

# The Impact of Teacher Errors on Senior Students' Understanding of Concept Respiration, in Awka, Anambra State.

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**Abstract-** The study investigated how teachers' conceptual errors influenced secondary school students understanding of concept of respiration. The sample comprised 40 out of 72 biology teachers and 432 out of 2049 biology students drawn from 10 secondary schools in Awka Education zone of Anambra State. Two research questions and one null hypothesis guided the study. Date was collected using three instrument developed by the researchers.

The result of the study indicated that student's error and misconceptions of respiration were partly contributed by the teacher's and partly by students' lack of understanding of the conceptual areas of respiration themselves. The result was discussed and its implication to biology education was given.

## I. INTRODUCTION

Over the years, the problem of conceptual and cognition of the processes in the life sciences has been the focus of research (Mintzes, Tombridge, Arnandin and Wandersee 1991, Songer, 1993) in Mintzes & Novoak (1994). One of the major issues explored in these evolving research programme was students' alternative conceptions in natural phenomena, and that of understanding the conceptual change (Wandersee, Mintzes and Novoak, 1994).. It was discovered that students come to class with a lot of naïve and prefixed, ideas about certain natural phenomena and construct knowledge individually using these ideas which may be resistant to change and which may lead to error and misconception. An error is operationally taken to represent a mismatch of student's performance with the correct model.

An Error as defined by the chambers dictionary is a blunder or mistake. Some scholars defined error in relation to performance and knowledge. An error is an observable event or performance which in a way judged to be significant, differs from an expected ideal, (correct) model of performance.(Sanders & Crammer, 1992).

A number of Nigerian science educators has investigated secondary school students' error in mathematics (Isineyi, (1991), Akusoba, Okafor & Nwokolo,2003) discovered that secondary school students develop error in solving in-equalities. Iwovi,(1983) discovered that physics students develop error in certain physics concepts. Soyibo,(1985,1992) discovered pre-services teachers errors in certain biological diagrams. Some non-Nigerian science educators also worked on error and discovered that even teachers have error in the subject they teach.

In their work with South African pupils, Sandars and Crammer (1993), discovered that teachers may propagate erroneous ideas about respiration to their students through dishing out inaccurate information, as well as not using the available texts critically. It is pertinent to note recently that no work has been done on the influence of teachers' error on students understanding of a concept, such as respiration.

However these researchers choose to focus on respiration as respiration has been identified by many researchers as a difficult concept that is poorly understood by students'.(Soyibo, (1985) Igelstud, (1988). The WAEC chief examiner's report.(1995 – 2000) showed consistency in students' poor performance in respiration.

Respiration can be defined as a process by which food substances in the body are oxidized to release energy. It is an important biochemical process the understanding of which is critical to a meaningful appreciation of life at organism and community levels of biological organization.

Understanding the events in cellular respiration is critical to an understanding of several of the conceptual understanding of topics in the biology discipline, including energy flow in the Ecosystem and metabolic activities of multicellular organisms. When students have difficulty in understanding a particular science concept, they develop erroneous views, which may impede the understanding of related concepts in order areas of subject matter.

The identification of error is an important and obvious stage in remediation of students' misconceptions and error. Driver and Easley,(1978) in Okoli, (2003) opined that not until the reasons for students misconceptions are understood will progress be made in instructional terms. It is these possibilities that have informed the need to identify errors held by secondary school students about respiration and the possible influence of teachers in the development of these errors.

The purpose of this study therefore is to identify the conceptual errors about respiration held by biology students and their teachers, and to determine the extent or the influence which teachers' errors have on students in understanding of the concept respiration. The study addresses these 2 research questions and 1 Hypothesis.

## II. RESEARCH QUESTIONS

(1) To what extent do teachers hold the same conceptual errors as their students about the concept respiration in the assessment of SEIT?

(2) To what extent do errors exhibited by teachers in their classroom teaching correspond to conceptual errors about respiration exhibited by students in SEIT?

One null hypothesis tested at 0.05 level of significance guided the study.

Ho: There is no significant relationship between students' errors on response to SEIT and teacher's assessment error on students response to SEIT.

## III. METHOD

A descriptive survey design was adopted in which biology teachers and students drawn from Awka Education zone of Anambra State were used. Awka Education zone is made up of 4 Local Government Areas which include, Awka North and South, Njikoka and Anaocha Local Government Areas. This Education zone is located at Anambra Central Senatorial zone of Anambra State.

### Population and Sampling:

There are about 72 biology teachers and 2049 biology students in Awka Education zone of Anambra State (source: Anambra State Education Commission Awka zonal office). Through random sampling, 40 biology teachers were drawn from 72 teachers, while 432 biology students were drawn from 2049 students to constitute the sample.

The research instrument for this study were 3 types (i) students Error identification test (SEIT) (ii) Teachers indirect Assessment Technique TIAT (iii) Teachers Direct Assessment Checklist TIDAC

SEIT is a 20 item researcher made test for students drawn from 4 conceptual areas of respiration. Teacher Indirect Assessment Checklist is prepared from four conceptual areas of respiration to check teachers' knowledge of the conceptual areas during classroom instruction and assessment. For the

convenience of this study, respiration was categorized into 4 conceptual areas which includes (a) purpose of respiration (b) chemical nature of respiration (c) source of energy release (d) time of occurrence in all organisms

**The instrument was validated by experts in department of biology and measurement and evaluation of Nnamdi Azikiwe University Awka, and was administered as follows:**

(a) Students error identification test (SEIT). Copies of the 20 items test of yes or No in concepts of respiration were administered to the students to respond to, from the student's response, conceptual errors were determined.

(b) Teachers indirect Assessment Technique. Students' responses on SEIT were given to the teachers to mark by ticking each correct answer and making cross to any incorrect answer. The researcher latter assessed the teachers markings using the marking scheme to determine where correct answers were marked wrong or wrong answers were marked correct. The scores of the items were used to determine the extent the teachers had correct or erroneous conceptions of respiration.

(c) Teachers Direct Observation Checklist. Each of the 40 teachers were observed for two weeks. During the teaching, mistakes and errors on the concept of respiration were noted and recorded. At the end of the lesson, the researchers held discussions with the teachers to find out if the concepts held by the teachers was a mistake of the language or level of knowledge, from that the researchers noted common conceptual errors.

Data was analyzed on corresponding ratios by using frequencies to facilitate the answering of the research questions. Chi-square was used to test the hypothesis. Care was also taking in noting the errors of omission especially where some numbers were not scored it will be recorded as omission.

## IV. RESULTS AND FINDINGS

Results of the findings are presented in the tables below.

Research question 1: To what extent do biology teachers hold the same conceptual errors as their students about the concept respiration in the assessment of SEIT?

**Table 1: Frequencies of conceptual errors made by students in response to Student's Error Identification Test ( SEIT) and errors made by the teachers in the assessment of SEIT.**

|   | Categories of conceptual areas of respiration | Frequency of students' incorrect responses on SEIT | Frequency of Teachers' errors in the assessment of SEIT |
|---|---|--|---|
| 1 | Purpose of respiration                        | 1076   | 402   |
| 2 | Chemical nature of respiration                | 1129   | 605   |
| 3 | Source of energy release                      | 952  | 325   |
| 4 | Time of occurrence                            | 813  | 46  |
| 5 | Omissions                                     | 82   | 70  |
|   | <b>Total</b>                                  | <b>4052</b>  | <b>1448</b>   |

From the data presented in the above table, it was noted that the frequencies of conceptual errors were high for both the students and the teachers, except for the errors of omission. It was also noted that there were correspondence ratio in the errors

committed by teachers during the assessment of SEIT and those committed by students in response to SEIT.

The result as presented on the table indicated that the frequency of conceptual errors were highest for both the students and teachers on the chemical nature of respiration (1129 for

students, 605 for teachers), followed by purpose of respiration 1076 for students, 402 for teachers, source of energy release 952 for students, 325 for teachers and least in the time of occurrence 813 for students and 46 for teachers.

**Research question 2:** To what extent do errors exhibited by teachers in their classroom teaching correspond to conceptual errors about respiration exhibited by their students in SEIT.

**Table 11: Frequencies of conceptual errors by students in response to SEIT and those by teachers during classroom instructions.**

|   | Categories of conceptual areas of respiration | Frequency of students incorrect response on SEIT | Frequency of teacher's errors during classroom instruction |
|---|---|--|--|
| 1 | Purpose of respiration                        | 1076   | 35   |
| 2 | Chemical nature                               | 1129   | 50   |
| 3 | Sources of energy release                     | 952  | 28   |
| 4 | Time of occurrence                            | 813  | 13   |
| 5 | Omissions                                     | 82   | 28   |
|   | <b>Total</b>                                  | <b>4070</b>                                      | <b>154</b>   |

As can be seen from the table, the categories of conceptual errors committed by teachers and students showed that more errors existed on the chemical nature of respiration with the frequencies of 50 and 1129 respectively for the teachers and students. Some errors were also found on the purpose of respiration with frequencies of 35 for teachers and 1076 for students. Source of energy release had a frequency of 28 and 952 respectively for teachers and students while in the time of occurrence it had 13 and 813 indicating that least error occurred in this category.

The above data showed that erroneous ideals existed between both the teachers and the students in the 4 conceptual

areas of respiration. Though, student's frequencies of errors were much higher than that of their teachers, probably because of their number. However, there were similarities of errors committed by the teachers and students in the categories of conceptual areas of respiration during classroom instructions.

Testing hypothesis. This is tested at 0.05 level of significance

**Chi-square Table**

**Table 111. X<sup>2</sup> contingency table for test of relationship between the teachers assessment errors and students response on SEIT in the 4 conceptual areas of respiration.**

|                 | Purpose of respiration | Chemical nature of respiration | Source of energy release | Time of occurrence in all organisms | Omission      | Total |
|-----------------|------------------------|--------------------------------|--------------------------|-------------------------------------|---------------|-------|
|                 | Observed               | Observed                       | Observed                 | Observed                            | Observed      |       |
| Teachers errors | 402<br>(456.3)         | 605<br>(535.3)                 | 325<br>(397.3)           | 416<br>(381.1)                      | 70<br>(46.9)  | 1818  |
| Students errors | 1076<br>(102.6)        | 1129<br>(1198.6)               | 952<br>(889.6)           | 831<br>(861.9)                      | 82<br>(105.0) | 4070  |
| Total           | 1478                   | 1734                           | 1287                     | 1247                                | 152           | 5888  |

Calculate  $X^2 = 60.30$

Critical  $X^2$  at  $df=4 = 9.49$  at 0.05 level of significance.

*The chi-square result indicated that significant relationship occurred between teachers errors and students errors since the calculated result was 60.30 while critical was 9.49 on  $df=4$  at 0.05 level of significance.*

**V. DISCUSSION**

The data above showed that both students and teachers committed errors in different categories of conceptual areas of respiration. It is pertinent to note that the teachers' errors were mainly noticed during teachers' assessment of students Error Identification Test (SEIT) and during teachers' classroom

instruction. Surprisingly both teachers and students committed similar errors and in the higher frequencies on conceptual areas of respiration, these errors include, purpose of respiration, chemical nature of respiration, source of energy release and time of occurrence in both plants and animals.

However, the result of this study suggests that students might actually be taught incorrect ideas through the teachers method of assessment as the teachers marked some correct answers wrong and some incorrect answers right. In any case, this type of result is not expected as teachers are looked upon as masters in the class of whom the students repose confidence on. This finding agreed with what Onyeike (1975) in Okoli (2003) said, that the amount and quality of learning that takes place in

the schools depends on the competences of the teachers in schools.

On the other hand, teachers who committed these errors may have been misinformed on the concept of respiration and can consequently impart such wrong information to their students. Or it could be that respiration is viewed as an abstract concept that involves physical process that cannot be conceived in physical terms. In most cases it is usually difficult to impart such information to a novice. This is similar to what Ukpeteran, (1988) reported. He noted that it requires good teaching to make students detach themselves completely from errors that appear to be backed by common sense such as sun revolves round the earth or heavy bodies fall faster than light ones.

As a remedy to this type of error and misconception, Mintezes & Clain (2000) suggested the use of instructional strategies like concept map for reconstruction and stable alteration of conceptual frame work through negotiation of meaning between students and teachers.

## VI. CONCLUSION AND RECOMMENDATIONS

The finding of this study show that conceptual errors exist between students and their teachers. Student's errors were caused partly by the teachers' during the course of instructions and assessment. And also by students misconception which may have arisen most probably due to lack of understanding of both the technical terms and conceptual understanding. Other factors such as use of language, poor illustration and poor diagrams in textbooks can also lead to students Error.

The implication of this finding to science Education can not be over emphasized. This study helps in creating awareness on the errors which SS2 biology students and their teachers committed on the concept respiration. The teachers therefore are enjoined to find means for eliminating these errors so as to improve performance of students in Biology. It also implied that students are expected to master basic concepts and acquire adequate knowledge of the pre-requisites topics in the concept. This knowledge will help to reduce the rate with which errors are committed in biology and science in general.

It is recommended therefore that teachers should Endeavour to update their knowledge with students misconception on various biology topics and device a better method to teach such topics so as to eliminate errors. Curriculum planners should try to restructure senior secondary school biology curriculum topics to reflect pre-requisite topics such as what is respiration, types, respiratory structures and mechanism before including biochemical processes in respiration. More so teachers are urged to device a better method of assessment in which students' problems will be identified at the on set of the lesson then tries to remedy the problems with a better teaching strategy before continuing the lesson

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