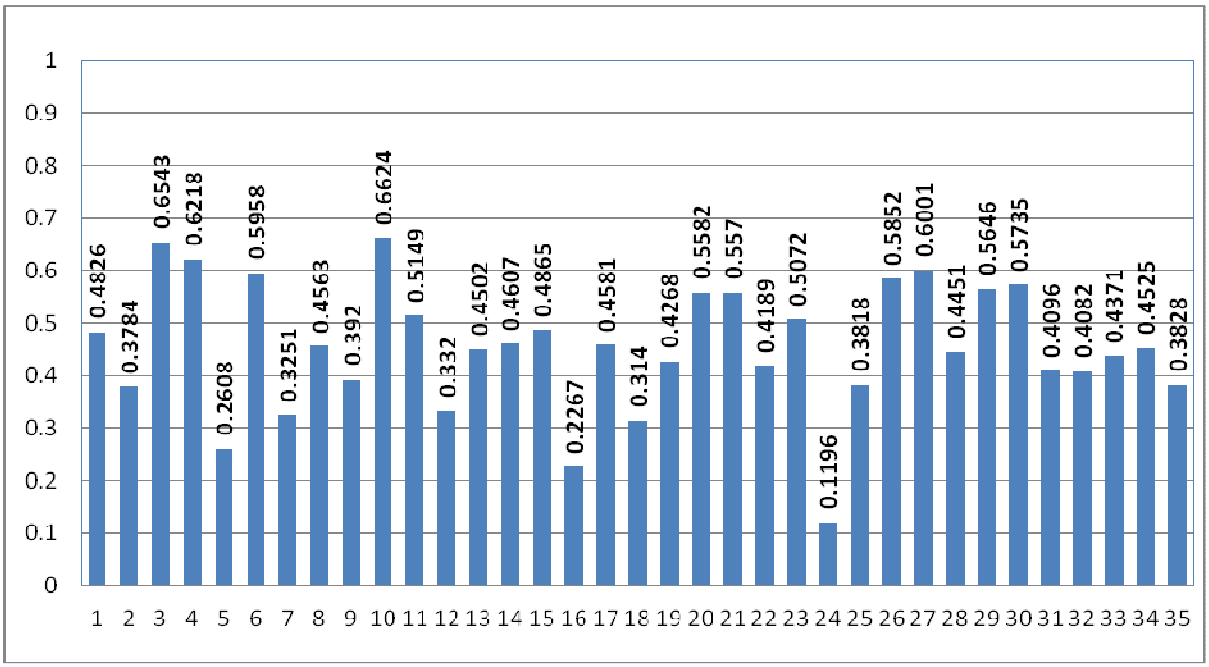


Fig. 5.18: Facility values for the different test items –English Language

The lowest facility index is for question 24. This question *What type of an island is Sri Lanka?* test the knowledge beyond the given reading text. The students had to use their higher order thinking skills such as apply, analyze and evaluate to answer this question.

On the other hand, in question 10 the students had to produce only knowledge and the facility index is high.

10. Hiruni spelt a word in four different ways. Underline the correctly spelt word.

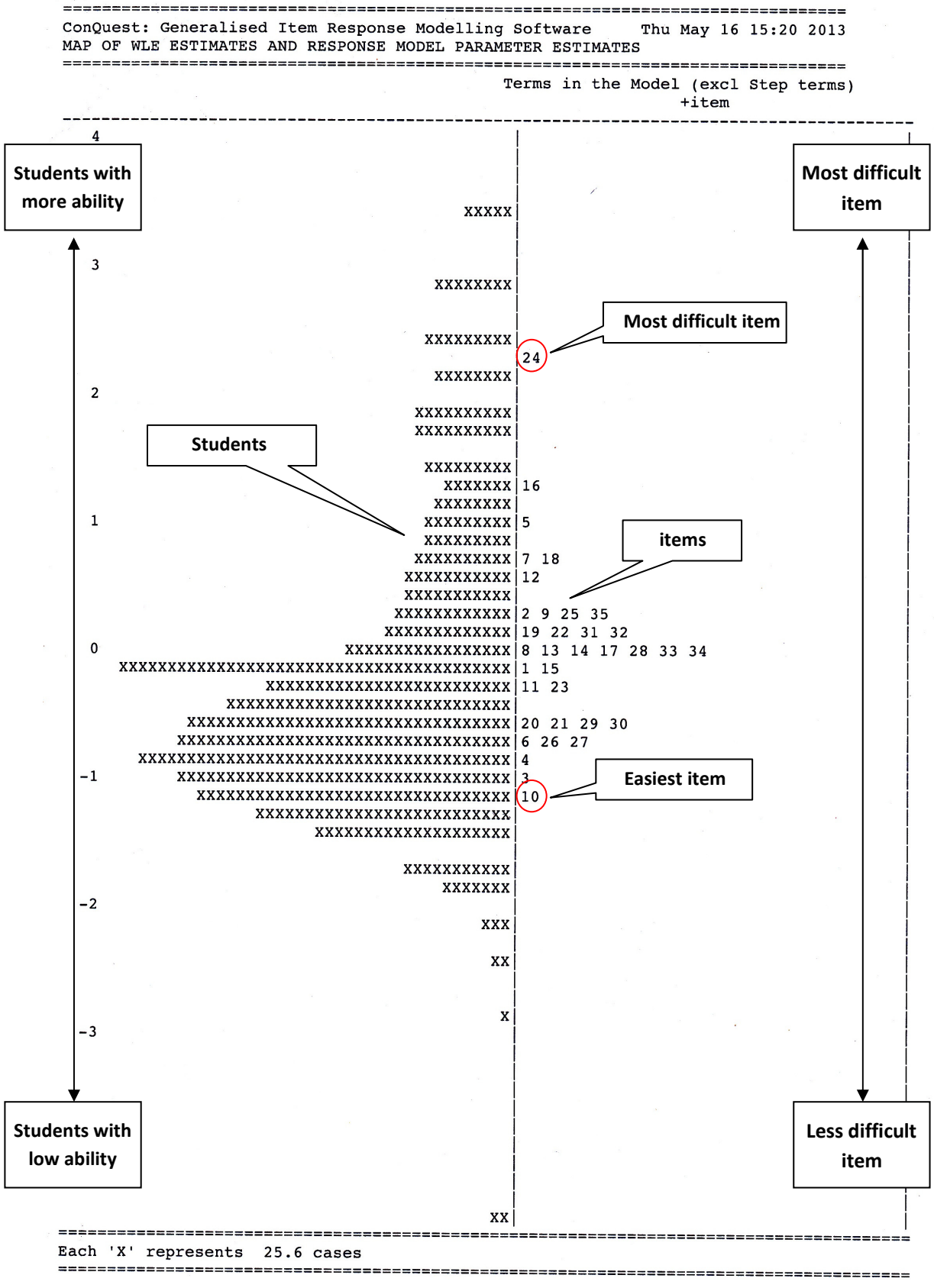
1. diery ii diary iii diry iv. diery

This analysis indicate that students higher order thinking skills as well creative writing skills in English are weak.

Disparity in achievement seen through item analysis

The Item Person Map (IRT) given on pg. 108 displays the range of difficulty of the test items as well as the range in student ability. According to the map there are approximately five hundred and sixty four 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 confirm, as already

discussed that there are outliers – those who are performing extremely well as well as those who are performing extremely badly.



5.8 Summary

This chapter discussed students' performance in the English language 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 wide disparity in achievement of learning outcomes in the learning of the English Language.

Chapter Six

Conclusion and the Way Forward

6.1 Introduction

The purpose of this chapter is to discuss the main patterns in learning outcomes identified through the National Assessment 2012. This chapter has three main objectives.

1. Summarize the findings in relation to the patterns observed
2. Analyze the main patterns observed, in the light of the main objectives of a national assessment.
3. Identify further measures to provide opportunities to achieve 'education for all'.

6.2 Patterns Identified in the achievement of learning outcomes - 2012

6.2.1 All island performance

Overall performance

The overall performance in **mathematics** is not quite satisfactory with a mean score of 51.4. Further, disparity in achievement could be seen with 34.2% of the national sample scoring less than 40 while 24.93 has scored above 70.

The performance in **science** is even less satisfactory with a mean score of 41.95 and a median of 39.

Disparity in achievement prevails with 51.2% of the national sample scoring less than 34 while 13.7% has scored above 70.

For the **English** language the national level mean and median values are 40% and 32% respectively. Approximately 61% of students score less than the pass mark. Further, the highest percentage of students' marks is within the range 20-29. Thus it could be concluded that the island wide achievement of learning outcomes for English language is not satisfactory.

Therefore, it could be concluded that the majority of the students have scored low marks in science and English. On the other hand there is disparity in all island achievement in all three subjects.

6.2.2. Provincial wise performance and trends

The findings of the present study indicate that there are variations in provincial wise achievement in all three subjects.

Achievement in mathematics

According to the performance in mathematics the provinces fall into three categories. The highest performing districts are the Western, Southern, North Western and Sabaragamuwa with mean scores above the national mean (>51.439). The Northern and Central Provinces cluster in the middle. The lowest performing districts being Eastern, North Central and Uva fall into category 3. Disparity of marks within a province is highest in the Eastern province. 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.

Achievement in science

The provinces can be clustered into three categories in relation to science performance as well. Similar to the achievement in mathematics Southern, Western and Sabaragamuwa with mean scores above the national mean (>41.95) fall into category one. However, North Western together with the Central Province cluster in the middle. Eastern, North Central and Uva with lower mean values fall into category three. Similar

to the performance in mathematics, in science achievement also the highest disparity is seen in the Eastern province. North Central and Uva Provinces' performance in science indicate a similar pattern of homogeneous achievement among students as in mathematics achievement.

Achievement in English

Unlike in the performance of the other two subjects in the achievement of English language the provinces fall into two categories.

Western, Central, Southern, North Western and Sabaragamuwa with mean scores above the national mean (40.04) fall into category one. The second category, Uva, North, North Central and Eastern are below the National mean. Disparity of marks within the lower group is higher than among the higher group. The significant feature of the performance in the three provinces with the lowest achievement levels – Eastern, North Central and the Northern is that there are a few outliers.

6.2.3 Achievement according to School Types

The gap between the achievement of students in 1AB schools and 1C and Type 2 is wide in all three subjects.

In the achievement of **mathematics**, 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.

In relation to the achievement in **science** the gap between the achievement of students in 1AB schools and 1C and Type 2 is wide. In the 1AB schools the percentage of high achievers are only slightly higher than the low achievers. In the 1AB schools those who have scored less than the pass mark is only 20.8%. On the other hand, in 1C and Type 2 schools cumulative percentage is 69.3 and 77.4 respectively.

Compared to 1AB schools, the performance in **English** language of 1C and Type 2 schools is low. In 1C and Type 2 schools 85.02 cumulative percentages and 89.30 cumulative percentage of students' scores are below 40. On the other hand, in 1AB schools, failure percentage is only 38.17% and there are also 22.80% of high achievers scoring above 70. However, in1C and Type 2 schools there are outlier – those who have scored high values and extreme values.

6.2.4 Achievement according to gender

In all subjects females have performed better than their male counterparts.

In **mathematics** female performance is slightly better than all island and male performance. While 18.1% of girls have scored below 39, the male percentage is 20.7%. Equal percentage of males and females have reached the higher mark range of 70 -100.

In **science** Female performance is slightly better than all island and male performance. While 48.30% of girls have scored below 39, the male percentage is 54.42

Female performance in the **English** language is higher than all island and male performance. Among both males and females there is a larger percentage of low achievers. On the other hand, the number of high achievers among both males and females is low. Therefore, the disparity in achievement in the English language is very high.

6.2.5 Achievement according to medium of instruction

There is wide disparity in achievement among students belonging to different medium of instruction in all three subjects.

Considering the pass mark as 40, in **mathematics** only 13.80% of bilingual students are below that range. On the other hand, 36% of Sinhala medium and 45% of Tamil medium students have scored below the pass mark.

In **science** the Sinhala medium students' mean score is closer to the national mean. Bilingual students' mean is higher than the national mean, while the Tamil medium students' mean is lower.

Sinhala medium students' mean achievement in the **English** language is closer to the all island mean value, bilingual students' mean achievement is exceptionally high. The Tamil medium students' mean achievement is below the national mean and is the lowest.

There are outliers in all three school types. However, while in the Sinhala and Tamil medium schools they have done exceptionally well in the bilingual medium schools these outliers have performed very much lower than the other bilingual students.

6.2.6 Achievement of competency levels

The analysis of the facility indices for the three subjects indicates that there is great variation in the achievement. The ranges for the facility indices for each subject is given below.

Mathematics	0.1873 - 0.7063
Science	0.1131 – 0. 8285
English	0.1196 – 0.6624

The facility indices given above indicate that there is wide disparity in achievement among students.

The percentage of correct responses to questions targeted at measuring different competency levels in all three subjects is not very satisfactory. For majority of the questions the achievement level is below 0.5. Therefore, it could be concluded that students' achievement of the different competency levels is not quite successful.

6.3 What the findings reveal

6.3.1 Impact of the curriculum reforms

As discussed in chapter 1, there are several objectives of a National assessment. Since the national assessment 2012 was the first study after the implementation of a new competency based curriculum in 2007, it is important to find out whether the aims and objectives of the new curriculum have been achieved.

Further, it is necessary to find out whether the findings indicate particular strengths and weaknesses in students' knowledge and skills.

The purpose of the reform was to produce students who could apply their learning to everyday situations. (World Bank, 2011)

In teaching **mathematics** it had been claimed that students skills in open ended problem solving and decision making were weak and only a few were able to demonstrate their ability in higher order skills. The main aim of the new curriculum "is to develop individuals who are able to think mathematically and apply mathematical knowledge effectively and responsibly to problem solving and decision making" (World Bank, 2011, p.88). It has been revealed that the curriculum strands and general aims in grades 6-10 curricular correspond to international standards. However, learning outcomes are not included for the process strands of communication, relationships, reasoning and problem solving (Mc Coal, 2007). This study further claims that the activities in the Teacher Instructional Manuals (TIM) are limited to focusing on basic concepts and mathematical skills and do not engage students in applying their learning to everyday problems and situations.

The present National assessment data also confirms these findings. The competencies identified in the grade 8 curriculum too provide very little emphasis on the development of the skills of reasoning, problem solving and relationships.

On the other hand, the curriculum is over loaded with subject content.

According to TIM the objectives of the **science** programme in grades 6-11 are the application of scientific knowledge and concepts to everyday living and to the nation's well being using inquiry skills, problem solving and scientific reasoning. However, it had been claimed that the activities relating to the competency levels identified are directed towards learning content and not so much to promote student directed inquiry (Mc Caul, 2007). Further shortcoming identified is the little attention paid to the practical work in the science curriculum (World Bank, 2012). Both these claims are justified through the findings of the NEREC, 2012.

As discussed in chapter 4, the lowest percentage of correct responses had been obtained for the test items corresponding to the following competency levels.

6.1 Conducts explorations to identify the morphological diversity of leaves.
.4 Uses the expansion of solids, liquids and gases in day today life effectively.
7.1Uses properties of light in human needs

In teaching **English** the new curriculum had been introduced to learn a language in order to use the language practically in day to day situations. "therefore, in preparing the new syllabus, the practical aspect was considered to be more important than the theoretical aspect" (TIM, 2009, p.1). However, as discussed in chapter 5 the students application of the language skills learnt had been weak. There is also a problem of sequencing the competency levels. For example, the competency level for creative writing is before writing short notes. Even understanding the basic competency levels there is disparity inter provincial as well as intra provincial wise.

Therefore, it appears that the overall achievement of the aims of the new curriculum has not been achieved.

6.3.2 Opportunities for equity

As already discussed in chapter 1, promoting "Equity" and "excellence" and reducing disparities in the education system is one of the main focuses of the Government of Sri

Lanka and this is highlighted in the Education Sector Development Framework and Programme (ESDFP) from 2007–2013.

One of the major areas identified in this Framework is "improving the quality of basic and secondary education" and "increasing equitable access to basic and secondary education" (p.2). Therefore, it is necessary to find out whether any particular subgroups in the population perform poorly. For example, whether disparities exist, between the achievements of boys and girls, students from different language or ethnic groups, or students in different regions of the country.

1. As discussed in section 6.2 there is disparity in achievement between provinces, between boys and girls, between different language or ethnic groups, among school types and different medium of instruction. There is not only inter provincial disparities but also intra provincial disparities. Therefore, it could be concluded that students' performance at the end of the eighth year of schooling indicates that equal opportunities to achieve the goal of 'education for all' had not been successful.

6.4 The way forward

The national assessment 2012 collected information on demographic and other background factors to compare the achievements of subgroups in the population. Such information would be correlated with student achievement in a subsequent report. That would help to identify the groups that are underserved by the system as well as factors associated with low achievement. This in turn will facilitate the planning of remedial measures (Kellaghan, Greaney and Murray, 2009).

It has been stressed that the national assessment of learning outcomes should be better utilized for policy purposes (World Bank, 2012). The Ministry of Education (MoE) in collaboration with the Provincial Education Authorities(PEAs) and national level education institutions has developed Education Sector Development Framework and Programme (ESDFP) from 2012-2016. As a rolling plan of this strategic plan, the ESDFP plan for 2013 -2017 has been formulated (Ministry of Education, 2013)

Section 6.4 of this chapter examines how the findings of the national assessment 2012 can be further strengthened the proposals of the ESDFP.

Curriculum revision

Under theme 2 of the ESDFP one of the areas identified for improvement is the secondary stage revision of the national curriculum. The subject curriculum committees had already identified certain issues such as content overload, over weight of textbooks and lack of discovery learning through practical projects especially in science. The national Assessment 2012 confirms that such issues exist. Therefore, it is recommended that the proposals of the EDCFP be implemented. A revision of the competencies and competency levels identified for all three subjects – mathematics, science and English should be revised.

In the mathematics curriculum more emphasis should be placed on the development of skills, in the relationships, reasoning and problem solving standards. As in other countries such as Singapore problem solving in mathematics should be the main focus and the syllabus should give clear guidelines as to how the content standards, processes, correct attitude formation and development of meta cognition should be incorporated into the teaching of mathematics (World Bank, 2012).

The content of the science curriculum is over burdened and there is an imbalance between subject content. Further, there should be more practical work and activities to enable students to use science in their day to day activities.

English language curriculum should also be revised to provide more opportunities to apply the basic concepts learnt in developing reading and writing skills. Reordering of the competency levels is also necessary

Diversify the curricula

Use of common teaching methodologies to teach students who are in different performance levels in the same classroom has been repeatedly identified as an issue in

teaching any subject and especially the English language and mathematics. The item analysis maps clearly indicated that there are high achieving as well as very low achieving students who are not catered to by the present curriculum. This was especially evident in the performance of English language. Therefore, there is a need to adopt the practice of countries such as Singapore and UK and introduce different syllabi and examinations.

Teacher development

Teachers need to identify the students with exceptional abilities as well as learners needing special attention. Further, they should be able to adapt the learning material to provide fast track programmes for the best students and remedial programmes for the low achievers. This teacher development programmes should include these skills as well as to train teachers in the use of strategies such as mixed ability and same ability groupings.

Bilingual programme

The performance of the bilingual students is clearly better than the Sinhala or Tamil medium students. However, only about 30% of the schools offer the bilingual programme due to various reasons. On the other hand this programme was introduced with the intention of implementing it in all schools over the period of five years. The ESDFP has identified several issues as well as strategies to expand the programme using internationally accepted practices. It is recommended that the proposal of developing a Sri Lankan Bilingual model should be based on research. The performance of the Bilingual students at the national assessment should be analysed and correlated with the background factors. Further case studies could be conducted to identify best practices.

Equity in learning opportunities

Increase equitable access in primary and secondary education and strengthening divisional level planning and enhancing resources to promote student learning at all

levels are some of the strategies identified by the ESDFP. However, the national assessment results indicate that there are inter and intra disparities among provinces, school types, ethnic groups and to a certain extent between genders. Multiple variables may influence these disparities and special attention of the policy planners and more public resources should be targeted to these provinces and low performing sub groups.

References

Burks, J. & Christopher, L. (2012) Education Research. Qualitative, Quantitative and Mixed approaches. UK; Sage Publications.

Department of Examinations (DOE) (2012) Reviewing of the performance of school candidates. G.C.E. (O.L) Examination -2011. Colombo, Sri Lanka.

Kamens, D. H. & McNeely, C. L. (2010). Globalization and the growth of international educational testing and national assessment. *Comparative Education Review*, *54*(1), 5-25.

Kellaghan, T. & Greaney, V. (2008) Assessing National Achievement Levels in Education. Washington: World Bank.

Kellaghan, T., Greaney, V. & Murray, S. (2009) Using the Results of a National Assessment of Educational Assessment. Washington: World Bank.

McCaul, T. (2007). Study of the Implementation of Mathematics and Science Curriculum in Grade 6 and 10 National Institute of Education, Sri Lanka.

National Education Research and Evaluation Centre (NEREC) (2005). National Assessment of Achievement of Grade 8 and 10 Students in Sri Lanka, University of Colombo, Sri Lanka.

National Education Research and Evaluation Centre (NEREC) (2008). National Assessment of Achievement of Grade 8 Students in Sri Lanka. University of Colombo, Sri Lanka.

National Institute of Education (NIE) (2008). An Evaluation of the Process of Development and Implementation of the New Curriculum in Grades 6 and 10, Colombo, Sri Lanka

National Institute of Education (NIE) (2009). An Evaluation of the Process of Development and Implementation of the New Curriculum in Grades 7 and 11, Colombo, Sri Lanka.

National Institute of Education (NIE) (2009). English Grade 8 Teacher's Instructional Manual. Colombo. Sri Lanka

National Institute of Education (NIE) (2009). Mathematics Grade 8 Teacher's Instructional Manual. Colombo. Sri Lanka

National Institute of Education (NIE) (2009). Science Grade 8 Teacher's Instructional Manual. Colombo. Sri Lanka

Ministry of Education (2011). Education First. education Sector Development Framework and Programme (ESDFP) 2012 -2016 Colombo, Sri Lanka

Ministry of Education. (2013). Education First. education Sector Development Framework and Programme (ESDFP) (2013-2017). Colombo, Sri Lanka

World Bank. (2011) Transforming School Education in Sri Lanka. From cut stones to polished jewels. The World Bank. Washington D.C., U.S.A.

World Bank. (2011) Strengthening Mathematics Education in Sri Lanka. Discussion Paper Series Report no.43. July 2011. The World Bank. Washington D.C., U.S.A.