Predictive Validity of Mathematics Mock Examination Results of Senior and Junior High School Students' Performance in WASSCE and BECE in Ghana

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

Original Research Article

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Abstract

This study was designed to investigate the validity of Mathematics Mock results of students in WASSCE and BECE in Ghana. One hundred and sixty-four (164) students were selected by convenience sampling technique from 15 public secondary schools in Ghana. Expo-facto design type was used as it made use of already existing data. The data used for the study were results of WASSCE, BECE and unprocessed raw scores of mock examination from the various schools selected. The study found no significant difference between the WASSCE and Mock grades in Core Mathematics. Mock Core Mathematics was found to have a WASSCE predictive power of 92%. There was also no significant difference between BECE and WASSCE grade with a predictive power of 90%. The study however found a significant difference between the BECE and Mock Mathematics grades. Based on the findings of this study, it was recommended that mock examinations be made compulsory for WASSCE candidates since it has the capacity to predict their grades in WASSCE.

Keywords: Mock; external; validity; secondary school; WASSCE; BECE.

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1 Introduction

If education is meant to prepare the youth for life, there is the need for these students to prepare well for both internal (mock) and external (WASSCE) examinations. Mock examination as a trial examination is selective, predictive and diagnostic in nature. It is supposed to reveal how successful teacher's instructions have been mastered. This mock examination being predictive in nature can be used for selection of students who will succeed in further academic endeavors. It also prepares the final year students in readiness for the final examination. Mock examinations are teacher-made tests prepared by the school teachers and are administered to students towards the end of the second term when those classes are supposed to have covered their examination syllabus [1]. Teachers rating (achievement and aptitude test scores) have been used to predict academic and occupational success. This is usually achieved by employing various instruments based on inferential statistics.

The practice of conducting mock examinations before the main examination is a common practice in many parts of the world but negative sentiments have always arisen from the culture of associating mock examinations with the main examinations. In most studies already reported, the two examinations show no significant correlation. Studies done by Carole and Bates [2] on the relationship between mock and main exams in the Florida dental school reported no significat association between the two. Papers presented at the Association for Educational Assessment in Africa (AEAA) annual conference have shown concern about the low correlation between continous assessment tests and the national examination scores. The same sentiments of low correlation were also reported by Bunza for Nigeria [3], Merwe for Namibia [4]. Lewin (1997) observed that the highest scoring standards had a low correlation between mock and the final examinations while the lowest scoring standards had a high positive correlation between the mock and the final examinations.

Survey carried out by Leonard [5] reported that conditions under which mock exams are done in some schools in Kenya is stricter than the main examinations which are manned by external invigilators. Furthermore, most teachers try to ensure that the mock examinations cover the whole syllabus as they are used to set standards for the final examinations. A significantly high percentage of the respondents (78%) indicated that mock exam questions are more difficult than the main exam questions. The respondents complained that the emphasis put on mock examinations and the resulting deterioration of standards as well as the prohibitive punishment given due to mock failure in schools and the fact that the schools strikes are often blamed on the mock examinations poses a serious challenge to educators and especially the examination assessors. The challenges associated with mock examinations have made it necessary to ban provincial and district mocks temporarily in Kenya.

Using mock examinations to predict the outcome of the main examination should be done only if the two examinations are done under the same conditions within the students and the environment. Falchikov and Goldfinch [6] reported in their quantitative studies comparing teacher assessment and the national examinations subjected to meta-analysis that the two resemble each other when judgment is based on well understood criteria rather than when marking involves assessing several individual dimensions. Franklin [7] reported in his book that the learning achievements obtained through assessment can be affected by constraints caused by the context in which the teaching and assessment conditions occur and the unawareness of the effect that assessment has on the students themselves. He emphasized that for two or more achievements to be compared, factors such as reliability, validity, designing plans, setting of questions, grading, assessment environment and approach must be constant. Doran et al. [8] emphasize that successful applications of measurements require comparable measurements even if they are made in differing circumstances by different methods and investigations. According to Ying and Sireci [9] un- intended factors introduce construct irrelevant variance in to the test scores and thus changes the construct that the test intended to measure. As a result, the test scores obtained from the test no longer provide an adequate basis for the kinds of inferences the test user intends to be able to make. This may bring differences and inaccuracies when comparing mock examinations and the final examinations.

1.1 Statement of the problem

Mock examinations serve as a fallback in case of a need to predict students' success in in the main external examinations, or helps to investigate any examination malpractices in the final examinations.

The perennial alarming rate at which students fail the WASSCE and BECE calls for attention and contemplation. Teachers in the basic and secondary schools assess students through teacher-made tests, continuous assessment and end-of-term examinations. Mock Examinations are mostly administered to students in the final year of their studies who are about to write the external examinations such as BECE and WASSCE. By the time mock examinations are administered, teachers may have covered as many topics as possible in the mathematics curriculum. The mock examinations are accorded the same format and conditions as there are in the WASSCE and BECE so as to expose the students to almost the same setting. It is therefore salient to measure the extent to which the mock examinations can predict the grades that students are likely to achieve in WASSCE and BECE in the subject of Mathematics.

1.2 Research questions

The following research questions were generated in line with the issues raised above and tested at 0.05 level of significance:

  i. Is there any significant difference between the achievements of students in mock core mathematics and WASSCE core mathematics?
  ii. Is there any significant difference between the achievements of students in mock mathematics and BECE mathematics?
  iii. Is there any significant difference between the achievements of students in BECE mathematics and WASSCE mathematics?
  iv. To what degree could Mock predict the WASSCE grade of a candidate in mathematics?
  v. To what degree could BECE grade predict the WASSCE grade of a candidate in mathematics?

2 Materials and Methods

The main research instrument was the questionnaire which was used to collect information from the respondents from each of the categories. One hundred and sixty-four (164) students were selected by convenience sampling technique from 15 public secondary schools in Ghana. The data used for the study were results of WASSCE, BECE and unprocessed raw scores of mock examination (in Mathematics) from the various schools selected. Mock raw scores were converted to grades using the WAEC certified score-grade interpretation. ANOVA was used to test significance. All grades were coded before used for the Analysis. Microsoft Excel and SPSS were used for the analysis.

Table 1. ANOVA Table

Source of Variation	Sum of Square (SS)	df	Estimate of σ^2	F ratio
Between groups	$n\sum_j \left(\overline{X_j} - \overline{\overline{X}}\right)^2$	$n-1$	$\dfrac{n\sum_j \left(\overline{X_j} - \overline{\overline{X}}\right)^2}{n-1}$	$\dfrac{SS_B}{SS_W}$
Within groups	$\sum_i \sum_j \left(X_{ij} - \overline{X_j}\right)^2$	$c(n-1)$	$\dfrac{\sum_i \sum_j \left(X_{ij} - \overline{X_j}\right)^2}{c(n-1)}$	
Total	$\sum_i \sum_j \left(X_{ij} - \overline{\overline{X}}\right)^2$	$cn-1$		

Where; $\quad SS_B = \dfrac{n\sum_j \left(\overline{X_j} - \overline{\overline{X}}\right)^2}{n-1}$ $\quad$ and $\quad$ $SS_W = \dfrac{\sum_i \sum_j \left(X_{ij} - \overline{X_j}\right)^2}{c(n-1)}$,

j = Column number, i = Row number, c = Number of columns (groups), n = Sample size, $\quad \overline{\overline{X}}$ = Grand mean, $\quad \overline{X_j}$ = Mean of the jth group.

Linear correlation coefficient (r) is given by:

$$r = \dfrac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$$

3 Results

From Fig. 1, more students obtained grades between A1 and C5 in Mock (30.6%) than in WASSCE (22.1%) in the Core Mathematics subject. However, in general more students obtained grades between C6 and F9 (77.9%) in WASSCE than in the Mock (69.4%) in mathematics.
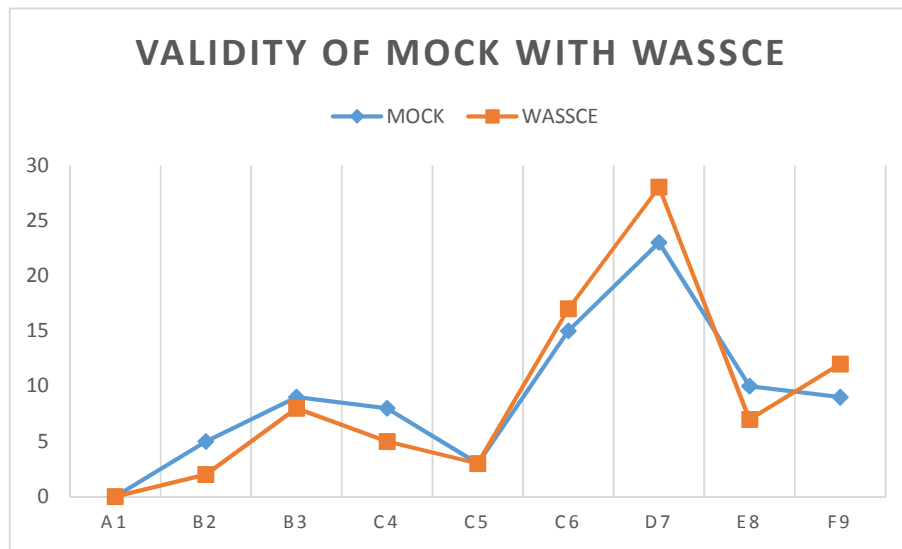

Fig. 1. Graphical representation of Mock with WASSCE in Core Mathematics

Table 2. Test of significance between WASSCE and Mock

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	0.161	1	.161	0.046	0.830[b]
	Residual	277.559	80	3.469		
	Total	277.720	81			

a. Dependent Variable: WASSCE
b. Predictors: (Constant), MOCKW

From Table 2, the calculated value of 0.046 is lower than the critical value of 0 .830 so we conclude that there is no significant difference between the WASSCE and Mock grades in Mathematics. This means the mock examinations in core mathematics can accurately predict WASSCE in the senior high school.

Table 3. Regression equation: WASSCE = 6.271+0.022 Mock

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	**Std. error**	**Beta**		
1	(Constant)	6.271	.645		9.724	.000
	MOCKW	.022	.101	.024	.215	.830

a. Dependent Variable: WASSCE

The coefficient of correlation was computed by the formula, $r = \dfrac{\sum xy}{\sqrt{\sum x^2 \sum y^2}} = \dfrac{3183}{\sqrt{3291 \times 3639}} = 0.92$

using Microsoft Excel.

There is a high positive linear correlation between Mock and WASSCE grades in Core Mathematics.

The result of the findings supported the claim of Alonge (1983) who investigated the predictive validity of mock mathematics for WASSCE and concluded that mock mathematics helped significantly in predicting success in academic performance of students in WASSCE mathematics [10].
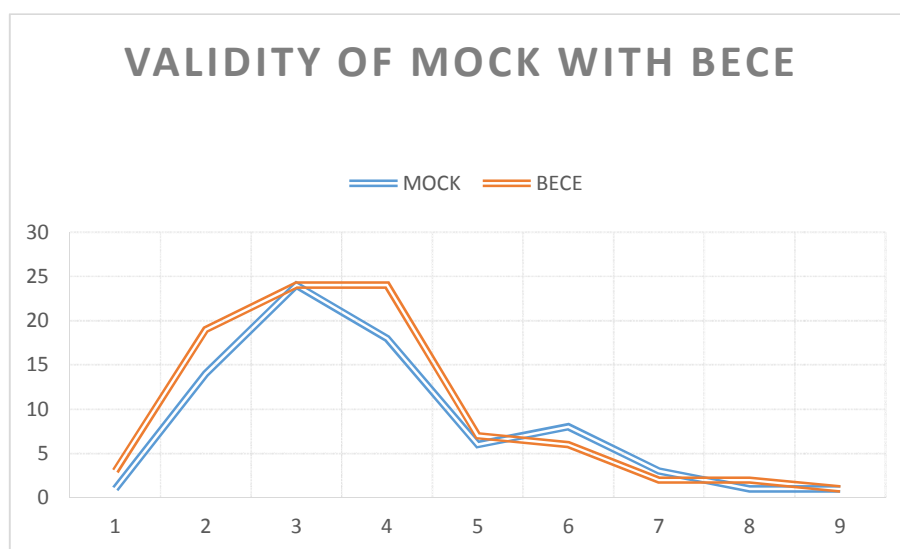

Fig. 2. Graphical representation of Mock with BECE in Mathematics

From Fig. 2, more students (94%) obtained grades between 1 and 5 in BECE than in the Mock (84.2) in Mathematics. However, in general more students obtained grades between 6 and 9 in Mock (15.8%) than in BECE (6%) in mathematics.

From Table 4, since the calculated value of 1.855 is higher than the critical value of 0.177, we conclude that there is a significant difference between the Mock and BECE grades in Mathematics. We reject the null hypothesis. This means the mock examinations in mathematics cannot accurately predict BECE in the junior high school.

Table 4. Test of significance between BECE and Mock

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	3.297	1	3.297	1.855	0.177[b]
	Residual	142.215	80	1.778		
	Total	145.512	81			

a. Dependent Variable: BECE
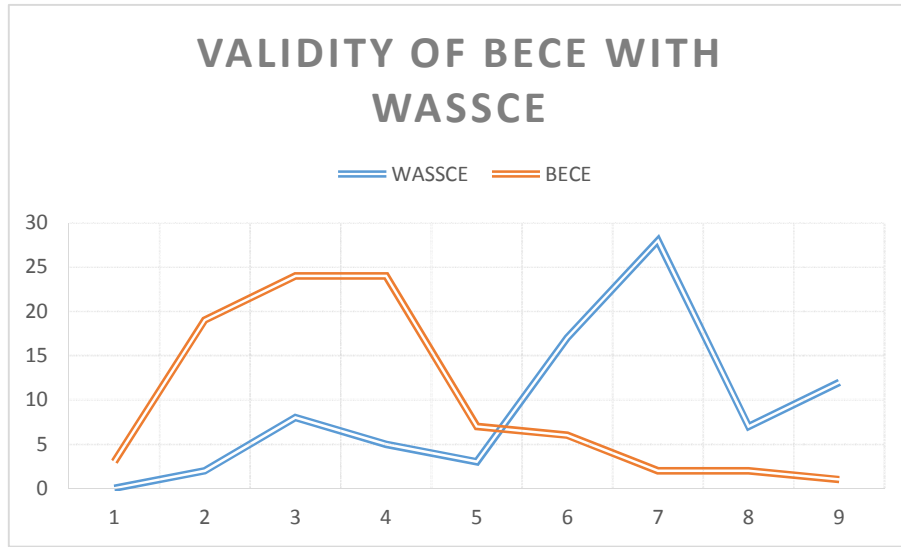*b. Predictors: (Constant), MOCK*

Fig. 3. Graphical representation of BECE with WASSCE in Mathematics

From Fig. 3, more students (82.4%) obtained grades between 1 and 5 in BECE than in the WASSCE (19.2%) in Mathematics. However, in general more students obtained grades between 6 and 9 in WASSCE (80.8%) than in BECE (17.66%) in mathematics.

Table 5. Test of significance between WASSCE and BECE

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	1.010	1	1.010	0.292	0.590[b]
	Residual	276.710	80	3.459		
	Total	277.720	81			

a. Dependent Variable: WASSCE
b. Predictors: (Constant), BECE

From Table 5, there was no significant difference between the achievement of students in BECE and WASSCE grade (F calculated value 0.292 < F table value 0.590).

Table 6. Regression equation: WASSCE = 6.120 +0.083BECE

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.
		B	Std. error	Beta		
1	(Constant)	6.120	0.562		10.898	0.000
	BECE	0.083	0.154	0.060	0.540	0.590

a. Dependent Variable: WASSCE

The coefficient of correlation was computed by the formula, $r = \dfrac{\sum xy}{\sqrt{\sum x^2 \sum y^2}} = \dfrac{1783}{\sqrt{1072 \times 3639}} = 0.90$

using Microsoft Excel.

There is a high positive linear correlation between BECE and WASSCE grades.

4 Conclusions

At the end of this study a number of findings have been made:

Firstly, there was no significant difference in the achievement of SHS candidates in the Mock and WASSCE in core mathematics.

Secondly, there was a significant difference in the achievement of JHS candidates in the Mock and BECE in core mathematics.

Again, there was no significant difference between the achievements of students in BECE mathematics and WASSCE mathematics.

It was also found that Mathematics Mock examinations in SHS could be used to predict the WASSCE grade of to the degree of 92%.

Finally but not the least, it was found that Mathematics BECE examination in JHS could be used to predict the WASSCE grade in Mathematics to the degree of 90%.

5 Recommendations

From the findings of the study, the following recommendations have been made to be considered in the Ghana education policy:

1. The moderation, invigilation and marking of mock examinations must meet the international standards. If possible the service of external invigilators should be incorporated.
2. Mock examination should be made compulsory for students intending to sit for WASSCE, since it has been found to be helpful to the student.
3. Time laps between mock and WASSCE should not be more than 6 weeks for it, to serve as a test-retest form of the SSCE examination.
4. Mock examination should undergo some process of standardization to be able to compete favorably with WAEC, which is also a standardized test.
5. Mock examination should be centralized (at least) in the local government and supervised by the Area education officer in the local government, since it significantly predicted performance in WASSCE.
6. It is recommended for the Government of Ghana and other stake holders to make mock examinations compulsory for all junior and senior high schools in Ghana.
7. It is further recommended for a national mock examination body to be constituted to manage the conduct of the examinations and also to emphasize bring validity, reliability and uniformity to the examinations.

Competing Interests

Author has declared that no competing interests exist.

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