



ANALYSIS OF ERRORS COMMITTED BY PHYSICS STUDENTS IN SECONDARY SCHOOLS IN ILORIN METROPOLIS, NIGERIA

Esther Ore Omosewo, Abdulrasaq Oladimeji Akanbi

Abstract. The study attempt to find out the types of error committed and influence of gender on the type of error committed by senior secondary school physics students in metropolis. Six (6) schools were purposively chosen for the study. One hundred and fifty five students' scripts were randomly sampled for the study. Joint Mock physics essay questions (JMPEQ) for SS3 physics students, and researchers prepared error identification and classification and index (REICI) were used as the instruments. The reliability coefficient of REICI scores was 0.78. Frequency counts, means percentages and chi-square were used to analyze the data collected. The findings of the study revealed that four types of errors were committed by students this include Operational errors, Defective Algorithms, Random errors and computational error. The total frequency of errors committed by male students was significantly higher than that of their female students. It was recommended that physics teachers should explore pedagogic techniques towards minimizing the occurrence of wrong operations, computational errors, defective algorithms, and random errors.

Keywords: Operational errors, Defective Algorithms, Random errors and computational error.

1. Introduction and Research Framework

It has been recognized that the path to national development is through technological development. There can however be no meaningful technology development without a very solid foundation in the sciences, especially physics, chemistry and biology. These subjects are very important to prospective scientists, engineers, science educators, e.t.c. This can improve the manpower requirement for the national developments in the areas mentioned above. Modern technology leans heavily on physics (Williams, 1990). It is the increasing understanding of physics, which led to the electrical power industry, radio, television, radar, and other means of electrical and electronics communication. This applies to electric lighting and heating too. In medicine today, many of the instruments for diagnosis and therapy are application of physics such as x-ray, radioisotopes, and electrocardiograph. Engineering Technology is responsible for space flight, rocketry, satellites communication systems, which are all application of physics. The development of modern supersonic of aircraft is an obvious application of the principle of physics. Despite the importance of these subjects to the development of a nation both male and female students performed poorly in physics. The achievement of students in science in Nigeria has remained consistently poor over the years (Eze 2003; Aprebo, 2003; Betiku 2003; Betiku 2001.) Some reasons have been attributed to be responsible for students under achievement in schools, these includes methods of studying, intelligence, gender, motivation, attitudes, science teachers and their attitudes, self-adequacy, influence of parents and misunderstood word (Abimbola, 2013; Akanbi, 2001; Balogun, 1999; Craker, 2006; Dieck, 1997; Mattern & Schau, 2002; Normah & Salleh, 2006; Onah & Ugwu, 2010).

Similarly, FME (2009) observed that low enrolment retention and transition at the basic education level; inadequate and obsolete infrastructure/equipment; inadequate number of competent teachers and weak leadership are some of the variables hampering teaching/learning of science. These factors could negatively affect the teaching/learning processes among students and hence could influence commission of errors.

Brown, 2004 differentiate between mistakes and errors which are technically two very different phenomena. Brown, (2004) also maintains that a mistake can be self-corrected, but an error cannot. Therefore, it could be corrected by the writer, if given the time to do so, or when they are slightly pointed out to the writer, whereas the error of a student, no matter how they are conspicuous could not be identified except when they are pointed out or made known to such student. An 'error' in this paper refers to misrepresentation of fact in the procedure of a given problem in physics. According to Brown (2004, p.216), "a mistake refers to a performance error in that it is a failure to utilize a known system correctly; while an error is a noticeable deviation from some institutionalized performance system". However, the present study is of the view that whether it is a mistake or an error, each one has to be corrected.

The West African Examinations Council (WAEC) physics examinations written by Senior Secondary School Students are designed and composed of two papers namely; practical Physics or simply (paper I), Multiple choice and Essay paper or simply (paper II) respectively. The importance of practical in Physics cannot be overemphasized; numerous scientific skills are developed like, observational skills and manipulative skills in the learners, Etherton (1977). Also, self-confidence, group work and social interaction are encouraged. The paper II tests the general Physics knowledge acquired by the students. The quality of their expressions in the theory part could contribute to the quality of the grade obtained i.e. where the number of errors committed is more it could lead to failure or poor performance (weak grades).

This present study attempts to identify areas of deficiency in students' presentation of answers to Physics question at SSCE. It attempts to identify the nature of error-types committed by gender and their frequencies. To this effect, factors responsible for the commission of errors in Sciences have been identified by different researchers. This include: poor teaching and didactic method of pedagogy (Soyinbo, 1991; Omosewo, 2009; Zakaria, Ibrahim & Maat, 2010); poor communication skills on the part of students (WAEC, 2005); non-conduct of practicals by Teachers and hence lack of practical skills in the students (Ogunsola-Bande & Lawal, 1996; Ajaja, 2002); and lack of technical know-how on improvisation (Njoku, 2004).

Similarly, lot of research efforts have been dissipated on the issue of gender and its relationship to performance in sciences which have generated controversies and this is yet unresolved. Some posited that male students perform better than female students, (Novak and Mosunda, 1991; Danmole, 1998; Oboh, 1998). Others argued that female students perform better than male students (Lawal 1995). Yet others contend that there is no significant difference between male and female students in achievement, (Bello, 1996; Nussbaum, 2000; Owolabi & Bamdele, 2000; Bichi, 2002; Etukudo, 2002; Igboke, 2004; Salman, 2004). If gender difference exists in achievements, there could be gender related differences in errors; hence, this study also looked at the effect of gender and its influence on commission of errors and the frequencies in order to buttress the existing claims.

Balogun (1999) and Akanbi (2001) in their different studies, looked at some candidates' examination script in their senior secondary school certificate examination (SSCE) and national examination council (NECO) and found out that student's failure in physics were not unconnected with errors made when answering physics question, among other factors. Error in physics are not simple the absence of correct answers, but the consequence of definite processes whose nature must be discovered.

2. Research design

Purpose of Study

The study attempt to identify and classify the type of errors committed by Senior Secondary School Physics Students and the influence of students' gender in the error types.

Research Questions

The following research questions were formulated:

1. What are the types of errors committed by students in secondary school physics?
2. What are the differences between errors committed by male and female students in physics?

Research Hypothesis

HO₁; There is no significant difference in the errors committed by male and female students in physics.

Sample and Sampling Technique

The sample for the study was physics students in senior secondary school in Ilorin metropolis. Scripts for the SS 3 in physics were grouped into two (2), based on gender. 150 scripts were randomly sampled.

Instruments

The instruments used for this study was a Joint Mock Physics Essay Questions (JMPEQ) and Researchers prepared Errors and Identification and Classification Index (REICI).

Table 1: Marking scheme used for selecting error type (Source: Akanbi, 2003)

Classification	Identification
Wrong Operational error	Operation different from the expected one
Computational error	Misrepresentation of several facts in the Procedure
Defective algorithm	when correct operation is applied but error in the procedure
Random error	when the response has no relationship with the problem

Instrument validation

JMPEQ was prepared by the appointed group of physics teachers and were subjected to face and content validity. The draft of REICI was given to a physics educator at the University of Ilorin as well as three experts in physics education in secondary school. The valutors adjudge the instrument adequately. 5 candidate's scripts were photocopied into three places and given to three experts in physics at college of education to score based on REICI. The test item was administered to twenty students from CSS College, Ilorin then subjected to Person Product Moment Correlation statistics. A reliability coefficient of 0.78 was obtained.

3. Research results

Results

The results of a study are displayed here.

Is there any difference between the frequencies of errors committed by male and female students in physics test?

Table 2: Analysis of errors committed by male and female students in physics test

Gender	No. of Students	Wrong Operational Errors		Computational Errors		Defective Algorithms		Random Errors		Total	
		Mean	%	Mean	%	Mean	%	Mean	%	Mean	%
Male	119	3.45	68.5	0.34	6.8	0.96	19.0	0.29	5.8	5.04	100
Female	36	3.89	82.9	0.25	5.3	0.36	7.7	0.19	4.1	4.69	100

The analysis of data in table 2 shows that the total mean errors by male students in physics test was higher than that of their female counterparts' male=5.04>X female=4.69).It must be pointed out that both male and female students committed four categories of errors. Both male and female students also recorded very high percentage of errors associated with wrong operation. However, the female students recorded higher errors in wrong operations than their male counterparts. The significance of

the frequencies of errors recorded by both male and female students in physics test was however tested in Hypothesis 1.

Hypothesis 1:

There is no significant difference in the frequencies of errors committed by male and female students in physics test

Table 3: Chi- Square Analysis of frequency of Errors Committed by Male and Female in Physics Test

O	E	O-E	(O-E)* 2	(O-E)*2	χ^2 Value	χ^2 Table	Decision
410	428.8	-18.8	353.4	0.82			
40	38.2	1.8	3.24	0.08			
114	99.0	15	225	2.27			
34	32.0	2	4	0.13	15.00	11.344	Hypothesis rejected
140	121.2	18.8	353.4	2.92			
9	10.8	-1.8	3.24	0.30			
13	28.0	-1.5	225	8.04			

The result in table 3 shows that the calculated chi-square (χ^2 T=11.34 α 0.05 probability level. This implies that the mean of errors committed by male students (χ^2 male= 5.04) is significantly higher than their female counterparts (χ^2 female=4.69) in physics test. Hypothesis 1 therefore rejected. This means that there is a significant difference in the error committed between male and female students in physics.

Discussion

The finding of the studies revealed that the major types of errors made by senior secondary school students in physics test are wrong operation, computational errors, defective algorithms and random errors. The findings of these are in conformity with that of Lawal (1995). Another finding of the study confirms that there is a significant difference in the frequency of error types identified among male and female students. Table 3 indicates that calculated χ^2 value of 15.00 is significant. This is in disagreement with the findings of Bello, (1996); Nussbaum, (2000); Owolabi & Bamdele, (2000); Bichi, (2002); Etukudo, (2002); Igboke, (2004); Salman, (2004), that there is no significant difference between male and female students in achievement.

4. Conclusions and recommendations

Conclusions

The result of finding of the study shows that the student in physics test committed four major types of error, these included: Operation error, Computational error, and Defective Algorithm and Random errors. It was also found that students committed more errors as a result of more computational while gender had statistical significant impact on the frequency of errors committed by the students in physics test.

Recommendations

From the findings, it is thought worthwhile to give the following recommendation; physics teachers should explore pedagogic technique towards minimizing the occurrence of wrong operation, computational errors, defective algorithm and random errors in their student's worksheets, assignment and tests. They should pay particular attention to identifying and correcting the wrong operation, which were commonly committed by students in the study. Also text book writers should provide simple and logical presentation of the content of physics textbooks in a way to reduce the incidence of various categories of errors identified in the study to the barest minimum.

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Authors

Prof. **Esther Ore OMOSEWO**, Department of Science Education, University of Ilorin, Ilorin, Nigeria. E-mail: oresewo2k2000@yahoo.co.uk

Dr. **Abdulrasaq Oladimeji AKANBI**, Department of Science Education, University of Ilorin, Ilorin, Nigeria. E-mail: physicsakanbi@yahoo.com