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Suitability for self-studiesof the newly introduced Grade 7 Mathematics textbook, in 2016 for the local syllabus in Sri Lanka

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Abstract
Textbooks play a prominent role in the teaching and learning process in developing countries like Sri Lanka. Mathematics textbooks could be the most important tool in a classroom environment of teaching and learning Mathematics. Several challenges of teaching and learning Mathematics have been identified in the Sri Lankan education system such as existence of teachers without adequate teacher training in Mathematics, teacher deployment issues, and severe shortage of competent Mathematics teachers in many schools. Therefore, it was observed that the Mathematics textbook is using as a hand book in Sri Lankan schools. Consequently, there is a huge need for providing highly effective textbooks to aid student learning.Further, it was decided to evaluate and to determine strengths and weaknesses of the Mathematics text books starting from Grade 7 for the first time in 2016. Therefore, it is essential to evaluate the features of the newly introduced Grade 7 Mathematics textbook, in 2016 for the local syllabus.
For this purpose 550 students from three different zonal education offices in Galle district took part in this study. Data collection was carried out through an assessment. The data was analyzed through descriptive statistics. Further, it was tested for the significance using the one sample T-test. According to the results, it suggests that the newly introduced Grade 7 Mathematics textbook in Sri Lanka helps to students' self-studies than the old one.

Key words: *Textbook, Mathematics, Evaluation, Self-study.*

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I. Introduction

Textbooks are considered as an essential resource in teaching andlearning process. Warren, (1981) defined textbook as a printed instructional material in bound form, thecontents of which are properly organized and intended for the use in elementary or highschool curricula. Similarly, ifa book is used in the learning and teaching process it can be considered as a textbookwhile being used in that way.In general, different writers have their own definitions for textbooks. However, for thepurpose of this study "textbook" is considered as a book used by a school forclassroom instruction to teach a subject in order to cover the curricula of subjects of aparticular grade.According to the above definition of a textbook, a Mathematics textbook could bedefined as a legitimately approved and academically designed book written to delivermathematical knowledge to learners.

Research Problem

According to the World Bank (2011) Mathematics textbooks which were used in 2015 contain many errors. They contain many factual, conceptual, grammatical and typographical errors. Several of the exercise problems in the textbooks too contain errors. Considering the Mathematics results of Ordinary Level examination during past years, the percentage of the failures was nearly 40% (Department of Examinations, 2014). According to the evaluation report published by the Examination Department, the preliminary knowledge of the students about basic concepts of the Mathematics is far below the standard level (Department of Examinations, 2012). Therefore, it is necessary to strengthen students' knowledge on the basic concepts of Mathematics with the aid of Mathematics textbooks. The Educational Publications Department has taken several steps to overcome these drawbacks when compiling the Grade 7 Mathematics textbook in 2016 for the new syllabus. Further, it was taught in 2016 for the first time in Sri Lankaand evaluation of its effectiveness is a need.

Objective of the study

The main objective of this studyis to examine the suitability of the Grade 7 Mathematics textbook revised in 2016 for self-studies.

II. Literature Review

School textbooks have received an increasing attention in the international researchcommunity of Mathematics education over the last decades (Fan, 2011). The researchconducted by Gracin (2013) showed that, Mathematics textbooks are widely used inMathematics education worldwide. Mathematics textbooks play an important role in Mathematics education because oftheir close relation to classroom instruction. They identify the topics and order them in away students should explore them. They also attempt to specify how classroom lessonscan be structured with suitable exercises and activities.Textbooks are the most important resource for Mathematics teachers in theirteaching practice, especially when they assign homework (Fan &Zhu, 2002)**.**According to Shield (1989), the most important use of textbooks by the students wasreading assignments to prepare for the lessons with the least being optional readingassignments.

The government plays an important role in general education in Sri Lanka. General education in Sri Lanka covers primary and secondary education. There areapproximately 10,400 schools out of which 9,410 (90%) are government schools. Theremaining number of schools consists of around 70 private schools, 700 Pirivenaschools and about 200-250 international schools. The government and Pirivena schoolsoffer the national curriculum and their students sit the national public examinations.International schools offer foreign curricula and prepare students for overseasexaminations (Vidanapathirana, 2014).

The government schools can be categorized into groups as illustrated in Table 1.According to Table 1, 10% of the schools fall into Type 1AB, which containsAdvanced Level Science stream. It is generally considered to be the best-equipped typeof schools (Ministry of Education, 2016) 72% of the schools fall into Type-2 and Type-3, which are the small schools with classes up to Grade 5, 8, or 11; the rest, 18% fallinto type 1C - schools with classes up to advanced level, with no Science stream.

Table 1: Categorization of government schools in Sri Lanka

Type of School	No. of Schools	%	Description of Schools
1AB	1016	10.00%	Science A/L only, or with non-science A/L
1C	1805	17.76%	Non-science A\L only
Type 2	3408	33.54%	Year 1 to 11
Type 3	3933	38.70%	Year 1 to 8 or Year 1 to 5
All School	10162		

The government provides Mathematics textbooks to all students in grade 3 to 11, free of charge. Mathematics textbooks in Sri Lanka are a major educational tool for students. In Sri Lanka, Mathematics education is compulsory up to grade 11. The main aim of the Mathematics curriculum in Sri Lanka is to create individuals who are able to think mathematically and applymathematical knowledge effectively and responsibly in problem solving and decisionmaking (World Bank, 2011).

III. Methodology

Experiment research strategy was used to examine the suitability of the Grade 7 Mathematics textbook for self-studies. According to Hakim (2000) (as cited in Saunders et. al., 2007), the purpose of an experiment is to study causal links; whether a change in one independent variable produces a change in another dependent variable. Therefore, experiments tend to be used in exploratory research to answer 'how'

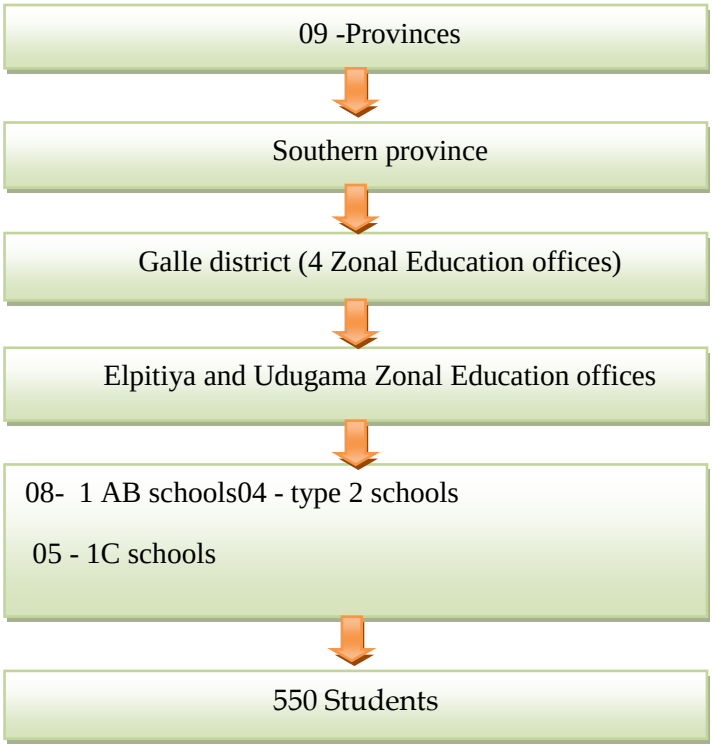


Figure 1: Diagram of sample selection for the assessment

and 'why' questions.

Multistage cluster sampling was used for the study, because of the naturally occurring geographical clusters and difficulty of constructing a sample frame for a large geographical area. The sampling procedure is presented in Figure 1. At the initial stage of sampling, 9 provinces of Sri Lanka were considered as clusters and the Southern Province was selected randomly. In the second stage the districts within the Southern Province were considered as clusters and Galle district was selected randomly. In the next stage the clusters were the zonal education offices out of which Elpitiya, Galle and Udugama were randomly selected. In the final stage the schools were divided into strata as 1AB, type2 and 1C schools. Then eight 1AB schools, four type2 schools and five 1C schools were selected randomly from eachstrata and 550 students of Grade7 in those schools were considered as the study population.

Data collection was done through an assessment which was given for students to find out the suitability of the textbook for self-studies. The last unit of Grade 7 Mathematics textbook, "Possibility of an event occurring" lesson was chosen to carry out the experiment. One of the activity papers has been made based on old Grade 7 Mathematics textbook and another activity paper has been made based on new Grade 7 Mathematics textbook. Same assessment was included into these two activity papers. Grade 7 students in selected schools were assigned into two groups randomly in each school. One of the activity papers was given to first group and other one was given to second group. Students were instructed to read the activity paper and given advices to do the assessment by themselves. After same time duration activity papers were collected and evaluated.

Independent samples t-test was used to analyze the data collected through the assessment. It was applied to compare whether the averages of two data sets are significantly different. It was used to determine if the new Grade 7 Mathematics textbook has really helped for self-studies of the students. The t-statistic was estimated as the difference between the two sample means, minus the difference between the true population means, divided by the estimated standard error of the difference between the sample means. For a null hypothesis of no difference, the difference between the true population means was zero. The standard error of the difference was usually estimated from the weighted variance about the means of the samples being compared.

IV. Results and Discussion

Two groups of children in Grade 7 were used to investigate the suitability of self-studies of new Grade 7 Mathematics textbook. While the experiment group was given the last unit of new Grade 7 Mathematics textbook, "Possibility of an event occurring", for self-studies, the controlled group was given the same lesson from the old Grade 7 Mathematics textbook for self-studies. The students in the experiment were then given the assessment to evaluate the suitability of the new text book for self-studies. Both groups had been given same time duration to complete assessment to evaluate their knowledge.

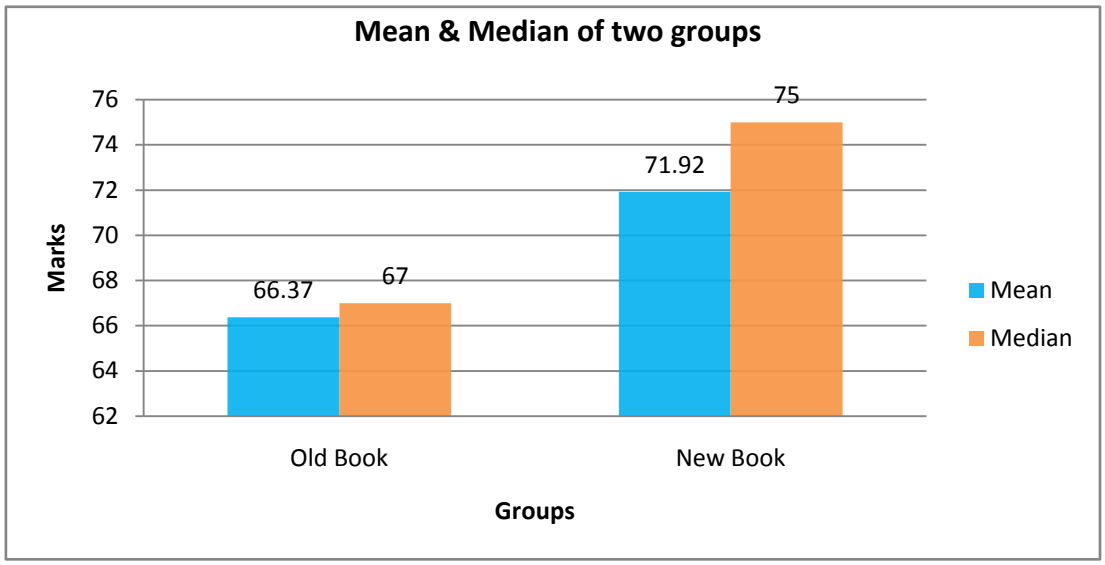
Based on the mean and the median values of the test marks, the achievement levels arediscussed. These are the indicators normally used to assess the level of performance especially; median can be used as a representative value of a set of data when the distribution of values is considerably skewed (Devore, 2006). Those values related to results of two groups are given in Table 2 below.

Table 2: Achievement in mathematics of two groups –Summary statistics

Group	Mean	Standard Deviation	Percentile (p25)=Q1	Median (p50)=Q2	Percentile (p75)=Q3	Skewness
G1-New Book	71.92	25.498	50	75	98	-0.573
G2-Old Book	66.37	25.743	50	67	92	-0.533

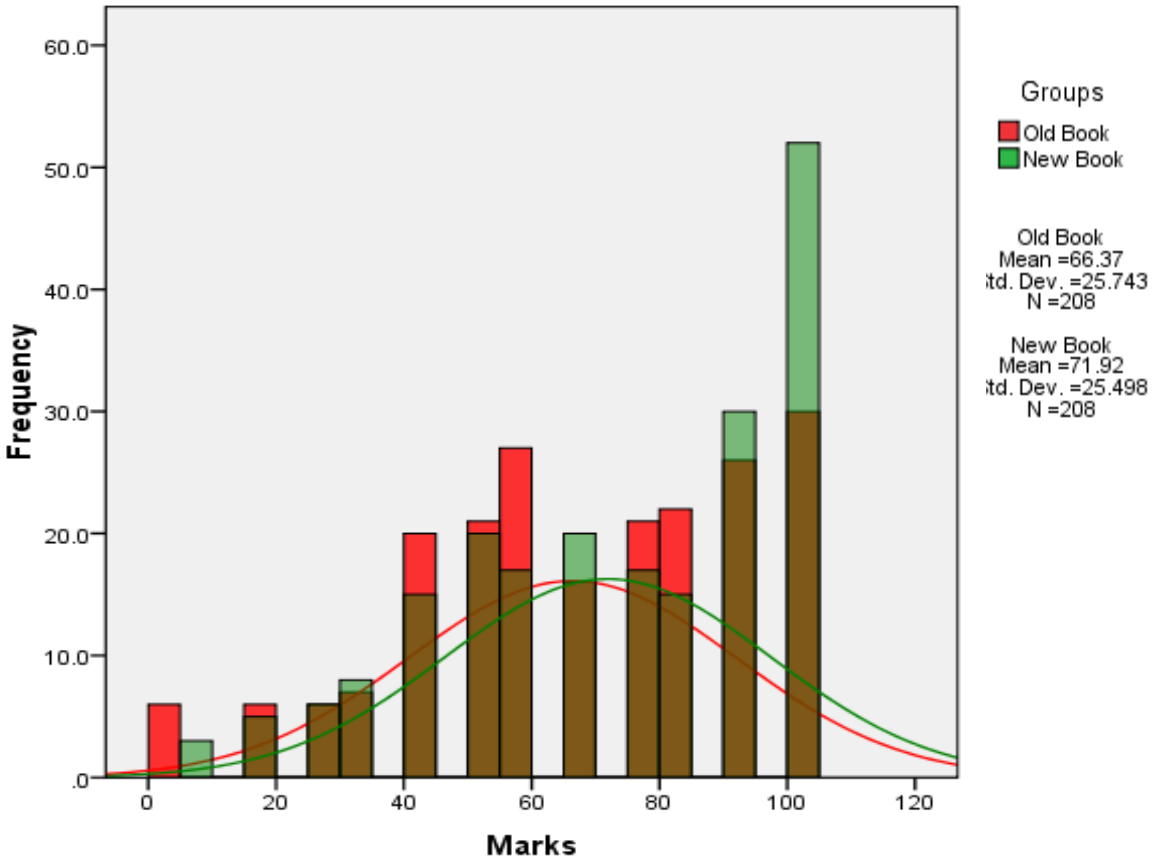
The mean value of the achievement level of students stands as 71.92 who used new Grade 7 Mathematics textbook. However, the median value is 75, indicating that half of the student population has scored above 75. Furthermore, 25 percent of students have scored below 50 marks while 25 percent of them have scored above 98 marks.

The achievement of group 1 (mean=71.92 and median=75) is relatively more satisfactory when compared with group 2. Achievementlevels in mathematics of two groups are further illustrated by the graph 1 below.



Graph1: Mean values and median values of assessment marks of two groups

Standard deviation of marks (SD) which describes how scores are scattered around the mean value is 25.498 for group 1. If the marks are normally distributed nearly 68 percent of students fall between 97.418 (71.92+25.498) and 46.422 (71.92-25.498). However, Mathematics scores of group-1 has negatively skewed distribution (skewness = - 0.573), which indicates that the majority of students of group 1 are high achievers in mathematics. This can be further observed in the graph 2 given below.



Graph 2: Distribution of marks of two groups

According to graph 2, it also can clearly be seen that the marks of the group 2 are also negatively skewed (skewness = - 0.533). Negatively skewed marks distribution, can be seen in both groups with a slight variations in the skewness. This indicates that majority of students tends to be higher achievers in Mathematics. However, skewness of the group 1 is higher than the skewness of the group 2. This indicates that students of group 1 have higher achievement level than the students of group 2.

Since the two groups were independent, two sample one tailed T - test was used to test and compute a confidence interval of the difference between two population means. In the analysis, the experiment group was designated as Group 1 (New book) and the controlled group designated as Group 2 (Old book). T-test was performed on the data.
Two hypotheses were formulated:
H_0: $\mu_1 \leq \mu_2$ (Null hypothesis);
H_1: $\mu_1 > \mu_2$ (Alternate hypothesis).

Where μ_1 – Mean of the marks obtained by students who used new Grade 7 textbook
μ_2 –Mean of the marks obtained by students who used the old Grade 7 textbook
Table 3 displays the inferential statistics: the output from the independent t-test.

Table 3:Independent Samples Test

		Levene's Test for Equality of Variances		T-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Err Difference	Lower	Upper
Marks	Equal variances assumed	.123	.726	-2.210	414	.028	-5.553	2.512	-10.491	-.614
	Equal variances not assumed			-2.210	413.96	.028	-5.553	2.512	-10.491	-.614

The independent T-test assumes the variances of the two groups are equal in the population. The assumption of homogeneity of variance can be tested using Levene's Test of Equality of Variances. Since Sig. = 0.726 here (Sig. > 0.05), the assumption of equal variances holds. Therefore, first line of T- test results can be used for analysis.

For an independent T-test, Statistical Package for the Social Scientists (SPSS) 16.0 for windowsreports the test at a 2-tailed significance level by default. To obtain a one-tailed probability (since the hypothesis is directional) need to divide the p-value in two. Therefore the p-value would be 0.014 (1-tailed).

The T-test is significant as the p-value is less than 0.05 ($p < .05$): $t(414) = -2.21$, $p = 0.014$. Therefore, the null hypothesis could be rejected. Together this suggests that the new Grade 7 Mathematics textbook helps to students' self-studies than the old one, supporting alternate hypothesis.

V. Conclusion and Recommendations

The results show that the mean mark obtained for the assessment that used new Grade 7 Mathematics textbook is significantly greater than those who used the old Grade 7 mathematics textbook. Therefore, it can be concluded that the new Grade 7 Mathematics textbook helps to students' self-studies than the old one.
For this study to yield conclusive results it is necessary to implement a larger sample size and to evaluate textbook in pre-use, whilst-use, and post-use stages in future research.

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