Predictive Validity of Continuous Assessment Scores on Students' Performance of Junior Secondary Certificate Examination in Mathematics in Gombe State, Nigeria

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Abstract
The study examined the predictive validity of continuous assessment scores on students' performance of Junior Secondary Certificate Examination in Mathematics in Gombe State, Nigeria. The population of the study consisted of 152,124 students in Gombe State, with a sample of 538 students using a multistage cluster sampling technique. The aim of the study was to determine whether any relationship exists between continuous assessment scores and JSCE scores in Mathematics and to determine whether continuous assessment scores could be used to predict the performance in Junior Secondary Certificate Examination in Mathematics. Ex-post facto and correlation research design was adopted for the study. One research question was raised and three hypotheses were formulated and tested at 5% level of significance. Data collected were analyzed using correlation coefficient and regression analysis. The findings showed that there was a weak positive relationship between CA scores and JSCE in Mathematics in 2014/2015 and 2016/2017, there was very weak negative relationship between CA scores and JSCE in 2015/2016 academic session. The JSCE performance of students in Mathematics could be predicted from CA scores for 2014/2015 and 2016/2017 academic sessions while it could not be predicted for 2015/2016 academic session. The study recommended that the CA scores should not be inflated in order to serve the purpose of predicting the final performance of students' achievement.

Keywords: *Continuous Assessment; Predictive Validity; National Examination Council; Junior Secondary Certificate Examination; Mathematics*

Introduction

Validity ensures that assessment tasks and associated criteria effectively measure students' attainments of the intended learning outcomes at appropriate level. It is the degree to which a measurement measures what it purports to measure (Lucke, 2005). Validity referred to appropriateness, meaningfulness and usefulness of specific inferences made from test scores (Olutola, Olatoye & Owolabi, 2018). It is the extent to which a test measures what it claims to measure (Ugodulunwa, 2018). The types of validity include; content, criterion-related and

construct validity. Criterion-related validity refers to the extent to which a measure is related to an outcome. It measures how well one measure predicts an outcome for another measure. There are two types of criterion –related validity; predictive and concurrent validity. Predictive validity is the extent to which a measure forecast future performance (Anikweze, 2014). It is helpful in determining who is likely to succeed or fail in a certain subject. Predicting student performance in advance can help students and their teacher to keep track of progress of a student (Benjamin and Habila, 2020). Many institutions have adopted continuous evaluation system today for improving performance of students. Continuous assessment could also help to predict what a student is likely to get in the final examination.

Continuous assessment (CA) is often regarded as a comprehensive mechanism for grading students' performance in the cognitive, affective and psychomotor domains of learning (Federal Ministry of Education, 1985). It was first introduced into the Nigerian School System in 1982, alongside the 6 3 3 4 system of education. This is carried out in a manner that is systematic, cumulative, comprehensive and guidance-oriented (Falaye & Adefisoye, 2016), thereby ensuring that relevant information, from which far reaching decisions affecting the learner's academic and future life could be taken.

Nwachukwu and Ogudo, (2014) assert that teachers are not assessing the students comprehensively in the three domains of learning rather they resort to the assessment of cognitive domain alone and paying less attention to affective and psychomotor domains. Even at that, problems still exist in the practice of continuous assessment in which the outstanding one being the quality of test used as instrument for continuous assessment process elucidate on the problem of compatibility standard of continuous assessment. According to Ayodele (2010) the differences in the quality of tests and other assessment instruments used in different schools as well as differences in the procedures of scoring and grading the various assessments in the various schools could pose problem of comparability of standard.

According to Ezeugwu and Omeje (2014) the Federal Government of Nigeria, in 1984 introduced the 6-3-3-4 system of education which incorporated continuous assessment of learning outcomes, at all levels of the educational system. This policy was made with the aim of replacing the one-shot, summative evaluation that was then in practice in the system at the end of each school year. But this is known to only encourage memorization or rote learning and create psychological tension that could lead to poor performance by the end of the term or final examinations. In addition, it makes no provision for students who fall sick during examination. This was also amplified by Federal Ministry of Education, Science and Technology 1985 document which adds that the over emphasis on examination grades and paper qualification has encouraged the prevailing large-scale examination leakage and other examination malpractice witnessed even today, to the detriment of actual performance by the learners.

Before the introduction of continuous assessment as a basic part of assessing students' achievements, the evaluation of students' performance was solely based on the achievements in a single examination set by some external body (Ugodulunwa & Ugwuanyi, 2003). Such examination includes a Primary School Leaving Certificate, Grade II Teacher's Certificate, the West African School Certificate (WASC) and the Higher School Certificate (HSC) to which students were exposed at the end of their school course. No conscientious effort was taken to assess the students at interval of time but at the end of the year. Promotion from one class to another was based on a child's performance at the end of the year examination for the purpose of certification; children were made to write examinations set by one external agency or the other. Among these agencies was the State Ministry of Education conducting part of the Grade II Teachers, Certificate Examination and the General Certificate of Examination (GCE) at 'O' level and 'A' level. This one short method of assessment had always been criticized by

educators. For its inadequacy and subjectivity as an evaluation tool stating some major weaknesses of the method.

Other major criticisms include the delay of educational decisions till the end of the year or course by which time such decisions might have been too late to help the pupils improve on their learning. The way and manner by which students report were being scantily presented in raw scores to parents or guardians formed another point for criticism. It was therefore a general welcomed idea when in the National Policy on Education was printed, reference was severally made into CA and its importance in evaluating students' performances.

Osunde (2005) points out that at the junior secondary school level "continuous assessment of pupils takes 60% while the final examination at the end of the programme takes only 40%." However, although the concept of the use of continuous assessment for formative and summative purposes are laudable, Kolo and Ojo (2005) found out that because of the large classes, many teachers do not regularly mark students work. "When called upon to submit continuous assessment scores, some teachers arbitrarily cook up scores in favour of few. This undoubtedly affects assessment and quality of education"

Furthermore, the National Policy on Education (NPE) in Nigeria recommends a two-tier secondary educational system, the Junior Secondary School, (JSS) and the Senior Secondary School, (SSS). The duration for each of the two levels is three years (Federal Republic of Nigeria, 1998). At the end of the duration, the JSS and SSS students write Junior Secondary Certificate Examination (JSCE) and the Senior Secondary Certificate Examination (SSCE) respectively. Mathematics is one of the core subjects recommended for both the JS and SS in the National Policy on Education. Mathematics is most essential subjects in any school curriculum for all levels of education.

Mathematics was always found to be central in everything people do in their daily routines, such that it was assumed to be developed according to Tsafe (2012) in response to the needs of the society and whose competence is vital to every person for them to have meaningful and productive life. Thus, the roles of Mathematics in a nation like Nigeria where scientific and technological advancement is very much desired cannot be over emphasized. Through Mathematics, man was raised from primitive stage when he finds it extremely difficult to even count to such an advanced stage of development. Similarly, Mathematics was described to be the language and currency of science and technology in every discipline in the world today. It serves as the instrument through which exchange of currency between individuals, organizations, companies and even countries could be possible without any barrier in the process. However, Mathematics is equally important in economic development and sustainability. This is because most of the economic policies taken by a country rely to a greater extent on some indices and these indices are being prepared in Mathematical terms.

It is in recognition of the power, relevance and universal applicability of Mathematics knowledge that the subject is core in our secondary education system. Despite efforts of the education authority to see that students do well in Mathematics, statistics show that for two years the junior secondary school students in Gombe State have not been performing very well in Mathematics at their junior secondary certificate examination. Failure in Mathematics at junior NECO could be seen in 2015/2016 academic session, 15% of the students had credit and above in Mathematics. In 2016/2017 academic session, 20.5% of the students had credit and above in Mathematics. Regrettably, this performance is far below expectation and the performance of students in Mathematics still dwindled.

In predicting academic performance, what a learner knows will play a large part in determining what sense they can make of new information. Learners build their own knowledge in an idiosyncratic way, using past experience and existing knowledge to make sense of new information. Prediction of a future examination result could be made on the bases of the results of an earlier examination. Thus, the study investigated into how CA scores could

predict performance in JSCE in Mathematics. This implies that the performance of students in JSCE in Mathematics may be influenced by the quality of their continuous assessment.

Research Question

In order to determine the predictive validity of Junior Secondary Certificate Examination the research question posed was:

1. What is the relationship between continuous assessment and Junior Secondary Certificate Examination scores in Mathematics for the period of 2015 - 2017?

Hypotheses

The following hypotheses were formulated in order to guide the conduct of the study:

HO_1: The students' CA scores in Mathematics cannot predict their performance in the Junior Secondary Certificate Examination in Mathematics for the 2014/2015 academic session.

HO_2: The students' CA scores in Mathematics cannot predict their performance in the Junior Secondary Certificate Examination in Mathematics for the 2015/2016 academic session.

HO_3: The students' CA scores in Mathematics cannot predict their performance in the Junior Secondary Certificate Examination in Mathematics for 2016/2017 academic session.

Methodology

The design of the study was ex-post facto and correlation research design. Ex post facto allow the assignment of participants to levels of the independent variable based on events that occurred in the past and dependent variable occurred thereafter the independent variable. The Ex post facto design was used in examining how an independent variable (continuous assessment), present prior to the study affects a dependent variable (Junior Secondary Certificate Examination), the correlation seeks to examine the relationships that exist between the two variables. The independent variable (predictor) is continuous assessment scores and the dependent variable (criterion) is the JSCE scores thus, the need for the design. The population for the study comprised 152,124 Junior Secondary School 3 (JSS 3) students from 296 Junior Secondary schools in Gombe State while 538 students were used as sample for the study , 169 students from 2014/2015 session, 187 students from 2015/2016 session and 182 students from 2016/2017 academic session.

The sampling method used was multistage cluster sampling technique. All the Junior Secondary Class 3 students in the four schools were used for this study. These Junior Secondary School class 3 students were made up of all students who were admitted into Junior Secondary School one (JS 1) in 2011/2012, 2012/2013 and 2013/2014 respectively, had cumulative continuous assessment for three (3) years and had NECO Junior Secondary Certificate Examination (JSCE) scores in the academic session 2014/2015, 2015/2016 and 2016/2017 respectively. The Researchers made use of two instruments for data collection, i.e. inventory in which continuous assessment scores and JSCE scores were accessed.

The researchers, requested for the CA score sheets and the JSCE score sheets of the students corresponding to the years on which analysis is to be carried out from the school authorities. From the record sheets, the CA scores sheets and the JSCE score sheets for Mathematics were extracted. The CA scores and the JSCE scores were extracted in grades i.e. A, C, P and F. The researchers, for convenience sake maintained the grading system as used by NECO for JSCE and such were converted to grade point, as shown in Table 1 and Table 2.

Table 1: Grading System Used by NECO for Junior Secondary Certificate Examination

JSCE Grading	Score Range	Letter Grade
Distinction	70-100	A
Credit	50-69	C
Pass	40-49	P
Fail	0-39	F

Both the CA and JSCE letter grades were later converted to grade points as presented in Table 2 below for easy analysis.

Table 2: Conversion of CA and JSCE Letter Grades to Grade point

CA	JSCE Score	Grade Points (G.P)
A	A	3
C	C	2
P	P	1
F	F	0

In analyzing the data collected, the researchers answered the research question using Correlation Coefficient (R), specifically, using Pearson Product Moment correlation. The researchers also tested hypotheses 1, 2 and 3 using simple linear regression (SLR) analysis with the aid of Statistical Package for Social Science (SPSS). The hypotheses were tested at .05 level of significance. Some cut off values for 'r' according to Awotunde and Ugodulunwa (2002. P. 93) are as follows:

0.00 – 0.25 = Weak relationship;
0.26 – 0.50 = Moderately weak relationship;
0.51 - 0.75 = Moderately strong relationship
0.76 – 1.0 = Strong Perfect relationship

RESULTS

Research Question

What is the relationship between continuous assessment and Junior Secondary Certificate Examination scores in Mathematics for the period 2015 - 2017?

Table 3

Relationship between Students Continuous Assessment and Junior Secondary Certificate Examination Scores

Variables	N	Mean	Standard Deviation	R
JSCE Scores	169	1.37	.48	.274
CA Scores	169	2.49	.66	

Table 3 reveals the correlation result showing the relationship between students' continuous assessment and Junior Secondary Certificate Examination scores in Mathematics for the 2014/2015 academic session. The result shows that the mean scores of students in CA ($\bar{X}$ = 2.49, SD = .66) is higher than that of JSCE ($\bar{X}$ = 1.37, SD = .48.) with a correlation coefficient of 0.27. Indicating that there is a positive moderately weak relationship between CA and JSCE scores in Mathematics

Table 4
Relationship between Students Continuous Assessment and Junior Secondary Certificate Examination Scores

Variables	N	Mean	Standard Deviation	R
JSCE Scores	187	1.57	.50	-.010
CA Scores	187	2.76	.43	

Table 4 reveals the correlation result showing the relationship between students' continuous assessment and Junior Secondary Certificate Examination scores in Mathematics for the 2015/2016 academic session. The result shows that the mean scores of students in CA ($\bar{X}$ = 2.76, SD = .43) is higher than that of JSCE ($\bar{X}$ = 1.57, SD = .50) with a correlation coefficient of -0.010. This means that there is a negative weak relationship between CA and JSCE scores in Mathematics for the 2015/2016.

Table 5
Relationship between Students Ccontinuous Aassessment and Junior secondary Certificate Examination Scores

Variables	N	Mean	Standard Deviation	R
JSCE Scores	182	1.52	.55	.17
CA Scores	182	2.75	.46	

Table 5 reveals the correlation result showing the relationship between students' continuous assessment and Junior Secondary Certificate Examination scores in Mathematics for the 2016/2017 academic session. The result shows that the mean scores of students in CA ($\bar{X}$ = 2.75, SD = .46) is higher than that of JSCE ($\bar{X}$ = 1.52, SD = .55) with a correlation coefficient of 0.17. This means that there is a positive weak relationship between CA and JSCE scores in Mathematics for the 2016/2017.

Hypothesis One

The students' continuous assessment scores in Mathematics cannot predict their performance in Junior Secondary Certificate Examination for the 2014/2015 academic session. The hypothesis was tested using regression analysis and the results are presented in Tables 6 and 7.

Table 6
Regression ANOVA and Model Summary of CA and JSCE Scores in Mathematics 2014/2015

Model	SS	Df	MS	F	p-value	R	R-Square	Adjusted R Square
Regression	2.968	1	2.968	13.594*	000	274	.075	.069
Residual	36.684	168	.218					
Total	39.653	169						

a. Dependent Variable: Junior Secondary Certificate Examination Scores. $\alpha = .05$
b. Predictors: (Constant), Continuous Assessment Scores
P < .05
F-Value = 13.594 is significant

Table 6 reveals the f-test and model summary that examines the degree of relationship between the variables. The result shows that F (1, 168) = 13.594, p < 0.05. Since the p value (.000) is less than the 0.05 level of significance, the null hypothesis was rejected, it then implies that the model is significant, meaning the students' continuous assessment scores in Mathematics can significantly predict their performance in Junior Secondary Certificate Examination for 2014/2015 academic session. The result yielded a regression coefficient of .274, coefficient of multiple determination of .075 and the adjusted R-Square of .069. It indicates that CA scores significantly predicts students' achievement in JSCE. It was deduced that 7.5 percent of variation in JSCE Mathematics is due to CA while 92.5 percent variation is due to other variables not investigated in the study.

Table 7
Regression Coefficient of CA and JSCE Scores in Mathematics for 2014/2015

	Unstandardized Coefficients		**Standardized Coefficients**		
Model	**β**	**Std. Error**	**β**	**t**	**P-Value**
Constant	.873	.140		6.247	.000
CA	.200	.054	.274	3.687	.000

Table 7 reveals the un-standardized regression coefficient (β), the standardized regression coefficient (beta weight) t, and p values. The result shows that continuous assessment scores β = .200, t (168) = 3.687, P = 0.000, significantly contribute to junior secondary certificate examination scores.

Hypothesis Two

The students' Continuous Assessment scores in Mathematics cannot predict their performance in Junior Secondary Certificate Examination for the 2015/2016 academic session. The hypothesis was tested using regression analysis and the results are presented in Tables 8 and 9.

Table 8
Regression ANOVA and Model Summary of CA and JSCE Scores in Mathematics 2015/2016

Model	SS	Df	MS	F	p-value	R	R-Square	Adjusted R Square
Regression	.004	1	.004	.018	.894	.01	.000	-.005
Residual	46.097	186	.248					
Total	46.101	187						

a. Dependent Variable: Junior Secondary Certificate Examination Scores. α = .05
b. Predictors: (Constant), Continuous Assessment Scores
P > .05
F-Value = .018 is not significant

Table 8 reveals the f-test that examines the degree of relationship between the variables. The result shows that F (1, 186) = .018, p > 0.05. Since the p value (.894) is greater than the 0.05 level of significance, the null hypothesis was not rejected, it then implies that the model is insignificant, meaning the students' continuous assessment scores in Mathematics cannot

predict their performance in Junior Secondary Certificate Examination for 2015/2016 academic session. The model summary result yielded a regression coefficient of .01, coefficient of multiple determination of .000 and the adjusted R-Square of -.005. It indicates that the predictor cannot significantly predict students' achievement in JSCE. It was deduced that zero percent of variation in JSCE Mathematics is due to CA while 100 percent variation is due other variables not investigated in the study.

Table 9
Regression Coefficient of CA and JSCE Scores in Mathematics for 2015/2016

	Un-standardized Coefficients		**Standardized Coefficients**		
Model	**β**	**Std. Error**	**β**	**t**	**P-Value**
Constant	1.600	.238			.000
				6.733	
CA	-.011	.05	-.010	-.133	.894

Table 9 reveals the un-standardized regression coefficient (β), the standardized regression coefficient (beta weight) t, and p values. The result shows that continuous assessment scores β = -.011, t (186) = 6.733, P = 0.894, insignificantly contribute to junior secondary certificate examination scores.

Hypothesis Three
The students' continuous assessment scores in Mathematics cannot predict their performance in Junior Secondary Certificate Examination for the 2016/2017 academic session. The hypothesis was tested using regression analysis and the results were presented in Tables10 and 11.

Table 10
Regression ANOVA and Model Summary of CA and JSCE Scores in Mathematics 2014/2015

Model	SS	Df	MS	F	p-value	R	R-Square	Adjusted R Square
Regression	1.615	1	1.615	5.408*	.021	.17	.029	.024
Residual	54.068	181	.299					
Total	55.683	182						

a. Dependent Variable: Junior Secondary Certificate Examination Scores. α = .05
b. Predictors: (Constant), Continuous Assessment Scores
P < .05
F-Value = 5.408 is significant

Table 10 reveals the f-test that examines the degree of relationship between the variables. The result shows that F (1, 181) = 5.408, p < 0.05. Since the p value (.021) is less than the 0.05 level of significance, the null hypothesis was rejected, it then implies that the model is significant, meaning the students' continuous assessment scores in Mathematics can predict their performance in Junior Secondary Certificate Examination for 2016/2017 academic session. The result further yielded a regression coefficient of .17, coefficient of multiple

determination of .029 and the adjusted R-Square of .024. It indicates that the overall model of the predictor can significantly predict students' achievement in JSCE. It was deduced that 2.9 percent of variation in JSCE Mathematics is due to CA while the remaining 97.1 percent variation is due other variables.

Table 11
Regression Coefficient of CA and JSCE Scores in Mathematics for 2016/2017

	Un-standardized Coefficients		Standardized Coefficients		
Model	**β**	**Std. Error**	**β**	**t**	**P-Value**
Constant	1.600	.238		6.733	.000
CA	-.011	.05	-.010	-.133	.894

Table 11 reveals the un-standardized regression coefficient (β), the standardized regression coefficient (beta weight) t, and p values. The result shows that continuous assessment scores β = -.011, t (186) = 6.733, P = 0.894, insignificantly contribute to junior secondary certificate examination scores in 2016/2017 academic session.

DISCUSSION

The study investigated the predictive validity of continuous assessment scores on students' performance in Mathematics of junior secondary certificate examination in Gombe south of Gombe state. The finding on relationship between students' continuous assessment and Junior Secondary Certificate Examination scores in Mathematics for 2014/2015 and 2016/2017 academic sessions revealed that there is a positive moderately weak relationship between CA and JSCE scores in Mathematics. The results further revealed that the performance of students in Mathematics in the Junior Secondary Certificate Examination could be predicted from their continuous assessment scores for two academic sessions i.e. 2014/2015 and 2016/2017. The result showed that continuous assessment scores β = .200, t (168) = 3.687, P = 0.000, significantly contribute to junior secondary certificate examination scores. This is in line with the works of Olujide (2006); O'kwu and Orum (2012) who found a positive and significant relationship between continuous assessment scores and J.S.C.E scores and hence, continuous assessment scores are good predictors of J.S.C.E. performance. In addition, the findings are consistent with Sylvanus and Okechukwu (2013) submission that there is a low, positive but significant correlation between students' achievement in NECO-JSCE and in the SSCE conducted by NECO. Low validity of CA according Kolawole and Ala (2013) could be due to increased pressure on school authorities to admit beyond the designed capacities of school facilities leading to overcrowding, which hamper the quality of assessment among other things.

Again, the result showed a negative weak relationship between students' continuous assessment scores and their performance in Junior Secondary Certificate Examination. Hence, the model was insignificant meaning the students' continuous assessment scores in Mathematics cannot predict their performance in Junior Secondary Certificate Examination for 2015/2016 academic session. The result showed that continuous assessment scores β = -.011, t (186) = 6.733, P = 0.894, insignificantly contribute to junior secondary certificate examination scores. For the academic year that the predictive validity of CA could not be ascertained, it could be as a result of over adjustment of the students' CA marks, lack of standardization in the CA scores, and other variables which must have contributed negatively to the performance of the students in the JSCE. However, continuous assessment record if properly handled and

managed, could provide explanatory information on variable for describing the quality of education in Gombe State as well as Nigeria at large. It will also help to identify some problems of school children and thereby enable the educators to plan programmes that would assist in arresting such situations before the students' final examination.

CONCLUSION

In conclusion, the study revealed a weak positive relationship between the students' continuous assessment scores and Junior Secondary Certificate Examination scores in Mathematics for two academic sessions while the relationship was negative and very weak for one academic session. The continuous assessment scores were good predictor of students' JSCE performance in Mathematics for two academic sessions 2014/2015 and 2016/2017) while it could not be used as a predictor in 2015/2016 academic session. From the foregoing, it could be presumed that there was an influence on CA scores which must have contributed negatively to the performance of the students in the JSCE especially in 2015/2016 academic session.

RECOMMENDATIONS

Based on the findings of the study the following recommendations were made:

1. The continuous assessment scores should not be inflated so that it could be used for predicting the final performance of the students' achievement in their end of year programme.
2. There should be uniformity and standardization in administering continuous assessment across schools.
3. Incompetence in the operation of continuous assessment by teachers should be checked through training and re-training of teachers.
4. The State Ministry of Education should ensure standardization in the conduct of their junior secondary certificate examinations and avoid repetition of questions and omission of correct answers.

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