

# Multiple Regression Analysis of Assessment of Academic Performance of Students in the Ghanaian Polytechnics

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## Abstract

One of the challenges of the educational reform introduced in 1987 was the introduction of continuous assessment as a component of students' final assessment in educational institution. Problems of comparability arise in situations where examinations are conducted by the individual schools. The issue of who takes the overall responsibility of assessing the work of students- the teacher or any accredited examining body- has, in fact, received more attention than any other matters of relevance in education worldwide.

The objective of this study was therefore to find out whether administrative and technical problems existed in the assessment and certification of students in the Ghanaian Polytechnics and to find out the causes and the extent to which such factors brought about weaknesses in the conduct of continuous assessment and final examination.

The population for the study was Polytechnics in Ghana, and a convenient sample of five polytechnics was used for the study. Multiple Regression Analysis of the results indicated that the assessment of students' academic performance was conducted using a variety of available instruments and methods, and these instruments and methods varied from polytechnic to polytechnic.

**Keywords:** continuous assessment, final examination, student learning, weighting, academic performance.

## 1. Introduction

The prime purpose of assessment is to enable students to demonstrate that they have achieved the aims and objectives of the academic programme, in particular that they have fulfilled the requirement of each subject and have, at the end of their study achieved the standard appropriate to the award. The assessment methods will also allow discrimination between the performance of students in each subject. Assessment will also serve as feedback to students. Students will be informed of their performance in the assessment so that they are aware of their progress and attainment. Thus, except for examinations, subject lecturers are required to return marked scripts or comments within a mutually agreed time frame.

From the foregone, it could be said that assessment plays an important part in the teaching-learning process at all levels of education( Ipaye, 1982) . Since assessment plays such an important and significant part in the future of students, there is no doubt that any assessment system will determine what students learn and the way in which they do this. Hence assessment will also determine the way in which we teach and what we teach.

Since assessment is not just about grading and examinations, but also about getting to know our students and the quality of their learning and to use this knowledge and understanding to their benefit, it is therefore important for teachers in the Polytechnics to be familiar with the technical aspects of the many different forms of assessment currently in use. The importance of measurement and evaluation in the teaching - learning process behoves every teacher to acquire the fundamental principles, skills and techniques of constructing, administering, scoring, and interpreting tests and test scores accurately.

### *1.1. Purpose of the study*

The purpose of the study is to find out the assessment tools and the aspects of Continuous Assessment that are used in the Polytechnics. It is also to find out the challenges confronting lecturers in the implementation of Continuous Assessment in the polytechnics and the contribution of Continuous Assessment scores to the final grade of the students.

### *1.2. Research Questions*

The questions which this research intended to find answers to were:

1. What assessment tools are used in gathering data on students' achievement within the framework of continuous assessment in the Polytechnics?
2. What are the major challenges confronting lecturers in the implementation of Continuous Assessment?
3. Are assessment marks similar in the polytechnics?
4. Which of the assessment types contribute significantly to the final grade of the students?

### *1.3. Hypotheses*

The following hypotheses have been formulated for testing

1. There is no significant difference in the continuous assessment weightings in the polytechnics?
2. There is no significant difference in the contribution of the assessment types to the final grades of the student

## **2. Methodology**

### *2.1. Population and sample*

The population for the study was all lecturers in the ten Polytechnics in Ghana. Six institutions were selected for the study using the convenient sampling technique. All the teachers in the

selected institutions constituted the sample for the study.

### 2.2. *Instruments for data collection*

Teachers' conceptions of assessment questionnaire and structured interview guides were designed to illicit responses from lecturers on issues concerning challenges in the use and construction of assessment tools. Other areas that the instruments focused on were final examination marks and continuous assessment processes.

### 2.3. *Validity and reliability*

Expert advice was sought from measurement and evaluation specialists to validate the questionnaire. The validated instruments were piloted in one of the polytechnics using twenty respondents. Necessary corrections were done based on the information gathered from the pilot study. The correlation coefficient calculated for the instrument was 0.87 .

### 2.4. *Data analysis*

Two data clerks were trained to enter the data collected using the SPSS. Appropriate statistical tests were performed to answer the research questions and test the research hypotheses. Teachers' conceptions of assessment questionnaire were analysed with structural equation modeling. Multiple regression was used to analyse the contribution of continuous marks to the final grades of students, and ANOVA was used to analyse differences in the assessment marks.

### 2.5. *Multiple Regression: Conceptual and Mathematical Models*

Multiple regression is a flexible method of data analysis that may be appropriate whenever a quantitative variable (the dependent or criterion variable) is to be examined in relationship to any other factors (expressed as independent or predictor variables). Relationships may be nonlinear, independent variables may be quantitative or qualitative, and one can examine the effects of a single variable or multiple variables with or without the effects of other variables taken into account (Cohen, et. al, 2003).

Many practical questions involve the relationship between a dependent or criterion variable of interest (call it Y) and a set of k independent variables or potential predictor variables (call them  $X_1, X_2, X_3, \dots, X_k$ ), where the scores on all variables are measured for N cases. A multiple regression equation for predicting Y can be expressed as follows:  $Y' = A + B_1X_1 + B_2X_2 + B_3X_3$ .

The correlation between Y' and the actual Y value is also called the multiple correlation coefficient,  $R_{y.12\dots k}$ , or simply R. Thus, R provides a measure of how well Y can be predicted from the set of X scores. The following formula can be used to test the null hypothesis that in the population there is no linear relationship between Y and prediction based on the set of k X variables from N cases: .

Alternatively, the independent variables can be expressed in terms of standardized scores where  $Z_1$  is the z score of variable  $X_1$ , etc. The regression equation then simplifies to:  $Z_{Y'} = \beta_1 Z_1 + \beta_2 Z_2 + \beta_3 Z_3$ . A useful application of multiple regression analysis is to determine whether a set of variables (Set B) contributes to the prediction of Y beyond the contribution of a prior set (Set A) using the R squared statistic.

The statistical significance of R squared is determined by the formula:

$$F = \frac{(R_{Y,AB}^2 - R_{Y,A}^2) / k_B}{(1 - R_{Y,AB}^2) / (N - k_A - k_B - 1)}, \quad df = k_B, N - k_A - k_B - 1.$$

With standardized scores, the regression

coefficients are: Once we have the beta coefficients for standardized scores, it is easy to generate the  $B_j$  regression coefficients shown in the formula  $Y' = A + B_1 X_1 + B_2 X_2 + B_3 X_3$  for prediction using the unstandardized or raw scores, given that

$$B_1 = \beta_1 \frac{SD_Y}{SD_{X_1}}, \quad B_2 = \beta_2 \frac{SD_Y}{SD_{X_2}}, \quad \text{and} \quad A = \bar{Y} - (B_1)(\bar{X}_1) - (B_2)(\bar{X}_2).$$

### 3. Results of the Study

**3.1. Research Question 1:** *What assessment tools are used in gathering data on students' achievement within the framework of continuous assessment in the Polytechnics?*

The research results revealed that all the polytechnics used varieties of assessment types that were recommended by NABPTEx in assessing their students. These are class work, individual assignment, group assignment, quizzes, class test and examinations. Table 1 shows the number of respondents that use these assessment types in assessing their students.

Over 148(98%) of the respondents used Individual Assignment and Examinations in assessing their students. Only 88(58.3%) of the respondents used Quiz/Test in the assessment process. This low percentage might be due to the difficulties associated with the conduct of such tests as a result the large number of students. The means, standard deviations, and correlations among all the assessment types are given in Table 1.

**3.2. Research Question 2:** *What are the major challenges confronting lecturers in the implementation of Continuous Assessment?*

Teachers were asked to indicate the challenges they faced in implementing and participating in continuous assessment. Simple percentages of the frequency of challenges indicated by respondents are presented in Table 2.

The most critical challenges faced by lecturers in assessing students were poor preparation on the part of students for continuous assessment, poor test administration procedures and coping with marking of students' scripts and record keeping with 94.7% ( $t = 6.112, \beta = .838, p < .01$ ), 94.0% ( $t = 5.142, \beta = .672, p < .01$ ) and 92.1% ( $t = 3.491, \beta = .587, p < .05$ ) respectively.

Other challenges faced by lecturers were large classes which translated to large number of scripts to mark and records to be kept, demand on teachers' time, and poor motivational level of teachers.

The least critical problems identified by lecturers included the fact that continuous assessment exerts a disruptive influence on the pace of work ( $t = .049$ ,  $\beta = .028$ ,  $p > .05$ ) as well as the frequency of assessments ( $t = .017$ ,  $\beta = .011$ ,  $p > .05$ ). The above findings confirm the fact that implementing continuous assessment was fraught with challenges (Onuka and Obialo, 2004; Onuka and Oludipe, 2004; Onuka, 2007; Yoloye, 2003; Anizekwe, 2005; Wiggins, 1998; Wosanju, 2005; Owolabi and Olasehinde-Williams, 2007).

### 3.3. *Research Question 3: Are continuous assessment marks similar in the polytechnics?*

Table 3 shows the mean marks on continuous assessment for students in the five institutions. The mean marks range from 21.0 for institution A to 24.0 for institution C. An Analysis of Variance (ANOVA) test was performed to find if there was any significant difference among the continuous assessment mean marks. The results of the Analysis of Variance (ANOVA) are reported in Table 3. The results of the Analysis of Variance show that there was a significant difference among the mean scores of the five institutions on the continuous assessment marks. This is indicated by an F-value of 8.286 which is significant at 5% level ( $F = 8.286$ ,  $p < .05$ ). The null hypothesis which states that there is no significant difference in the continuous assessment weightings in the polytechnics, was therefore rejected. The rejection of the null hypotheses means that some institutions achieved higher on continuous assessment scores than other institutions.

Similar analysis was done using the end of semester examination marks. Table 4 shows the mean marks on the end of semester examination for students in the five institutions. The mean marks ranged from 54.2 for institution C to 55.7 for institution B. The results of the Analysis of Variance show that there is no significant difference among the mean scores of the five institutions on the end of semester examination.

This is indicated by an F-value of 0.394 which is not significant at 5% level ( $F = 0.394$ ,  $p > .05$ ). The null hypothesis is therefore accepted. The acceptance of the null hypotheses means that all the institutions achieved the same standard on the end of semester examination.

### 3.4. *Research Question 4: What is the relationship between the assessment types?*

Scatter plots were used to find nature of relationship between the assessment types. Figure 1 shows that the relationship between continuous assessment, examination and Final scores is linear. This means that as continuous assessment or examination scores increase, final scores also increase. However, the increase in the final scores as a result of an increase in Continuous Assessment is more than that resulting from the increase in examination scores.

In order to find the strength of the relationship among the continuous assessment, examination and final scores, the correlation coefficients of these scores were computed (Table 1).

The correlation coefficients show a very strong positive relationship ( $r = 0.891$ ) between Continuous Assessment and final scores. On the other hand, the data in Table 1 show a weak positive relationship ( $r = 0.420$ ) between Examination and Final scores. Data in Table 1 reveal a negative relationship between examination and continuous assessment scores. What this means is that as Continuous Assessment scores increase, examination scores decrease.

**3.5. Research Question 4: Which of the assessment types contribute significantly to the final grade of the students?**

The independent variables were entered into the regression equation simultaneously. Preliminary examination of the results indicated there was no extreme multicollinearity in the data (all variance inflation factors were less than 3) nor were there any influential data points. The regression results indicate that the set of independent variables explained 64.3% ( $F(5,258) = 95.6$ ,  $p < .001$ ) of the variance in student satisfaction; with three of the five variables having a significant unique influence on satisfaction (Table 5).

In order of significance, they are Group Assignment ( $\beta = .771$ ), individual assignment ( $\beta = .337$ ), quiz/test ( $\beta = .138$ ), class work ( $\beta = .076$ ), and end of semester examinations ( $\beta = .017$ ). The findings suggest that group and individual assignments contribute very significantly to the students' final scores.

#### **4. Discussion**

Assessment in the Ghanaian polytechnics can be referred to as School Based Assessment(SBA). School based assessment as cited by Nitko (1995) refers to the “process where students, as candidates, undertake specified assignments during the course of the school year under the guidance of the teacher as part of subject examination”. It is therefore expected that the school environment in its totality provides a conducive situation to facilitate learning and subsequent assessment procedures. School Based Assessment brings assessment and teaching together for the benefit of the students and provides the teacher with the opportunity to participate in a unique way in the assessment process that leads to the final grade obtained by his or her students.

For this reason, Ajuonuma(2006b) added that “The fundamental role of Assessment is to provide authentic and meaningful feedback for improving student learning, instructional practice and educational options” which means that assessment is not and so should not be seen as an end in itself but a means to a justifiable end of learning”.

Continuous Assessment is crucial to school based Assessment. It usually forms a substantial component of any School Based Assessment policy as it ranges from thirty to forty percent in a majority of cases. The Continuous Assessment policy according to Ajuonuma(2006a) is entirely a school based assessment.

Many experts believe that a combination of assessment approaches can be the most effective way to measure student learning. The type of assessment chosen related to learning outcomes and governed by decisions about its purpose, validity and relevance. In addition, as it is

probably true to say that every assessment method will place some students at a disadvantage to some extent, a range of types of assessment is desirable to hopefully reduce the element of disadvantages suffered by any particular student. It is for these reasons that NABPTEX recommended varieties of assessment types to be used in the polytechnics (MOE, 1986).

There are good reasons why forms of assessment and frequency of assessment vary widely. These included the need to ensure that types of assessment, including re-assessment, test the intended learning outcomes accurately and fairly, and are appropriate to the subject being studied, the mode of learning, and to the students taking the programme. Deciding on the appropriate number and timing of assessment tasks was part of designing assessment that was fit for purpose. Institutions considered carefully how to coordinate assessment deadlines, including re-sits, to avoid clashes and excessive assessment burdens for students and staff.

Continuous Assessment gives students adequate opportunity to show the extent to which they have achieved the intended learning outcomes at different levels and stages. It is therefore helpful to avoid premature summative assessment and to give students enough time to mature in their learning and to synthesize knowledge. This may deepen knowledge and understanding of the subject and allow development of any personal, intellectual or practical skills that contribute to the intended learning outcomes.

## 5. Conclusion

The following conclusions are drawn based on the foregone analysis:

- a. Assessment of student learning is conducted using a variety of available instruments and methods.
- b. Individuals and institutions determine the frequency, regularity and weighting of Continuous Assessment.
- c. Students are not assessed using a wide variety of instruments and they are also not assessed in affective and psychomotor domains
- d. Assessment scores are not similar in the polytechnics:
  - some institutions achieved higher on continuous assessment scores than other institutions
  - all institutions achieved the same standard on the end of semester examination scores.
- e. Continuous assessment scores contribute significantly to the final grade of the student.

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**Table 1: Correlations, Means, and Standard Deviations of the Assessments types**

Type of assessment	1	2	3	4	5	6	Number
1. Individual Assignment	1						148
2. Group Assignment	.821	1					142
3. Quiz/Test	.810	.643	1				88
4. Class work	.783	.635	.470	1			95
5. Examinations	.477	.322	.562	.503	1		151
6. Final Score	.821	.710	.783	.683	.420	1	
Mean	1.16	3.45	2.58	3.16	3.63	3.57	
SD	.551	1.137	1.212	1.045	1.080	1.099	

**Table 2: Challenges of Lecturers in Assessing Polytechnic Students**

Description of the challenge	Percentage of the respondents	Percentage	Beta coefficients	t- values
Poor Preparation of students for CA	143	94.7	.838	6.112**
Poor test administration procedures	142	94.0	.675	5.142**
Marking and recording	139	92.1	.587	3.491*
Large student population	136	90.1	.542	2.023
Setting questions/item writing	135	89.4	.371	1.017
Demand on teachers' time	126	83.4	.138	.437
Teachers' level of motivation	137	90.7	.076	.121
Disruption of work pace	97	64.2	.049	.028
Number of assessments	113	74.8	.017	.011

\*p < .05; \*\* p < .01

**Table 3 : Comparison of Continuous Assessment mean marks**

Source of variations	Sum of squares	df	Mean Square	F-ratio	Sig.	Institution	Mean	SD
Between Groups	908.184	4	227.046	8.286	.000	A	21.0	6.85
Within Groups	24797.644	905	27.401			B	23.0	4.99
Total	25705.829	909				C	24.0	3.82
						D	21.5	6.42
						E	22.8	3.95

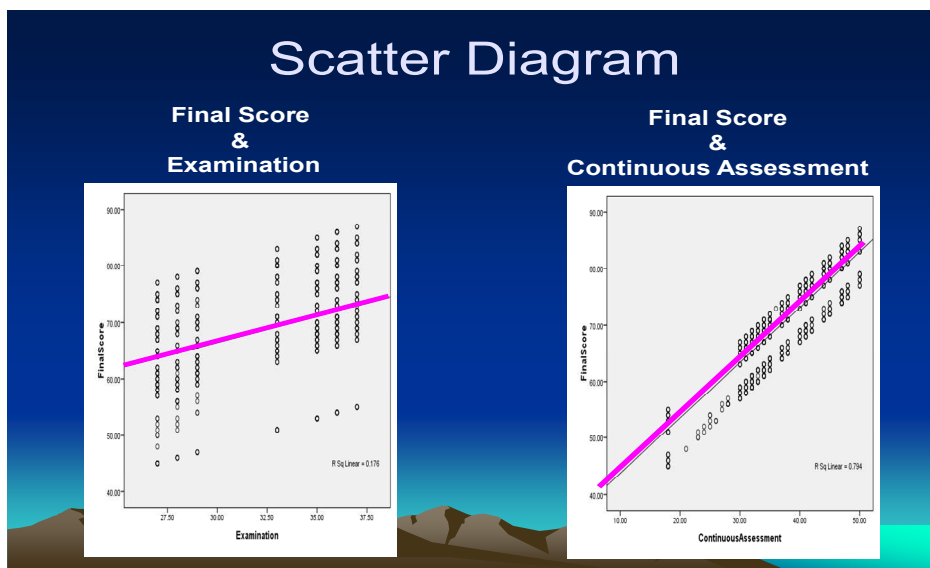
**Table 4: Comparison of end of semester examination mean marks**

Source of variations	Sum of squares	df	Mean Square	F-ratio	Sig.
Between Groups	285.901	4	71.475	.394	.813
Within Groups	164165.2	905	181.398		
Total	164451.1	909			

**Table 5: Results of Regression Analysis of Student Satisfaction**

Variables	$\beta$	t
1. Individual Assignment	.638	12.373**
2. Group Assignment	.876	13.942**
3. Quiz/Test	.417	5.104*
4. Class work	.351	5.142*
5. Examinations	.093	1.942

\*p < .05; \*\* p < .01



**Figure 1:** Scatter plots showing the relationship between Continuous Assessment, examination and Final scores

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