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# Impact of Continuous Assessment Scores on the Final Result of Theory of Structures course at Politeknik Sultan Mizan Zainal Abidin

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## Abstract

Assessment is a dynamic process with variable aims. The assessment can be continuous, a final examination or a combination of both. Objective of this study was to identify continuous assessment variables that contribute to final result of Theory of Structures course and to describe the impact of these variables. The final result (dependent variable) in this study is a dichotomous variable with two categories, Pass or Fail. This study applied binary logistic regression to continuous assessment data collected from Sistem Pengurusan Maklumat Politeknik (SPMP) records at Politeknik Sultan Mizan Zainal Abidin (PSMZA) in order to examine the contributing factors to final result. A total of 170 data obtained from students undertaking Theory of Structures course from academic session of Jun 2016 was used. Among the variables obtained from SPMP, several continuous assessment variables were found most significantly associated with final result of Theory of Structures course at PSMZA, namely Test 1, Test 2, Quiz 2 and Assignment 1. The results of this study suggest that the continuous assessment scores can predict the students' performance of the final result. Serious attention should be directed to the important tasks that are used in the continuous assessment of Theory of Structures course.

**Key Words:** continuous assessment; logistic regression; impact

## 1.0 INTRODUCTION

Continuous assessment is an education policy in which students are examined continuously over most of the duration of their education, the results of which are taken into account after leaving their higher learning institutions. It is proposed or used as an alternative way to access students rather than depending solely on the final exam system.

Theory of Structures is one of the courses taken by Diploma in Civil Engineering students on the 4th semester of their studies duration at Politeknik Sultan Mizan Zainal Abidin (PSMZA). The course assessment comprises two components, namely: Continuous Assessment (CA) and Final Examination Assessment (FE) with 50%: 50% weightage. Assessment tasks for CA includes 2 Tests, 2 Quizzes and 2 Assignments. The Final Result (FR) is calculated by adding the CA and the FE thus mounting to 100 marks. Any student score of 40% or more in the FR is considered pass the course.

### 1.1 Problem Statement

Interest for this study came as a result of poor performance of students in Theory of Structures course at PSMZA as the official final result released. Though, the success rate of final result depends on many factors like method of evaluation, interest of students towards

certain course or others, the researchers in this study went to find out which CA task scores contribute to the success in FR and the impact of the CA task scores to the FR.

## 1.2 Objectives

a) To identify Continuous Assessment (CA) variables that contribute to Final Result (FR) of Theory of Structures course.
b) To describe the impact of CA scores to FR of Theory of Structures course.

## 1.3 Significance of the study

Result of this study will help lecturers at PSMZA or other Polytechnics who teaches Theory of Structures course to know the most significant CA tasks that contribute to success in FR and help them understand the impact of these tasks.

## 1.4 Scope and Limitation

The study focuses on the impact of selected CA marks in Theory of Structures course only and the data of this study collected from examination record database released officially on 21 November 2016.

## 1.5 Literature Review

Assessment is a dynamic and multi‐faceted process with variable aims (Vergis A and Hardy K, 2009). It is used to in find out how much student has acquired in terms of knowledge and learning skills. Many researchers, (Trottera E. 2006, Logan JM et. al., 2011 and Carrillo MT and Perez J, 2012) report that assessment can be continuous, final examination or a combination of both. The principal rationale behind the continuous assessment (CA) is to enhance the quality of education by ensuring that students do not wait for the end of the semester or term to exert study efforts. It is designed with the aim of sustaining quality of learning throughout a period of semester or term. In this respect, the CA is more important than the final examination as it keeps students' learning as an on‐going process and helps the retrieval of knowledge. This fact determines that the CA has an impact on the overall student's performance,(Anaf YS and Yamin SB, 2014 and Emmanuel IO and Clement C, 2012 ). Anaf YS and Yamin SB, (2014) in their study suggest that the CA is supposed to relieve the pressure of examination as it accounts for a percentage. The weightage for CA in Malaysia is 50% to 60% and for the final examination is 40% to 50%. Continuous assessment can cause an effect on the FR of students in two ways: The first is by the percentage it accounts for on the overall student assessment. The second is the student's overall achievement. Student's achievement is influenced by the amount of knowledge of skills being tested or the tools or the instrument that used in the CA. (Rezigalla AA. et. al., 2014). According to Van der Vleuten and Schuwirth,(2005) the CA is valid as an instrument that measures what is purposed to be assessed. CA includes all strategies implemented by teachers to a certain the knowledge, the understanding and the skills gained by students (Anaf

YS and Yamin SB ,2014). Furthermore, it is the frequent interactions between teachers and students that enable teachers to know the strength and weakness of the learners (Hernandez R, 2012).The increase in the success rates for the CA is associated with high success rates in the FR (Rezigalla AA. et. Al., 2014). This suggests that the CA can predict the students' performance of the FRs. María AJ, (2012) in her study reported that the success rates of students on the CA are greater than the FE. Furthermore, Rezigalla AA. et. al., (2014) and María AJ (2012) findings also showed that high success rates in the CA are associated with the FRs and the student's achievements were better than the FE. The high percentage of correlation between both CA and FE with the FR is justified since both are included in the FR. The CA shows higher level correlation and this demonstrates a greater impact on the FR.

A study by O.Wambuguh and TY Brown, (2013) on quizzes scores as predictors of final result performance using logistic regression analysis was conducted. Objective of the study was to analyze data to support the widely held view that student final examination performance (and successfully passing a course) can be predicted from their overall score in routine semester-long quizzes given periodically by the instructor. The results generally indicate that: 1) performance in the quizzes is positively correlated with performance in the final examination; 2) students who attain a score of 70% or more in the quizzes are nine times as likely to pass the final examination with the same or higher score compared to those who do not. However, achieving better grades of a high "B" and above requires lecture quiz scores 80% and above; and 3) students attaining passing grades of 90% and over in the quizzes are three times as likely to pass the final examination with a similar or higher score; while students who attain a failing grade of 59% or less in the quizzes are twenty five times as likely to fail the final examination compared to those who passed.

## 2.0 MATERIALS AND METHOD

Since the dependent variable is of a binary nature (i.e. has two categories-pass or fail), the logistic regression technique was used to develop the model in this study. According to Ali S.Al Ghamdi (2002), the aim of an analysis using logistic regression is the same as that of any model-building technique used in statistics: to find the best fit and the most parsimonious one. What distinguishes a logistic regression model from a linear regression model is the dependent variable. In the logistic regression model, the dependent variable is binary or dichotomous. The difference between logistic and linear regression is reflected both in the choice of a parametric model and in the assumptions. Once this difference is accounted for, the methods employed in an analysis using logistic regression follow the same general principles used in linear regression analysis. In any regression analysis the key quantity is the mean value of the dependent variable given the values of the independent variable.

## 2.1 Model description

The dependent variable in this research is Final Result (FR) and of dichotomous type. Each score in the sampled data was categorized as either pass or fail. The binary logistic model used was as follows:

$$P(Pass\ FR) = \pi(x) = \frac{e^{g(x)}}{1+e^{g(x)}} \quad (1)$$

and thus

$$P(Pass\ ) = 1 - P\ (Fail) = 1 - \pi(x)$$
$$= \frac{1}{1+e^{g(x)}}$$

where $g(x)$ stands for the function of the independent variables:

$$g(x) = \beta_0 + \beta_1 x_1 + \beta_1 x_2 + \cdots + \beta_n x_n$$

## 2.2 Data description

The data set used in this study was from 170 students under taking Theory of Structures course at Civil Engineering Department, Politeknik Sultan Mizan Zainal Abidin (PSMZA) during June 2016 session . Students' scores were obtained from students' results of the CA and FR extracted from Sistem Maklumat Pengurusan Politeknik (SPMP), a centralized database system currently in use at Malaysia Polytechnics. The dependent variable is Final Result (FR) which is binary (dichotomous) in nature. Two levels for FR exist; 1 if the student pass, and 0 if the student fail. Any student score of 40% or more in the FR is considered pass the course. For the explanatory variables (independent variables), Test 1, Test 2, Quiz 1, Quiz 2, Assignment 1 and Assignment 2 are all continuous variables.

**Table 1:** Description of the study variables

| Number | Description | Codes/Values | Abbreviation |
|---|---|---|---|
| 1 | Final Result | 0= Fail<br>1=Pass | FR |
| 2 | Test 1 | Marks | T1 |
| 3 | Test 2 | Marks | T2 |
| 4 | Quiz 1 | Marks | Q1 |
| 5 | Quiz 2 | Marks | Q2 |
| 6 | Assignment 1 | Marks | A1 |
| 7 | Assignment 2 | Marks | A2 |

## 3.0 RESULTS AND DISCUSSIONS

The binary logistic regression analysis is performed using the SPSS version 20 software. The result of the analysis are shown below.
A review of the final examination result of Theory of Structures course revealed that among the 170 records, 41 students failed and 129 students passed the course.

**Table 2:** Classification Table

| | | **Predicted** | |
|---|---|---|---|
| | | Final_Result | |
| **Observed** | | 0.00 | 1.00 | **Percentage Correct** |
| **Final_Result** | **0.00** | 30 | 11 | **73.2** |
| | **1.00** | 8 | 121 | **93.8** |
| **Overall Percentage** | | | | **88.8** |

### 3.1 Variable Selection

The analysis started by testing the significance of the association of each independent variable could have with the dependent variable.

**Table 3:** Variables in the Equation

| | | **B** | **S.E.** | **Wald** | **df** | **Sig.** | **Exp(B)** |
|---|---|---|---|---|---|---|---|
| **Step 1[a]** | T1 | .168 | .075 | 5.022 | 1 | .025 | **1.183** |
| | T2 | .512 | .138 | 13.760 | 1 | .000 | **1.669** |
| | Q1 | -.024 | .127 | .035 | 1 | .852 | **.977** |
| | Q2 | .555 | .242 | 5.266 | 1 | .022 | **1.741** |
| | A1 | .482 | .198 | 5.915 | 1 | .015 | **1.620** |
| | A2 | .286 | .174 | 2.701 | 1 | .100 | **1.331** |
| | **Constant** | **-21.141** | **4.915** | **18.501** | **1** | **.000** | **.000** |

Bold figures are significant at 5% level of significance.

For this purpose the entering selection process of logistic regression was followed. Table 3 presents the results from fitting all the independent variables simultaneously. Positive B values means increasing probability of pass the FR while negative means decreasing. From Table 3 above, it appears that variables T1, T2, Q2 and A1 show some significant effect while the rest of the variables are not significant. Therefore further analysis was made only on those variables which showed some significant association with the dependent variable.
Finally, analysis was made on the four variables that showed significant effect on the dependent variable and they still remain significant as shown in Table 4 below.

**Table 4:** Variables in the Equation

| | | B | S.E. | Wald | df | Sig. | Exp(B) | 95% C.I.for EXP(B) | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Lower | Upper |
| Step 1[a] | T1 | .171 | .047 | 12.993 | 1 | .000 | 1.187 | 1.081 | 1.302 |
| | T2 | .478 | .124 | 14.949 | 1 | .000 | 1.612 | 1.266 | 2.054 |
| | Q2 | .453 | .158 | 8.246 | 1 | .004 | 1.573 | 1.155 | 2.143 |
| | A1 | .615 | .175 | 12.329 | 1 | .000 | 1.850 | 1.312 | 2.608 |
| | **Constant** | **-17.928** | **3.770** | **22.617** | **1** | **.000** | **.000** | | |

### 3.2 The Logit Model

According to the previous analysis, the logit model with the significant variables is as follows;

$g(x) = 0.171T1 + 0.478T2 + 0.453Q2 + 0.615A1 – 17.928$

Hence the logistic regression model developed in this study is

$$\pi(x) = \frac{e^{0.171T1 + 0.478T2 + 0.453Q2 + 0.615A1 - 17.928}}{1 + e^{g0.171T1 + 0.478T2 + 0.453Q2 + 0.615A1 - 17.928}}$$

Once the model has been fit, the process of assessment of the model begins. Several tests, including Pearson chi-square and deviance, Wald Statistic, and the Hosmer- Lemeshow Tests, can be used to determine how effective the model is in describing the outcome variable. This is referred as its goodness-of-fit. These tests end up with a chi-square criterion to make the decision on the model fit. The validity of the model in this study was first checked by examining the statistical level of significance for its coefficients using Wald statistic as shown in Table 4 above.

**Table 5:** Hosmer and Lemeshow Test

| Step | Chi-square | df | Sig. |
|---|---|---|---|
| **1** | **9.304** | **8** | **.317** |

The Hosmer and Lemeshow test as shown in Table 5 above indicates the model is satisfactory fit where p=0.317 (d.f =8) and the Nagelkerke R square estimation is 0.718. A large value of Chi-squared (with small p-value < 0.05) indicates poor fit and small Chi-squared values (with larger p-value closer to 1) indicate a good logistic regression model fit.

The classification table in Table 2 above also shows that we are 88.8% right in the prediction of our cases.

### 3.3 Model interpretation

Interpretation of the coefficient in a logistic regression model depends on being able to place a meaning on the difference between two logits. The exponent of this difference gives the odds ratio, which is defined as the ratio of the odds that the independent variable will be present to the odds that it will not be present. Thus, the relationship between the logistic regression coefficient and the odds ratio provides the foundation for interpretation of all logistic regression results. The odds ratio that is equal to Exp B can provide the relative amount by which the success of final result likelihood increases (greater than 1.00) or decreases (less than 1.00) when the value of the independent variable is increased by 1.0 units.

### 3.4 Impact of Continuous Assessment (CA) scores on Final Result (FR)

The impact or influence CA scores to FR are measured by the odds ratio. From Table 4, the odds ratio (Exp (B)) for Test 1 is 1.187, indicating that that student who scores more by 1.0 mark in Test 1, the likelihood to pass the FR increases by approximately 1.2 times. The odds ratio (Exp (B) ) for Test 2 is 1.612, indicating that those students who scores more by 1.0 mark in Test 2 are on average 1.6 times likely to pass the FR. The odds ratio (Exp (B) ) for Quiz 2 is 1.573, indicating that those students who scores more by 1.0 mark in Quiz 2 are on average 1.6 times likely to pass the FR. Finally, the odds ratio (Exp (B) ) for Assignment 1 is 1.850, indicating that those students who scores more by 1.0 mark in Assignment 1,the likelihood to pass the FR increases by approximately 1.9 times.

## 4.0 CONCLUSION

This study investigates the impact of continuous assessment scores on the final result of Theory of Structures modules. Since the dependent variable is binary in nature, logistic regression analysis was used in this study. The most important CA tasks contributing to final result of the modules can be assessing through this model. All six CA tasks, Test 1, Test 2, Quiz 1, Quiz 2, Assignment 1 and Assignment 2 were used in the model development process. After statistical testing, only four variables were included in the model, namely, Test 1, Test 2, Quiz 2 and Assignment 1. Analysis of odds in this study also showed that students who students who scores more by 1.0 mark in Test 1, the likelihood to pass the FR increases by approximately 1.2 times. For Test 2, those students who score more by 1.0 mark in Test 2 are on average 1.6 times likely to pass the FR. The odds ratio(Exp(B)) for Quiz 2 is 1.573, indicating that those students who scores more by 1.0 mark in Quiz 2 are on average 1.6 times likely to pass the FR. Finally, for Assignment 1 those students who score more by 1.0 mark in Assignment 1, the likelihood to pass the FR increases by approximately 1.9 times. The results of this study suggest that the CA can predict the students' performance of the FR.

Serious attention should be directed to the important tasks that are used in the CA of Theory of Structures modules. Students must be encouraged to maintain sustained engagement in the course they undertake. Lecturers can also remind the students to constantly review relevant course material, preparing and taking all routine tests offered in the course, revaluating and reassessing performance periodically and seeking help without delay when the need arises.

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