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African Journal of Educational Research is committed to the publication of research articles in the area of educational theory and practice. It is accessible to researchers from any part of the world who have articles in the field of education and wish to share their thoughts and experience with their colleagues. It is published twice in a year– June and December.

Those wishing to submit papers for inclusion in any volume of the journal are expected to note the following guidelines carefully and allow them to guide the style and format of the papers they wish to send:

1. Papers must be original and may not have been previously submitted to any journal for publication.
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## Editorial Comments

Volume 10, Nos 1&2 (2006) of African Journal of Educational Research (AJER) contains twelve (12) well researched articles in the areas of language, science, social sciences and curriculum. All the articles have been carefully packaged in this edition to make it handy for readers. The members of the Editorial Board are happy to see this edition – an edition which for the first time in the history of the journal contains three articles from the USA and Botswana – being published now after Vol 9 which came out last in 2003. The reason for this long delay, though regrettable, is beyond the control of the Board.

Coffey's paper takes us through an exploration in psycholinguistics in her concern to shed more light on how children acquire language while Akinjobi embarks on a journey on rhythmic description of Nigerian English drawing examples from research and her experiment. In addition, Fakeye makes a case for the use of componential analysis in the teaching of vocabulary if students are to be helped to overcome their problems in developing appropriate vocabulary base.

Similarly, Emeke and Adegoke in their paper make a case for the use of objective test items as a way of improving students performance in physics. Though this is almost similar to Odili's paper, the difference however lies in the use of simplified language in test construction in biology. Thus, the arguments of Emeke, Adegoke and Odili that test items must be constructed and administered in ways that students will understand what they are expected to do came out clearly as the focus of their papers. This position is further strengthened by Odetoyinbo who advocates for proper implementation of performance assessment in science classroom by science teachers.

Ekundayo and Akomolafe examine the role of principals supervision on secondary school teachers effectiveness and integrity in the appointment of teachers in Ekiti state. It is clear from their papers that issues that border on school administration and appointment of teachers have to be handled in ways that the objectives of secondary school education are achieved. Silo makes a serious case for the inculcation of EE in the curricula of primary schools in Botswana as a way of promoting a more sustainable level of awareness in EE while Mosothwane examines children's understanding of environmental education in Botswana.

The paper by Adegbija examines the role and utilization of programmed instruction by teachers in her area of study and concluded that teachers need to become more aware of the instructional strategy and use it well to promote students performance. The last paper on HIV/AIDS education in primary school contains a strong case for its introduction in order to create awareness about it in the minds of students as a way of sustaining the campaign to eradicate it.

It is therefore the expectation of the editor that readers will find the volume a good companion in their continuous search for knowledge.

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## Determinant of Students' Cognitive Achievement in Senior Secondary School Physics: How Important is Test Response Mode?

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### Abstract

*In this paper, the authors, using the ex-post-facto procedure, examine the effect of test response mode (essay and objective tests) on students' scholastic achievement in physics at the senior secondary school level. The sample consisted of 475 SSII students (233 males and 242 females) drawn from seven randomly selected senior secondary schools in Ibadan South East Local Government Area of Oyo State. Data analysis was done using mean scores, and t-tests (paired and independent sample). Results showed that:*

- *Students performed better in objective tests than in essay tests.*
- *There was no significant difference in the performance of male and female students in the objective test.*
- *Male students performed better than female students in essay tests.*

*The authors offered suggestions on what physics teachers could do to help students achieve better results in physics essay tests and sustain their interest in physics, and more importantly improve their overall performance in physics.*

### Introduction

There are many different ways of measuring the extent to which a student has acquired certain

knowledge or mastered certain skills as a result of planned instruction. Some of these methods include the use of essay tests, objective tests (multiple-choice type), projects, rating scale, observation, and anecdotal reports, among others.

Out of these many ways of knowing the students academic abilities, essays and objective tests (Multiple-choice) stand out very clearly considering the rate at which these two techniques of assessments are being employed in all levels of the educational system around the world. Multiple choice items require testees to choose a correct response from about four or five options that are provided for each item. It can be used to measure many different kinds of content and levels of behaviour including such higher levels as application, analysis and evaluation. The test is objectively scorable and no human judgment is required.

However as Emeke (1999) noted, the items contained in the test are more sensitive to guessing than the items in which the testee must create his or her own answers rather than choosing an answer from the options provided. Essay items on the other hand requires the testee to create rather than choose a correct response from options provided. Testees' ability to select, relate and organise to create essentially new patterns and to use language to



express new patterns and express one's ideas are best appraised by essay items (Grolond 1968; Joff, 1986; Okpala, Onocha & Oyediji 1995). A major defect of an essay test is that there is not only a marked difference in absolute standards from judge to judge but also inconsistencies in the relative judgment of one paper in comparison with the other (Emeke & Adegoke, 2000).

As a result, many test constructors have advocated for the use of multiple-choice test items. In addition, some educationists believe that because of the fact that it is almost impossible to score essay tests objectively, its use should be discontinued in the grading system especially in examinations conducted by public examining bodies such as West African Examinations Council {WAEC} and National Examinations Council {NECO}. Anti-essayists maintained that one of the reasons for the continued mass failure of students in physics as well as the persistent low enrolment ratio in physics departments in institutions of higher learning is the undue emphasis placed on the use of essay tests to examine students' scholastic achievement in physics even in practical work.

Adegoke (2000) however opined that the educational system may run into problems if too much emphasis is placed on any one such method of assessment without taking cognizance of the fact that each assessment technique has its own distinctive characteristics. Furthermore according to Adegoke (2000), a teaching-learning system that relies entirely on the objective test for instance might suffer the side effect of students learning to scan materials for factual testable items, gobblets of details or technical terms, rather than looking for clues that might be demanded of them in essay tests.

In view of the foregoing, the study sought to determine the extent to which test response mode determines students' cognitive achievement in senior secondary school physics. Gender was introduced to serve as a moderator variable.

### **Research Questions**

The study provided answers to the following three research questions.

1. Is there any significant difference between the performance of the students in the physics essay tests and physics objective tests?
2. Is there any significant difference between the performance of male and female students in physics essay tests?
3. Is there any significant difference between the performance of male and female students in physics objective tests?

### **Methodology**

#### **School sample**

There are nineteen senior secondary schools in Ibadan South East Local Government Area of Oyo State out of which seven were purposively selected having satisfied the conditions spelt out by the investigators. Each of the selected schools:

- had at least sixty physics students in SSII;
- is co-educational;
- the laboratory facilities were comparable to the standard set by the West African Examinations Council; and had at least one trained physics teacher up to the level of 1st degree.

#### **Student sample**

These were all the students in SSII offering physics as one of their probable SSCE subjects and who were in the science classes.

In all, the sample consisted of 475 SSII physics students (233 males and 242 females). Their ages ranged from 15 to 18 years with a mean age of 16.94 years and a standard deviation of 0.62.

#### **Instrumentation**

Two research instruments were used in the data collection:

- Physics Achievement Test (PAT) Form A
- Physics Achievement Test (PAT) Form B

The PAT form A was a 4-option multiple choice test of 50 items. It had a reliability coefficient of 0.61

using KR 20 formula. The average of the difficulty and discrimination indices of the items were 0.53 and 0.56 respectively. It was scored dichotomously and the maximum score obtainable was 50.

The PAT form B consisted of two parts I and II. Part I consisted of 10 questions which required short answers composed in essay form; while part II consisted of 2 questions which required extended answers composed in essay form. The test was scored twice by two physics teachers using the analytic approach. The inter-rater reliability of 0.95 was obtained using Pearson's coefficient formula. The students were instructed to answer all questions. The maximum score obtainable in the test was 50.

The two forms of PAT were constructed by the researchers based on the topics prescribed for SSII physics syllabus (1st and 2nd terms) in senior secondary schools in Nigeria by the Federal Ministry of Education, Lagos (1996), Science Curriculum. An investigation of the Scheme and records of work of all schools that participated in this study showed that the topics from which (PAT) items were picked had been covered.

### Data Collection and Analysis

The instruments were administered directly to the students by one of the researchers with the assistance of the physics teachers in each of the participating schools. Data collection lasted seven days. In each of the participating schools, all the students in the science class took both Forms A and B to enable uniformity in all the schools.

Data analysis centered on the profile of students performance in PAT Forms A and B. The mean scores were compared on PAT Forms and on gender. It was done using simple descriptive (mean and standard deviation) and inferential statistics (paired sample for Research question 1 and independent sample for Research questions 2 and 3.

### Results

The results are hereby presented and discussed in the order of presentation of the research questions.

**Research Question 1:** Is there any significant difference between the performance of the students in physics essay test and physics objective test?

**Table 1a: Paired Sample Statistics**

Pair	Mean	N	SD	S.E.M
Essay	15.91	475	5.61	0.4715
Objectives	19.94	475	8.64	0.4976

**Table 1b: Paired Sample t-test**

Pair	Paired differences				t	df	Sig
	Mean	SD	S.E.M.	95% of confidence interval of			
Obj-Essay	4.03	6.05	0.3814	-0.2133 1.2595	14.9	474	0.004

The results as shown in Tables Ia & b indicate that students tend to perform significantly better in physics objective tests than in physics essay tests. The calculated t-value at  $P < 0.05$  of 14.2 is considerably greater than the t.tab of +1.96.

**Research question 2:** Is there any significant difference between the performance of male and female students in physics essay test?

**Table II: Comparison of the male and female students' mean scores in PAT form B (Essay test).**

Group	N	X	S.D	t.cal	Df	Sig.
Boys	233	17.91	3.81	14.11	474	Sig.
Girls	242	12.83	4.21			

t-critical = +1.96 at  $P < 0.05$ .

From Table II, there was a statistically significant difference in the performance of male and female students in the physics essay test. The calculated t-value is considerably greater than the critical t-value ( $t_{cal} = 14.11 > t_{cri} = +1.96$  at  $P < 0.05$ ). Male students performed better compared to their female counterparts in essay tests.

**Research question III:** Is there any significant difference between the performance of male and female students in physics objective test? Tab III shows the results of the analysis

**Table III: Comparison of the male and female students' mean score in (PAT) form A (objective test).**

Group	N	X	S.D	t.cal	Df	Sig.
Males	233	20.10	3.41	0.90	474	Not sig.
Female	242	19.80	4.10			

t critical = +1.96 at  $P < 0.05$

From Table III, there was no statistically significant difference in the performance of male and female students in the physics objective test. The calculated t-value is considerably greater than the critical t-value ( $t_{cal} = 0.90 < t_{cri} = +1.96$  at  $P < 0.05$ ).

### Discussion

The results of the data analysis of this study reveal that a significant difference existed among the students as a result of the different types of tests administered. Students tend to perform better in objective tests than in essay tests. An essay test by its nature has great potential for assessing the testee's ability to organise, integrate and synthesise his or her

knowledge. It also provides great scope for the exercise of the candidates' creativity. Therefore in essay tests, reasoning ability is very important. For a student to succeed in essay tests, he or she not only needs to recall the principles and concepts he or she has been taught, he or she also has to analyse and integrate these concepts and principles and find a logical way of synthesising them to get the correct answer.

The test in which the students have performed better from the findings of this study was PAT form B (objective test) which may not necessarily demand formal reasoning ability. Nzewi and Osioma (1994) while investigating students' ability for formal

reasoning and some other selected variables along with science achievement, found that a correlation of  $r = 0.40$  exists between formal reasoning and science achievement, the relationship though not so high but positive. This is an indication that students need a certain minimal level of reasoning ability before they can do well in physics achievement essay tests. It appears many students lack this reasoning ability and this cuts across gender. This observation agrees with the general comments of the Chief Examiner (physics) West African Examinations Council [ WAEC ] that:

- many candidates were only good in rote memorization, but very poor in application of knowledge;
- many candidates could not express themselves clearly in English language; and
- many candidates could not express their ideas logically and in clear terms. [ Chief Examiner's Report WAEC 2004).

The findings of this study have far-reaching implications for physics instruction, test construction, writing and curriculum development. Since good results in tests and examinations tend to create and sustain students' interest in physics, the authors hereby recommend that essay questions like objective questions should contain relatively easy and relatively difficult test items. Through this, the weak student will be able to attempt some items while the brilliant student will be able to demonstrate his or her depth of knowledge. More importantly effective teaching

should always be the aim.

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