MATHEMATICS PLACEMENT TEST SCORES & ITS SIGNIFICANCE – A CASE STUDY

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ABSTRACT

The aim of this study is to examine the relationship between Mathematics placement test scores and students' final scores in the Mathematics course. Questions have been raised regarding the importance of Mathematics placement tests in placing students in the most suitable Mathematics course. The study examines the importance of the Mathematics placement test and its significant contribution to students' performance in Mathematics course taken at pre-university level. Mathematics placement tests undeniably fulfill its purpose of providing preliminary Mathematics course placement recommendation, encouraging students to register themselves for the most appropriate Mathematics course based on their competence, thus helping students to perform better. The study will focus on the sample of 58 students enrolled in the Monash University Foundation Year (MUFY) at Sunway College Johor Bahru in January 2013. The correlation between their Mathematics Placement Test scores and their final marks in the Mathematics Unit 1(equivalent to Year 12 Mathematics) and Fundamental Mathematics Unit 1 (equivalent to Year 11 Mathematics) is analysed.

Keywords: *Mathematics placement test, Mathematics course, correlation*

INTRODUCTION

Students entering pre university studies often come from a wide variety of backgrounds. Such heterogeneity highlights the need for a placement measure for incoming students, as the wider the range of competence in class, the more challenging it is for lecturers to accommodate to students' need. Mathematics is a compulsory subject in most pre-university programmes and also the common pre-requisite subject in getting into a degree programme. The importance of a Mathematics placement test cannot be underscored. The Mathematics placement test serves an important tool to advise and enroll the students in the appropriate Mathematics course. Students attend a pre-university programme with varying degrees of Mathematics competence. Their score on a Mathematics placement test is the most current and accurate indicator that can be used to help identify the appropriate Mathematics course being offered. Being enrolled in the correct Mathematics course (especially when there are various levels of Mathematics courses) is vital to students' performance and success.

LITERATURE REVIEW

Lam (2010) states that the diversity of levels is also a disadvantage to students who may feel intimidated and discouraged by their more competent classmates or, conversely bored by the less competent ones. Sen, Ucar and Delen (2012) emphasised that placement tests and future academic achievements are considered to be related concepts. They also added that the analysis of the success factors behind placement tests may help understand and potentially improve academic achievement.

Mo, Yang, Hu, Calaway and Nickey (2011) state that the advance placement tests provided high school students with an opportunity to choose appropriate college-level courses and this greatly increased the likelihood of passing the subject in high school. They reported that the advance placement test-taking experience has a positive impact on academic performance and retention by college students. Schumacher and Smith (2008) cited that mathematics departments at colleges and universities in the United States have been concerned with students' success in Mathematics courses and correct placement for many years. They also reported that today, many universities in the United States use Mathematics placement tests in combination with high school grades and SAT scores to place students in freshman Mathematics course.

The Mathematics placement test is also used to place students in remedial courses which ensure a significant increase in students' performance in their Mathematics course in university. A 2005 study by Bettinger and Long (2005) in the National Bureau of Economic Research stated that 27,000 students produced results that suggest that remediation resulted in success intervention. In an attempt to make the placement test process more convenient for students and universities, these tests are increasingly being given online.

METHODS

Students' Mathematics placement test scores were extracted from their individual diagnostic report on their mathematics placement test which was conducted early in the semester upon registration in the MUFY programme. Then the final marks in Mathematics and Fundamental Mathematics for the same group of students were also compiled at the end of the semester.

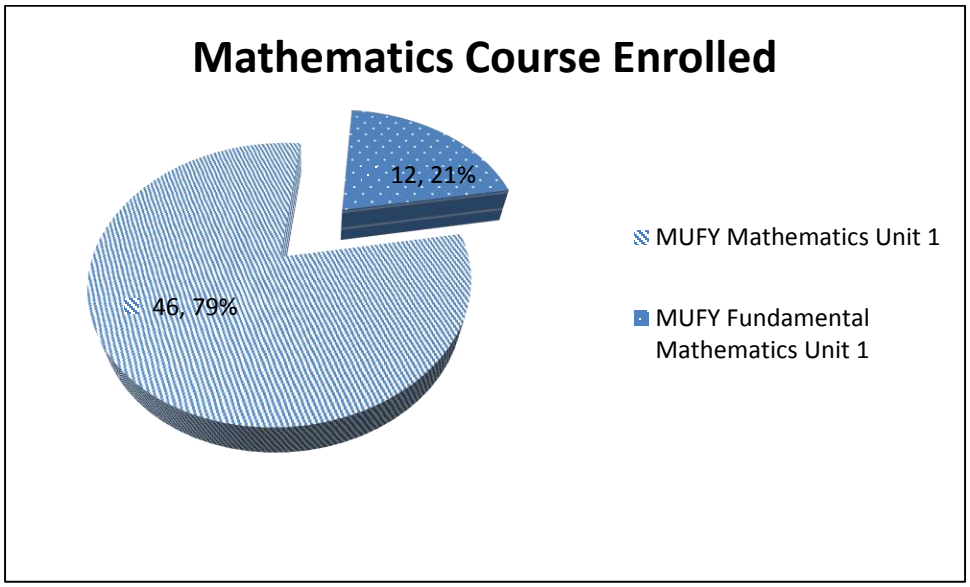
Descriptive analysis helps to draw general conclusion about the Mathematics placement test scores, Mathematics unit 1 scores and Fundamental Mathematics Unit 1 scores. The correlation between the Mathematics Placement Test scores and their final marks in the Mathematics Unit 1 and Fundamental Mathematics Unit 1 was analysed. McClave and Sincich (2009) stated that the correlation described the relationship between two independent variables.

The strength of this relationship is measured from the coefficient of correlation, r. The r value between 0 and 0.25 shows that there is no positive linear association between the two variables. $0.25 < r < 0.5$ shows that there is weak positive linear association. The r value between 0.5 and 0.75 shows that there is moderate positive linear association between the two variables and an r value more than 0.75 shows that there is a strong positive linear relationship between the variables (Nolan, Watson & Stambulic 2000, p. 87). The use of simple linear regression develops the straight line relationship between the Mathematics placement test scores and the Mathematics course score.

RESULTS AND DISCUSSION

A sample of 58 students who sat for the mathematics placement test at the beginning of the semester were selected and their Mathematics score at the end of the semester recorded. 46 of these students were enrolled in MUFY Mathematics Unit 1 and 12 of them were enrolled in the MUFY Fundamental Mathematics Unit 1.

Figure 1: Mathematics course that the students enrolled in MUFY Semester 1



The main measures of central tendency which are mean and median were measured. To determine the variability and dispersion of the data range, interquartile range, standard deviation and variance were also measured. The following Table 1 summarises the measurements.

Table 1: Descriptive statistics of Placement Test scores, Mathematics Unit 1 scores and Fundamental Mathematics Unit 1 scores.

Statistics	Mathematics Placement Test	Mathematics Unit 1	Fundamental Mathematics Unit 1
Mean	73.05	60.89	73.67
Median	74	62	80.5
Variance	183.91	315.432	268.788
Standard deviation	13.561	17.76	16.395
Minimum	34	9	41
Maximum	97	97	91
Range	63	88	50
Interquartile range	20	19	27

The statistics show that students scored relatively higher in Fundamental Mathematics Unit 1 because the nature of the paper itself is comparatively easier than the Mathematics Unit 1. Fundamental Mathematics Unit 1 score also seemed to be comparable to the Mathematics Placement Test score. The

dispersion of the score is fair across all the 3 sets of scores recorded and Mathematics Unit 1 recorded a relatively wider spread of the score.

The assumption of normality is a prerequisite for many inferential statistical techniques. The normality is explored graphically using the histogram plot.

Figure 2: Histogram of students' Mathematics Placement Test scores

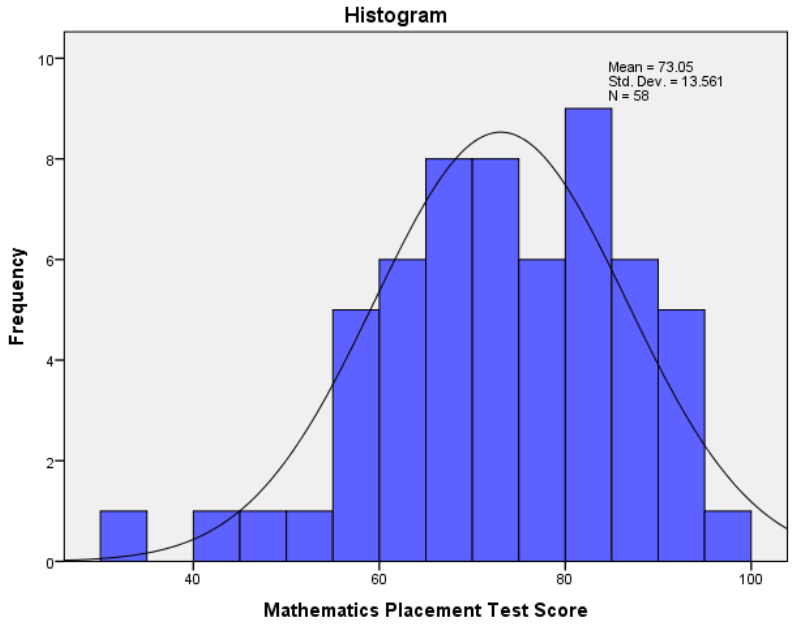


Figure 3: Histogram of students' Mathematics Unit 1 scores

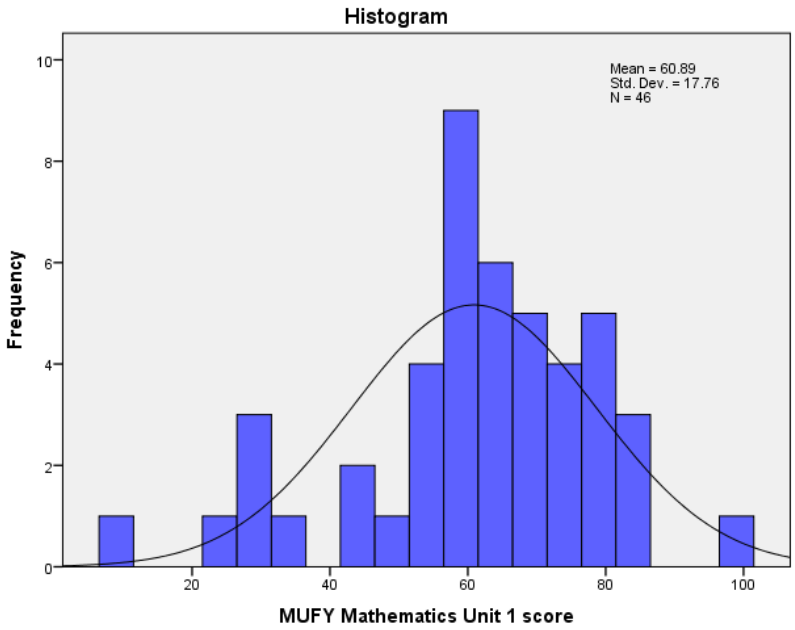
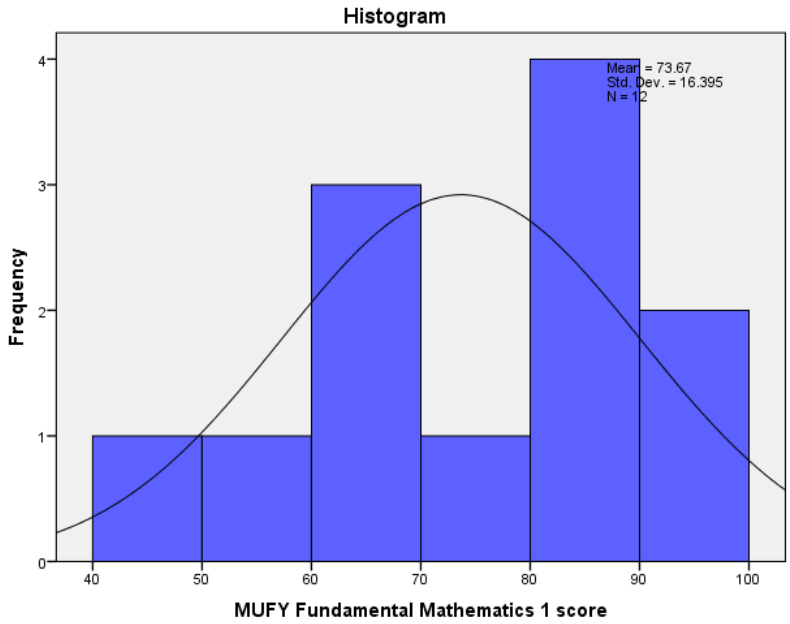


Figure 4: Histogram of students' Fundamental Mathematics Unit 1 scores



All the three histograms show that the scores are distributed in the bell shape. Hence, normality is assumed for the Placement Test and both Mathematics courses.

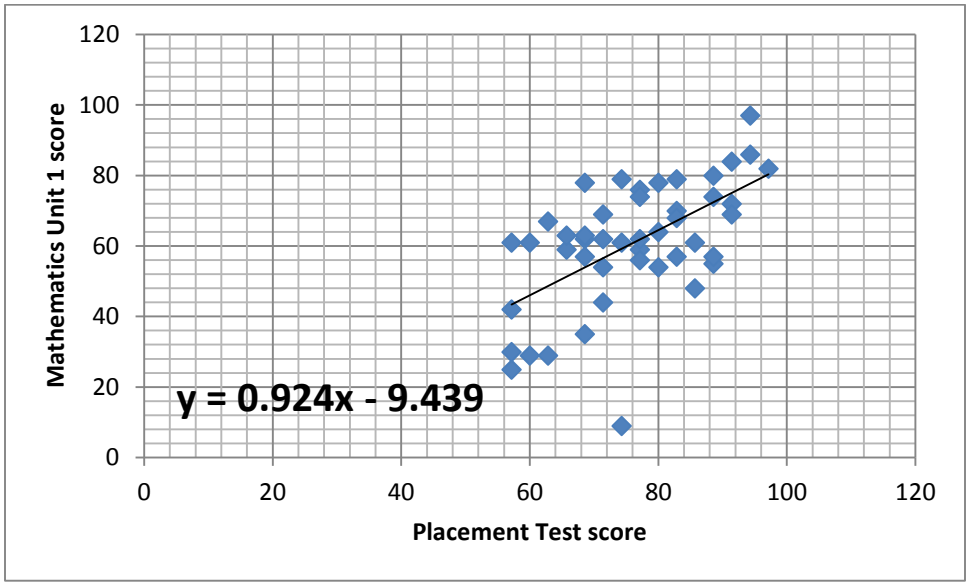
The correlation between the Mathematics Placement Test scores and their final marks in the Mathematics and Fundamental Mathematics was analysed.

Table 2: Correlation Statistics between Placement Test scores and Mathematics course

Correlation Statistics with Placement Test	Mathematics Unit 1	Fundamental Mathematics Unit 1
Pearson's Correlation, r	0.588	0.787
Significant, p	0.000	0.002
N	46	12

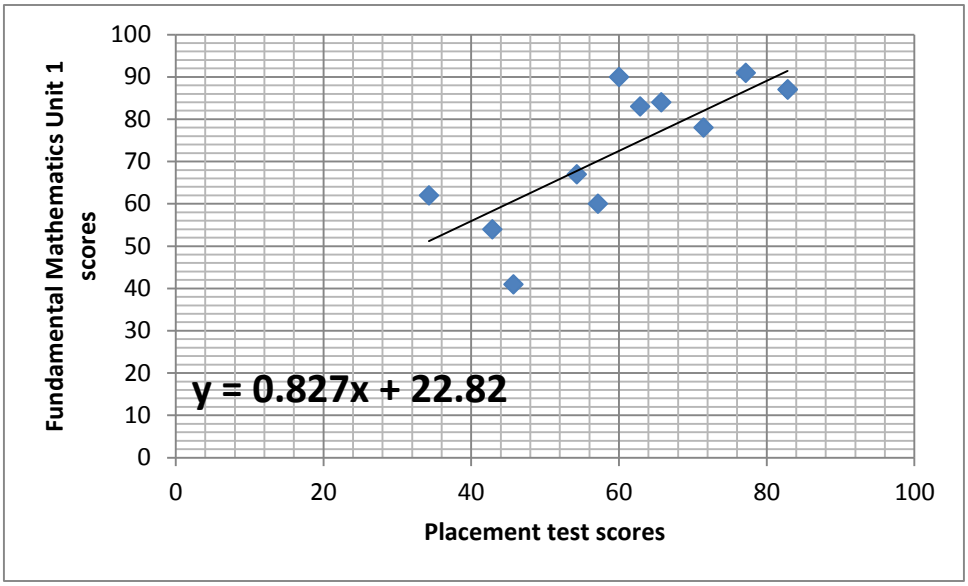
The output shows that a significant, positive and moderate linear relationship exists between the Placement Test scores and their Mathematics Unit 1 scores ($r = 0.588,\ p < 0.05$). The table also shows that there is a significant, positive and strong linear relationship between the Placement Test scores and their Fundamental Mathematics Unit 1 scores ($r = 0.787,\ p < 0.05$). The relationship between the Placement Test scores and Mathematics Unit 1 scores are displayed in the following scatterplot.

Figure 5: Scatterplot showing the relationship between the Placement Test scores and Mathematics Unit 1



The scatterplot supports the correlation coefficient statistics which indicates a moderate positive linear relationship between the Placement Test scores and Mathematics Unit 1 scores. The simple linear regression line is $y = 0.924x - 9.439$ where y represents the Mathematics Unit 1 scores and x is for the Placement test scores. This equation can be used to forecast future Mathematics Unit 1 scores given Placement test scores, provided that the standards of both Placement Test and Mathematics Unit 1 paper are comparable and parallel to this year's. The relationship between the Placement Test scores and Fundamental Mathematics Unit 1 scores is displayed in the following scatterplot.

Figure 6: Scatterplot showing the relationship between the Placement Test scores and Fundamental Mathematics Unit 1



The scatterplot supports the correlation coefficient statistics which indicates a strong positive linear relationship between the Placement Test scores and Fundamental Mathematics Unit 1 scores. The simple linear regression line is $y = 0.827x - 22.82$ where y represents Fundamental Mathematics Unit 1 scores and x represents the Placement test scores. This equation can be used to forecast future Fundamental Mathematics Unit 1 scores given Placement test scores, again provided that the standards of both Placement Test and Fundamental Mathematics Unit 1 papers are comparable and equivalent to this year's.

The Mathematics Placement Test does give us an early indication of how the students will score in their Mathematics course that they are enrolled in. As this is possible we will be able to advise students to take the appropriate Mathematics course to ensure a better score at the end of the semester. It will also be a good forecast of the students' Mathematics scores as well as an indicator and guideline for them to work harder to achieve a better score.

CONCLUSION & RECOMMENDATION

The Mathematics placement test is imperative not only to place the student in the appropriate level of Mathematics course, but also to give an early prediction of the students' score in the Mathematics course. The significance of the Mathematics Placement Test is apparent from the results, so, the test should be carried out and the results should be taken into serious consideration in placing the students in the appropriate Mathematics course. The Mathematics Placement Test should also be implemented for students who are enrolled in other pre-U programmes such as AUSMAT which offers various Mathematics courses - Mathematics 3AB/3CD and Mathematics Specialist 3CD. A larger sample size in future will also ensure the reliability and validity of the results.

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