East African Journal of Education and Social Sciences
EAJESS November –December 2023, Vol. 4, No. 6, pp. 39-.47.
ISSN: 2714-2132 (Online), 2714-2183 (Print). Published by G-Card
DOI: https://doi.org/10.46606/eajess2023v04i06.0332.

Classroom Assessment and Academic Performance in Ghanaian Junior High Schools Integrated Science

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Abstract: The study took place in the Sunyani municipality, the capital of the Bono region of Ghana. The purpose of the study was to investigate public and private junior high school pupils' perceptions of classroom assessment and academic performance in integrated science. The study employed the descriptive survey research design involving 200 second-year pupils. A questionnaire was used to collect data on their perceptions of classroom assessment while the national BECE examination results for three consecutive years were used to determine pupils' performance in the subject based on school type. Mean scores, standard deviations and t-test were used to analyze the data. The study concludes that pupils had a positive perception on transparency of assessment, application and their capabilities. However, the pupils had a neutral perception towards congruence with planned learning. Private JHS pupils performed higher than public JHS pupils. To address the pupils' neutral perceptions of congruence with planned learning, it is recommended that the teachers from the sampled schools be open to the pupils and inform them of the mode of assessment to be taken. Since the private JHS pupils performed better than the public JHS pupils, it is recommended that the district and municipal education directors and circuit supervisors keep close eyes on the work of the public integrated science teachers in the municipality to bridge the gap between the performance of public and private junior high school pupils in integrated science.

Keywords: Perception; assessment; academic performance; integrated science; junior high school.

How to Cite: Acheampong, R., Ameyaw, Y. and Koomson, C. (2023). Classroom Assessment and Academic Performance in Ghanaian Junior High Schools Integrated Science**.** East African Journal of Education and Social Sciences 4(6), 39-47.Doi: https://doi.org/10.46606/eajess2023v04i6.0332.

Introduction

Teaching and assessment are inseparable in the field of education. However, the way teachers assess their students determines the kind of perceptions students develop towards assessment and their performance in the discipline. In the words of Brubacher (1939, p. 110), "teaching is the arrangement and manipulation of a situations in which there are gaps or obstructions that an

individual will seek to overcome and from which he or she will learn in the process of doing so."

Assessment is the collection of relevant information that may be relied on in making decisions (Nurhayati et al., 2020). The impact of assessment is significantly observable on students' performance. The way students approach learning determines the way they think about classroom assignments and tests (Lowe, 2022). Thus, students attach more seriousness to their studies if they perceive classroom assessment to be useful. The ways educators teach determine students' perceptions and their academic performance.

Nevertheless, studies that have monitored students' performance in science at the early stages of their education across Africa indicate that achievements in integrated science is low (Onanuga & Saka, 2018; Osuolale, 2014; Ogunkola & Olatoye, 2011; Oladejo et al., 2021; United Nations Education, Scientific and Cultural Organization [UNESCO], 2010). Factors such as inadequate funding for science education, inadequate teaching and learning resource, inadequately qualified teachers, inappropriate teaching methods, students' negative perceptions towards assessment and poor classroom assessment practices have been cited as major causes of students' poor achievements in science (American Association for the Advancement of Science, 2009; Deodat-Otami, 2019; Laugksch, 2012; Obanya, 2003; Ogundipe, 2003; Onanuga & Saka, 2018; Maarschalk, 2008; Polesel et al., 2014).

Ghana is no exception when it comes to poor performance in science at the basic level of education. For example, the West African Examination Council's Chief Examiners' Reports for Integrated Science for BECE in 2017 and 2020 show that most students had a poor understanding of basic scientific concepts and were unable to apply such understanding to real-world problems (Opoku-Agyemang, 2013; Frimpong, 2012; The West African Examinations Council, 2017 & 2020). In addition, the performance of pupils in integrated science in the Sunyani municipality is not different from the repeated low academic performance in integrated science according to the education sector performance (ESP) review report**.** For example, in the 2016 BECE, 55.8% of pupils who sat for the examination had an aggregate of 5 to 9, which is considered to be relatively weak in the WAEC grading system. Similarly, in the 2017 BECE, 52.17% of the pupils who wrote the examination had an aggregate of 5 to 9 in Integrated Science in the Municipality (WAEC, 2016, 2017). A grade is considered to be weak if it is below the cut-off mark set by the WAEC. The pass is usually set at the minimum mark of 40%.

To find solutions to the poor performance of students in integrated science at the basic level, Fletcher (2016) and Anamuah-Mensah (2008) advised that teachers with the requisite academic and professional qualifications in science should teach the subject. Suleiman (2011) suggested that to improve students' performance in science at the basic level, higher-order questions should be used to assess the students' scientific understanding.

Studies indicates that not enough research has been carried out on pupils' perceptions of assessment and their differences in academic performance in a single study (Byrne et al., 1986; Hattie & Anderman, 2013). This gap makes it difficult to explain pupils' perceptions of assessment and their academic performance in integrated science. In response, this study investigated pupils' perceptions of classroom assessment in integrated science and the differences in their academic performance.

Methodology

This section presents the methodological structure of the study. It looks at the research design, population, and sampling procedure. It also gives a description of the instrument used for data gathering and analysis.

Research Design

This study employed the descriptive survey design to collect data related to JHS pupils' perceptions of classroom assessment and the differences in their academic performance. Ary et al. (1990) stressed that descriptive survey is an important method that is frequently used in educational research. This is because in education, most of the issues that are researched into are descriptive in nature; hence the adoptions of the descriptive survey design.

Population and Sampling

The study was conducted in the Sunyani Municipality, the capital of the Bono Region of Ghana. The target population was JHS pupils in the municipality. There are 92 JHS schools in the municipality. A stratified sampling technique was used to partition the schools into public and private strata. Out of these 92 schools, 54 are public while

the rest are private. A convenient sampling technique was used to select five schools from the 54 public schools and three schools from the 38 private schools. A proportional simple random method was used to select 200 second-year pupils from the participating schools.

Data Collection Instrument

In determining pupils' perceptions towards classroom assessment, a questionnaire developed by Fisher et al. (2005) was adopted. It contained 19 items distributed among five sub-scales, namely: congruence with planned learning (3 items), authenticity of assessment (5 items), students' consultation about assessment (4 items), transparency of assessment (3 items) and students' capabilities (4 items). Each item began with a statement and was followed by five options, each with a numerical weight: strongly agree (5 points), agree (4 points), neutral (3 points), disagree (2 points), and strongly disagree (1 point).

Three of the items in the questionnaire were changed or modified to suit the context of the study. Again, the sub-scales were reduced from five to four while the items were reduced from 19 to 13. Furthermore, the items were rearranged among the four sub-scales based on a specific key theme to meet the local setting. Finally, in determining pupils' performance based on school types, WAEC examination results for three consecutive years, namely 2020, 2021, and 2022, were used.

Validity and Reliability

To determine the validity of the questionnaire, it was given to colleague researchers to determine their content and face validity. This was to ensure that the items reflected the intent of the researchers and were also clear and understandable to the pupils who took them.

The reliability of the questionnaire was determined using the reliability coefficient (Cronbach's Alpha). Some authors, such as Leech et al. (2011) claim that the reliability of a research instrument can be assessed by measuring a tool's internal consistence and the guaranteed way is the use of Cronbach's Alpha. The questionnaire was pilot tested with 60 pupils who were not involved in the actual study. According to Sirem and Çatal, 2022; Cohen et al., 2007 and Borg et al., 1996, coefficients of reliability values above 0.75 are considered reliable. The reliability coefficient value obtained for each item ranged from 0.77 to 0.80.

Data Analysis

Data was analyzed using descriptive statistics in terms of mean scores and standard deviations. Principal Component analyzed 13 items to determine pupils' perceptions toward classroom assessment. T-test was used to test a hypothesis at a significant level of 0.05.

Results and Discussion

This section presents the results of the study and discusses the findings based on literature.

Research Question 1: What is the perception of pupils towards classroom assessment in integrated science?

The research question sought to establish the perception of pupils towards classroom assessment in integrated science. A questionnaire was used to gather information on the pupils' perceptions of classroom assessment in the subject. Descriptive statistics were used to organize the pupils' responses to each sub-scale of the questionnaire into means and standard deviations. In the analysis, sub-scale means between 3.5–5.0, 2.5–3.49, and 1.00–2.49 are considered positive, neutral, and negative perceptions, respectively.

Prior to the determination of pupils' perceptions towards classroom assessment, the questionnaire items were subjected to factor analysis and the results are presented in table 1 and 2.

Table: 1 KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.784
Bartlett's Test of Sphericity	Approx. Chi-Square	442.119
	Df	78
	p-value	.000

The Kaiser-Meyer-Oklin (KMO) value was determined to be .784, which is greater than the commonly recognized value of .6. In factor analysis, .6 is considered as the minimum (Sovey et al., 2022). The results demonstrate that the data was well-suited for factor analysis. The Bartlett's Test of Sphericity was statistically significant (p = .000), confirming the factorability of the correlation

matrix. The components with an eigenvalue of one or more were identified using the Kaiser's criterion as appears in table 2.

The principal component analysis result shown in Table 2 indicates that only the first four components had eigenvalues greater than one (3.48, 1.43, 1.13 and 1.05). This signifies that only four components can be retained in the PCA, as it shows how much of the variation is explained by each component. The remaining 9 items having eigenvalues less than one (0.95-0.44) explain very little variation and addition of any of the items do not significantly increase the amount of variance explained. Hence, they can be discarded. The four factors accounted for 54.48 percent of the variation, whereas the remaining items accounted for 45.52 percent. The factors were further explored using the scree plot in Fig. 1.

Table2: Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.48	26.73	26.73	3.48	26.73	26.73	1.98	15.21	15.21
2	1.43	10.98	37.72	1.43	10.98	37.72	1.77	13.59	28.8
3	1.13	8.73	46.44	1.13	8.73	46.44	1.7	13.11	41.91
4	1.05	8.04	54.48	1.05	8.04	54.48	1.64	12.58	54.48
5	0.95	7.29	61.78						
6	0.83	6.35	68.13						
7	0.77	5.95	74.08						
8	0.73	5.58	79.65						
9	0.65	4.97	84.62						
10	0.57	4.4	89.03						
11	0.51	3.94	92.96						
12	0.47	3.63	96.59						
13	0.44	3.41	100						

Extraction Method: Principal Component Analysis

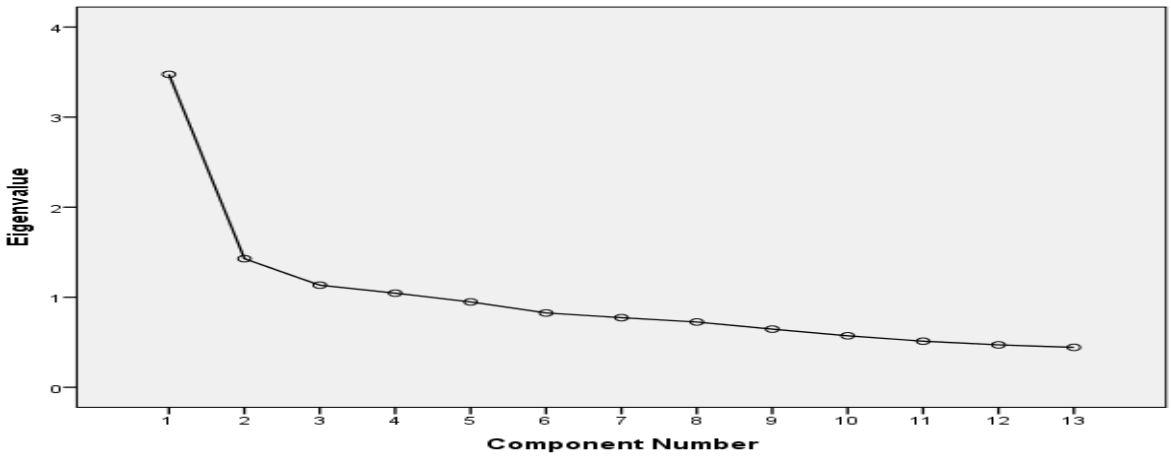

Figure 1: Scree Plot

The scree plot reveals that the top four columns' eigenvalues are above one (1), as shown on the vertical axis, indicating that they can be preserved. The line on the graph seems practically flat after the fourth element, indicating that those factors did not significantly contribute to pupils' perceptions towards assessment. Additionally, a Varimax Rotation was performed to illustrate the loadings of the four principal components.

Table 3 shows the rotated two-factor solutions or loadings.

Table 3: Rotated Component Matrix

	Component			
	1	2	3	4
Transparency				
In science I am clear about the types of assessment being used	1.742			
I am told in advance on what I am being assessed	1.627			
I am clear about what my teacher wants in my assessment tasks	1.681			
I am aware how my assessment will be marked	1.432			
Application				
Learning has helped me to do things in my surroundings		1.747		
Assessment in science examines my ability to answer everyday questions		1.565		
Assessment tests my ability to apply what I know to real- life problems		1.440		
Capability			1.606	
I am given assessment tasks that suit my ability			1.681	
I remember all my assessment in science class tests			1.532	
My teacher has explained to me how each type of assessment is used				
Congruence				
In science I am given a choice of assessment tasks				1.664
My assignments are about what I do in class				1.563
I have a say in how I will be assessed in science				1.554

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization. Rotation converged in 6 iterations.

Table 4: Perceptions of Pupils towards Classroom Assessment

SN	Statement	N	Mean	SD
	Transparency			
1	In science I am clear about the types of assessment being used	200	3.6350	1.2727
2	I am told in advance on what I am being assessed	200	3.0200	1.4387
3	I am clear about what my teacher wants in my assessment tasks	200	3.8900	1.1811
4	I am aware how my assessment will be marked	200	3.8000	1.3033
	Sub Mean/ SD		3.58625	1.2990
	Application			
5	I can show others that my learning has helped me to do things in my surroundings	200	4.6900	.6130
6	Assessment in science examines my ability to answer everyday questions	200	4.1100	1.0065
7	Assessment in science tests my ability to apply what I know to real- life problems	200	3.7550	1.2701
	Sub Mean/ SD		4.1850	0.9632
	Students' Capabilities			
8	I am given assessment tasks that suit my ability	200	4.6900	.61301
9	I remember all my assessment in science class tests	200	4.1300	.87575
10	My teacher has explained to me how each type of assessment is to be used	200	3.9150	.89542
	Sub Mean/ SD		4.2450	.7947
	Congruence with planned learning			
11	In science I am given a choice of assessment tasks	200	2.1400	1.3034
12	My assignments are about what I do in class	200	4.6050	.6332
13	I have a say in how I will be assessed in science	200	2.3200	1.3991
	Sub Mean /SD		3.0217	1.1119
	Overall Mean/ SD		3.7595	1.0422

As illustrated in Table 3, the result of the rotation solution indicates that the item loadings on the four factors are above 1. Component 1 contains four items, Component 2 contains three items, Component 3 contains three items and Component 4 contains three items. Transparency, application, students' capabilities and congruence with planned learning were identified as the main dimensions of students' perceptions towards class assessment.

The average mean score of the four factors indicating students' perceptions of classroom assessment ranged from 3.0217 to 4.2450, as shown in Table 4. The mean score for each factor varied. Transparency ranged from 3.0200 to 3.8900, application was from 3.7550 to 4.6900, students' capability was from 3.9150 to 4.6900, and congruence with planned learning ranged from 2.1400 to 4.6050. The majority of the mean scores are above the scale's midpoint of 2.5–3.49.

As indicated in Table 4, the pupils had a positive perception of the transparency of assessment (3.58625), application (4.1850), and students' capabilities (4.2450). However, the pupils had a neutral perception towards congruence with planned learning (3.0217). This indicated that the pupils are clear about what their teacher wants in their assessment tasks, and they are also told in advance what they will be assessed on. The pupils are capable of applying what they learned in class to real-life situations. Furthermore, they are also given assessment tasks that suit their abilities. Their neutral perception of congruence with planned learning suggests that the pupils might not have a say in how they will be assessed in science, and they are not usually given a choice of assessment tasks.

The findings support those of Koul et al. (2005) who investigated the relationship among students' perceptions of their assessment tasks, classroom learning environment, academic self-efficacy and attitude to science in years eight, nine, and ten of schooling. The study found that among the five scales of students' perceptions of their assessment tasks, the scales of students' capabilities, authenticity and transparency were positively associated. In contrast, the scale of student consultation and congruence with planned learning were neutral.

In addition, the study confirms that of Ahmad et al. (2020) on students' perceptions of classroom assessment that mean score for students' capabilities and transparency in assessment were high, which suggests that students are given assessment tasks that suit their ability and transparency exists in their assessment. However, the scale-item values for students' consultations on assessment were the lowest, meaning that students did not have a say in how they will be assessed in science.

Research Question 2: What are the differences in academic performance between public and private JHS pupils in integrated science?

This research question sought to establish the difference in academic performance in integrated science between public and private JHS pupils in the Sunyani municipality. The research question called for testing of the following null hypothesis: There is no significant difference in academic performance between public and private JHS pupils in Integrated Science.

To answer the research question, the mean and standard deviation of the variables were computed to determine the performance of pupils in Integrated Science. This was done on a 9-point scale as stipulated by the West African Examination Council (WAEC), 1 and 9 being the lowest and highest grades, respectively.

The corresponding range of marks for the scales is as follows: scale 1: marks range 80-100; scale 2: marks range 70-79; scale 3: marks range 60-69; scale 4: marks range 50-59; scale 5: marks range 40-49; scale 6: marks range 30-39; scale 7: marks range 20-29; scale 8: marks range 10-19; and scale 9: marks range 0-9.

One sample t-test was used to determine the differences in pupil performance based on school type. The results appear in Tables 5 and 6. The number of pupils sampled for the study was 200.

Table 5: Academic Performance of Pupils based on School Type

School type	N	Mean	SD	Std. Error Mean
Public	110	6.29636	7.46276	.71155
Private	90	7.94185	5.66800	.59746

Table 6: Difference in academic performance of pupils based on school type

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	120624.982	1	120624.982	297.180	.000
Within Groups	80367.813	198	405.898		
Total	**200992.795**	**199**			

Out of those, 110 were from public schools with the mean score of 6.29636, while 90 were from private schools with the mean score of 7.94185. This suggests that the pupils from private junior high schools performed better than the pupils from public junior high schools. To determine whether there is a significant difference in the performance of pupils based on school types, results appear in Table 6 where the p-value of .000 leads to rejection of the null hypothesis, maintaining that there is a significant difference in academic performance between public and private JHS pupils in Integrated Science, the private schools performing significantly higher than their public schools counterparts. The findings support those of Ankomah and Hope (2011) where students' achievement in public basic schools was significantly lower than in private schools. Asiedu (2002) made a similar comparative study between public and private schools in the provision of quality education in Ghana and established that private schools performed significantly better than public schools.

Conclusions and recommendation

Conclusions

The study concludes that pupils had a positive perception on transparency of assessment, application and their capabilities. However, the pupils had a neutral perception towards congruence with planned learning. The neutral perceptions on congruence with planned learning might be due to the teachers' failure to inform the pupils as to when, what and how they will be assessed in science and their failure to give the pupils a choice of assessment tasks. Private JHS pupils performed higher than public JHS pupils. The differences in pupils' performance based on school type may be associated with inadequate supervision at the public JHS.

Recommendations

To address the pupils' neutral perceptions of congruence with planned learning, it is recommended that the teachers from the sampled schools be open to the pupils and inform them of the mode of assessment to be taken. Since the private JHS pupils performed better than the public JHS pupils, it is recommended that the district and municipal education directors and circuit supervisors keep close eyes on the work of the public integrated science teachers in the municipality to bridge the gap between the performance of public and private junior high school pupils in integrated science.

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