

Cognitive Test Anxiety As Predictors Of Secondary School Students' Achievement In Biology In Ogidi Education Zone

ORAKWUE, Justina Ngozi

OKIGBO, Ebele Chinelo

Department of Science Education, Nnamdi Azikiwe University, Awka

Abstract: *The study investigated cognitive test anxiety as predictors of secondary school students' achievement in Biology. Three research questions and three hypotheses guided the study. Correlation design was adopted for the study. The population of the study was 4, 210 senior secondary year two (SS2) students offering Biology in Ogidi Education zone out of which 840 students were sampled using a multistage sampling procedure. The instrument for data collection was Cognitive Test Anxiety Scale (CTAS) validated by three experts. The reliability of the instruments was established using Cronbach Alpha to be 0.77. The data obtained were analyzed using simple linear regressions. The findings of the study revealed that 1.7% of the variance in Biology achievement was predicted by students' cognitive test anxiety. Also, achievement in Biology was significantly predicted by cognitive test anxiety. The study recommended that Biology teachers should ensure that test conditions are favourable to secondary school students to reduce cognitive test anxiety.*

Keyword: *cognitive-test anxiety, Biology, achievement, predictor*

I. INTRODUCTION

Biology is the most popular science subjects among secondary school arts and science students in Nigeria. Biology is the natural science that studies life and living organisms, including their physical structure, chemical processes, molecular interactions, physiological mechanisms, development and evolution (Ihekwoaba, Chinweuba-eze and Nduji, 2020). As a field of science, Biology helps one to understand the living world and the ways its many species (including humans) function, evolve, and interact. Advances in Medicine, Agriculture, Biotechnology, and many other areas of Biology have brought improvements in the quality of life. Biology, because of its importance is popular among secondary school students. A good number of students irrespective of the discipline (science or arts) strive to enroll for the subject. Despite the importance and the large enrolment for Biology in external examinations, students' achievement in the subject has always been greeted by appalling remarks such as 'not encouraging'. This is evident in the external examinations such as the West African Senior School Certificate Examination (WASSCE).

The West African Examination Council Chief Examiner's reports from 2007-2012 showed that students' achievement in Biology have not appreciated expectedly. According to the Chief Examiner, among students who sat for Biology from 2007-2012 with a population range of 1, 238, 163 to 1, 646, 150, only 33.37 to 35.66% passed at credit level. From 2013-2016, 51.73% passed at credit level despite the increasing population of students enrolled for the examination. Although there was an increment in the percentage number of students who passed at credit level from 2013-2016, all important popular subject such as Biology among both science and arts students deserve better and higher achievements. In addition, judging by students' raw mean score which is an index used by the Chief Examiner to compare students' yearly achievement, students' achievement in Biology in 2017 was better than their achievement in 2018. The raw mean score of overall students' achievement in 2017 was 31 while it was 30 in 2018 with a population of 1,087,884. The raw mean score of students in 2019 was 31 with a slight decline in population of students to 1, 086, 449. Also, the trend in students' enrolment showed slight decline from 2019 at which time Biology was no longer a compulsory subject. In 2020 and

2021 there was no notable change in students' achievement as compared to the previous year.

Researchers (Mbaegbu, 2020; Ezenwabachili and Okoli, 2021) have been concerned about identifying factors that influence students' academic achievement. The fluctuating achievement of students in Biology and decline in enrolment has been attributed to a lot of factors especially the teaching methods adopted by Biology teachers (Mbaegbu, 2020). A lot of studies (Irede and Okoli 2019; Onu, Anyaegbunam and Uzoigwe, 2020) on methods by which Biology could be taught to improve achievement have been conducted, yet, not much improvement has been recorded. The interest of researchers however, is no longer driven by the quest for high academic achievement but by the spate of fluctuating achievement and reduction in enrolment in science subjects like Biology.

Many studies have tried to examine the relationship between achievements in Biology and identified factors which could be environmental, psychological, teacher or students related, parental or social. Studies (Khatoon and Zinat, 2017; Ugwuanyi, Okeke and Terparse, 2020; Victor and Abdulwahid, 2018) have focused on specific psychological factors such as self-efficacy, cognitive test anxiety, academic resilience, emotional intelligence and students' motivation and have found that these factors influence students' achievement in various school subjects. However, the predictive power of these variables especially cognitive test anxiety on academic achievement in Biology is not well understood and this is of interest to the present researcher.

Cognitive test anxiety is a measure of test anxiety which focuses explicitly on cognitive dimensions of test anxiety (Cassady and Johnson, 2002). Shokrpour, Zareii, Zahedi and Rafatbakhsh (2011) defined test anxiety as a feeling of uneasiness or apprehension before, during, or after a test because of worry or fear. Test anxiety affects people of all ages who have to be evaluated, assessed, and graded on their abilities or achievements. High cognitive test anxiety is known among research to result in poor achievement but could result in otherwise positive achievement owing to its relationship to motivation. However, students' cognitive test anxiety may be influenced by gender resulting in varying academic achievements for male and female students with high and low cognitive test anxiety.

Owan and Bassey (2020) study showed that there was a significant interaction effect between gender and test anxiety on academic achievement, despite that test anxiety negatively affected achievement. Galle, Atiku and Bala (2020) reported a significant effect of male and female students' scores on test anxiety subscales and academic achievement scores. The understanding of how gender moderates the predictive power of cognitive test anxiety on achievement is not fully known. One plausible explanation according to the findings of Chukwu (2014) was that there was a significant difference in the mean test anxiety of male and female students with the male students having high test anxiety. Chukwu however noted that test anxiety positively predicted achievement. The contrasting notions that cognitive test anxiety whether positive or negative could predict achievement suggests that the moderating effect of gender could differ when cognitive test anxiety is facilitating or debilitating.

According to control-value theory of achievement emotions by Pekrun (2006), test anxiety results from an interaction of cognitive control and value appraisals regarding a specific achievement situation (example, an upcoming examination). While value appraisals refer to the value students subjectively attribute to achievement activities (example, learning for the exam) and their outcomes (example, passing the exam), control appraisals refer to students' assessment of their subjective control regarding these achievement activities and their respective outcomes (Crenguta and Stan, 2015). Cognitive test anxiety therefore may arise when students focus on a pending achievement situation of high value (example, final examination) while only feeling that they have not the ability that can warrant that achievement and may vary among male and female students.

A student with high cognitive test anxiety may suffer low motivation be irrespective of gender. This is because the nature of the cognitive test anxiety is debilitating at such times. On the other hand, students with high cognitive test anxiety may be motivated owing to the facilitating nature of their cognitive anxiety. These interactions may affect students' achievement including achievement in Biology negatively or positively and may further be moderated by the students' gender. There is need therefore, to establish empirically, how cognitive test anxiety predicts achievement in Biology as well as the moderating influence of gender in the prediction model.

OBJECTIVES OF THE STUDY

Specifically, the study sought to investigate:

- ✓ The predictive power of cognitive test anxiety on achievement of students in Biology.
- ✓ The predictive power of cognitive test anxiety on achievement of male students in Biology.
- ✓ The predictive power of cognitive test anxiety on achievement of female students in Biology.

RESEARCH QUESTIONS

- ✓ What is the predictive value of cognitive test anxiety scores on the achievement of secondary school students in Biology?
- ✓ What is the predictive value of cognitive test anxiety scores on the achievement of male secondary school students in Biology?
- ✓ What is the predictive value of cognitive test anxiety scores on the achievement of female secondary school students in Biology?

HYPOTHESES

- ✓ Cognitive test anxiety scores is not a significant predictor of the achievement scores of secondary school students in Biology.
- ✓ Cognitive test anxiety scores is not a significant predictor of the achievement scores of male secondary school students in Biology.
- ✓ Cognitive test anxiety scores is not a significant predictor of the achievement scores of female secondary school students in Biology.

II. METHOD

The design adopted for the study is correlation survey. The study was carried out in Ogidi Education Zone of Anambra state. The population of the study is 4,210 senior secondary year two (SS2) students offering Biology in the public secondary schools in Ogidi Education Zone. The sample for the study is 840 (approximately 20% of the population) SS2 students offering Biology in twenty-four secondary schools in Ogidi Education Zone. The sample for the study was obtained using multi-stage sampling procedure. The sampling procedure is as follows: first, 15 schools out of the 24 school was purposively chosen. The rationale was to ensure that the schools selected is made up of eleven coeducational schools, two single sex boys and two single sex girls schools. Secondly, using purposive sampling, 56 SS2 Biology students were selected from each of the 15 secondary schools to make up the 840 students for the sample. The choice of the students is because their results in Biology for three terms are completely and comprehensively recorded in the teachers' folder.

The instruments that was used for data collection was Cognitive Test Anxiety Scale (CTAS). Cognitive Test Anxiety Scale (CTAS) is a 27-item scale that was adapted from Cassady and Johnson (2002). CTAS is a four point scale ranging from 'Not at all typical of me' through 'Somewhat typical of me', 'Quite typical of me' to 'very typical of me'. The instrument was designed to assess cognitive indicators of test anxiety across the preparation and achievement phase of the learning test cycle. The students rated themselves on the given items using the scale of 1-4. To score the CTAS, the sum of the responses provided to each item was computed to create a total score. The major modification was the change in the manner by which the students respond to the instrument. Preliminary page was designed by the researcher to generate demographic information from the respondents which included age, sex and school. Biology Teachers' Folder is a diary booklet in which the Biology teachers record students' assessment scores for each term. The students' achievement score in Biology for three terms was obtained from the teachers' Folder and was recorded accordingly.

The instrument was validated by three experts. The reliability of instruments was established using Cronbach's Alpha. The choice of Cronbach's Alpha is because the instruments have multiple rating (no right or wrong answer). The instruments were administered to 50 Biology students in one coeducational school in Onitsha Education Zone that was not involved in the study. The scores generated were used to compute the reliability coefficients. The reliability coefficient obtained for CTAS was 0.77. The data for the study was collated for data analysis. Data relating to research questions was analyzed using regression R (Pearson correlation) and R-square (coefficient of determination) coefficients while the hypotheses were tested at 0.05 level of significance using simple linear regressions. The decision for the hypothesis is that where Pvalue is less than or equals 0.05 ($P \leq 0.05$), the null hypothesis is rejected whereas where Pvalue is greater than 0.05 ($P > 0.05$), the null hypothesis is not rejected.

III. RESULTS

RESEARCH QUESTION 1: What is the predictive value of cognitive test anxiety scores on the achievement of secondary school students in Biology?

Model	R	R ²	Adjusted R ²	Unstandardized coefficients (b)	Std. Error	Decision
Constant				85.081		
Cog. Tst. Anx.	.131 ^a	.017	.016	-.174	12.873	Low positive relationship

a. Predictors: (Constant), Cognitive test anxiety

Table 1: Prediction of Students' achievement in Biology by Cognitive Test Anxiety

Table 1 shows a low positive relationship ($R = 0.131$) exists between students' cognitive test anxiety and their achievement in Biology. The R-Square value of 0.017 indicates that 1.7% of the variance in Biology scores is predicted by cognitive test anxiety.

RESEARCH QUESTION 2: What is the predictive value of cognitive test anxiety scores on the achievement of male secondary school students in Biology?

Model	R	R ²	Adjusted R ²	Unstandardized coefficients (b)	Std. Error	Decision
Constant				71.402		
Male Cog. Tst. Anx.	.012 ^a	.001	.003	-.016	13.528	Low positive relationship

a. Predictors: (Constant), Male Cognitive test anxiety

Table 2: Prediction of Male Students' achievement in Biology by their Cognitive Test Anxiety

Table 2 shows a low positive relationship ($R = 0.12$) exists between male students' cognitive test anxiety and their achievement in Biology. The R-Square value of 0.01 indicates that 1.0% of the variance in Biology scores of male students is predicted by cognitive test anxiety.

RESEARCH QUESTION 3: What is the predictive value of cognitive test anxiety scores on the achievement of female secondary school students in Biology?

Model	R	R ²	Adjusted R ²	Unstandardized coefficients (b)	Std. Error	Decision
Constant				97.051		
Fem. Cog. Tst. Anx.	.236 ^a	.056	.054	-.311	12.226	Low positive relationship

a. Predictors: (Constant), Female Cognitive test anxiety

Table 3: Prediction of Female Students' achievement in Biology by their Cognitive Test Anxiety

Table 3 shows a low positive relationship ($R = 0.236$) exists between female students' cognitive test anxiety and their achievement in Biology. The R-Square value of 0.056 indicates that 5.6% of the variance in Biology scores of female students is predicted by their cognitive test anxiety.

HYPOTHESIS 1: Cognitive test anxiety scores is not a significant predictor of the achievement scores of secondary school students in Biology.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2431.560	1	2431.560	14.673	.000 ^b
1 Residual	138873.744	838	165.720		
Total	141305.304	839			

a. Dependent Variable: Biology Achievement

b. Predictors: (Constant), Cognitive Test Anxiety

Table 4: ANOVA on Significance of Prediction of Achievement in Biology by Students' Cognitive test Anxiety

Table 4 shows that cognitive test anxiety is a significant predictor of achievement scores in Biology F (1, 839) = 14.673, P (0.000) < 0.05. The null hypothesis was therefore rejected implying that cognitive test anxiety scores is a significant predictor of the achievement scores of secondary school students in Biology.

Since cognitive test anxiety is a significant predictor of achievement scores in Biology, the regression model (Y= a + bX) for the prediction of achievement score in Biology as derived from Table 1, where constant = 85.081 and b value = -0.174 is:

$$BP = 85.081 - 0.174(CTA)$$

Where, BP = Biology Achievement and CTA = Cognitive Test Anxiety

HYPOTHESIS 2: Cognitive test anxiety scores is not a significant predictor of the achievement scores of male secondary school students in Biology.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	9.546	1	9.546	.052	.819 ^b
1 Residual	64962.442	355	182.993		
Total	64971.989	356			

a. Dependent Variable: Male Biology Achievement

b. Predictors: (Constant), Male Cognitive Test Anxiety

Table 5: ANOVA on Significance of Prediction of Male Students' Achievement in Biology by their Cognitive test Anxiety

Table 5 shows that male students' cognitive test anxiety is not a significant predictor of their achievement scores in Biology F (1, 355) = 0.052, P (0.819) > 0.05. The null hypothesis was therefore not rejected implying that cognitive test anxiety scores is not a significant predictor of the achievement scores of male secondary school students in Biology.

HYPOTHESIS 3: Cognitive test anxiety scores is not a significant predictor of the achievement scores of female secondary school students in Biology.

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	4254.091	1	4254.091	28.459	.000 ^b
1 Residual	71900.808	481	149.482		
Total	76154.899	482			

a. Dependent Variable: Female Biology Achievement

b. Predictors: (Constant), Female Cognitive Test Anxiety

Table 6: ANOVA on Significance of Prediction of Female Students' Achievement in Biology by their Cognitive test Anxiety

Table 6 shows that female cognitive test anxiety is a significant predictor of their achievement scores in Biology F (1, 481) = 28.459, P (0.000) < 0.05. The null hypothesis was therefore rejected implying that cognitive test anxiety scores is not a significant predictor of the achievement scores of female secondary school students in Biology.

Since female students' cognitive test anxiety is a significant predictor of their achievement scores in Biology, the regression model (Y= a + bX) for the prediction of female students' achievement score in Biology as derived from Table 3, where constant = 97.051 and b value = -0.311 is:

$$FBA = 97.051 - 0.311(FCTA)$$

Where, FBP = Female Biology Achievement and FCTA = Female Cognitive Test Anxiety

IV. DISCUSSION

The study showed that cognitive test anxiety significantly predicted students' achievement in Biology. Cognitive test anxiety is known to be caused by a lot of factors among which late preparation of test and examinations is prominent. Students often time are overloaded with study materials and some even stay for some more lessons after school. When they get home, they are exhausted and barely have time to study what has been taught for the day. During weekend, couples of assignments are given to students to engage them. This circle continues until a test within which time the student struggle to study the materials and have personal and proper conceptualization of what has been taught. The study of the many materials within such time frame stirs some perception of the test as a threat, as students begin to fear that they might fail.

The fear of failure and anxiety towards the test further creates in the students cognitive overload as there are too many materials to study with a short time frame and especially where the test conditions are not favourable to the child. The cognitive overload further creates worry and students begin to spend time worrying over what has been studied and what more materials is left to be studied. As the worry heightens, the students begin to suffer cognitive interference, and the rate of assimilation of the learning material decreases sharply. The end result normally brings the student to a condition of forgetfulness and going blank in the examination or test hall.

The finding of the study is in line with the findings of Melvina (2017) cognitive test anxiety significantly predicted academic achievement. The findings of Eman, Hind, Rufa, Nadiyah and Brouj (2016)) lends credence to the findings of the present study when it reported statistically significant negative relationship between test anxiety scores and undergraduate nursing students' academic achievement. The findings of the study however, contradict the findings of Ihekwoaba, Chinweuba-Eze and Nduji (2020) that variation in students' achievement in Biology that can be attributed to their test anxiety is not significant. The findings of the study also contravened the findings of Dami, James and Gogwim (2019) that no significant relationship existed between cognitive test anxiety and achievement.

The findings of the study showed that while the cognitive test anxiety of female students significantly predicted their achievement in Biology, it did not significantly predict that of the male students. This could be attributed to the fact that being more emotional, female students cognitive test anxiety could be magnified given the gender stereotyping common in science class. The findings of the study support the findings of Iroegbu (2013) that the subjects with low anxiety performed better than those with high anxiety and that there was an interaction effect of anxiety and gender on students' achievement. The finding of the study is in line with the findings of Chukwu (2014) that there was a moderate positive relationship between test anxiety and academic achievement

of students in geometry, there was a significant difference in the mean test anxiety of male and female students with the male students having high test anxiety. The findings of the study contradict the finding of Afolayan, Bitrus, Olayinka, Adeyanju and Agama (2013) that there was no statistical difference between gender of students in their academic achievement of students predicted by test anxiety.

V. CONCLUSION

Cognitive test anxiety predicted secondary school students' achievement in Biology. It can be concluded from the findings of the study that cognitive test anxiety play significant roles in students' achievement in Biology.

VI. RECOMMENDATIONS

Based on the findings of the study and the conclusion, the following recommendations are made:

- ✓ Biology teachers should ensure that test conditions are favourable to secondary school students to reduce cognitive test anxiety.
- ✓ Biology teachers should adopt continuous assessment techniques and add up students' achievement for summative evaluation. This is to reduce the bulk of materials that students may have to study when test and examinations are overloaded and incite cognitive test anxiety.

REFERENCES

- [1] Afolayan, J. A., Bitrus, D., Olayinka, O., Adeyanju, B. A. & Agama J. A. (2013). Relationship between anxiety and academic performance of nursing students, Niger Delta University, Bayelsa State, Nigeria. *Advances in Applied Science Research*, 4(5), 25-33.
- [2] Cassady, J. C. & Johnson, R. E. (2002). Cognitive test anxiety and academic achievement. *Contemporary Educational Psychology*, 27(2), 270-295. <http://doi.org/10.1006/ceps.2001.1094>
- [3] Chukwu, L.O. (2014). Relationship between test anxiety, academic achievement and interest of senior secondary school students in geometry in Enugu state. Unpublished thesis submitted to the Faculty of Education, University of Nigeria, Nsukka.
- [4] Chukwu, L.O. (2014). Relationship between test anxiety, academic achievement and interest of senior secondary school students in geometry in Enugu state. Unpublished thesis submitted to the Faculty of Education, University of Nigeria, Nsukka.
- [5] Crenguta, O. & Stan, A. (2015). Test anxiety and achievement goal orientation of students at Romanian University. *Precedia Social and Behavioural Sciences*, 180, 1673-1679.
- [6] Dami, B.E. & James, C.A. & Gogwim. P.C. (2019). Test anxiety as predictor of academic performance in biological science examination among secondary school students. *Clinical Research in Psychology*, 2(1), 1-6.
- [7] Eman, D., Hind, A.G., Rufa, M., Nadiyah, A., & Brouj, A. (2016). Relationship between test anxiety and academic achievement among undergraduate nursing students. *Journal of Education and Practical*, 7(2), 57-65.
- [8] Ezenwabachili, C.G. & Okoli, J.N. (2021). Effect of flip classroom and think-pair-share instructional strategies on students' retention in Biology in Enugu education zone. *International Journal of Education and Evaluation*, 7(3), 70-79.
- [9] Galle, S.A., Atiku, C.S. & Bala, M.A. (2020). Relationship between tests anxiety and students' academic achievement in educational measurement and evaluation in Usmanu-Danfodiyo University Sokoto State, Nigeria. *World Journal of Innovative Research*, 9(5), 71-78.
- [10] Ihekwoaba, C.C., Chinweuba-eze, V.O. & Nduji, C.C. (2020). Test anxiety and self-concept as a predictor of Biology students' academic achievement. *IOSR Journal of Research and Method in Education*, 10(3), 47-55.
- [11] Ihekwoaba, C.C., Chinweuba-eze, V.O. & Nduji, C.C. (2020). Test anxiety and self-concept as a predictor of biology students' academic achievement. *IOSR Journal of Research and Method in Education*, 10(3), 47-55.
- [12] Irede, E.A. & Okoli, J.N. (2019). Teachers' use of science writing heuristics in Biology instruction and its effect on students' acquisition of science process skills. *IOSR Journal of Research and Method in education (IOSR-JRME)*, 9(6), 17-26.
- [13] Iroegbu, M.N. (2013). Effect of test anxiety, gender and perceived self-concept on academic performance of Nigerian students. *International Journal of Psychology and Counselling*, 5(7), 143-146.
- [14] Khatoon, V. & Zinat, A.P. (2017). Comparing the math anxiety of secondary school female students in groups. *International Journal of Environmental and Science Education*, 12(4), 755-761.
- [15] Mbaegbu, C.S. (2020). Improving students' retention of Biology concepts in Onitsha education zone: effect of sequential usage of three teaching method. *International Journal of Innovative Research and Advanced Studies*, 7(8), 119-125.
- [16] Melvina, N.A. (2017). Cognitive test anxiety as predictor of academic achievement among secondary school students in Makurdi Metropolis, Benue State. *International Journal of Scientific Research in Education (IJSRE)*, 10(4), 362-372.
- [17] Onu, W., Anyaegbunam, N. & Uzoigwe, A. (2020). Improving Biology students' interest and achievement through collaborative instructional strategy. *Journal of Education, Society and Behavioural Science*, 33(2), 9-20.
- [18] Owan, V.J. & Bassey, A.B. (2020). Interactive effect of gender, test anxiety, and test items sequencing on academic achievement of SS3 students in mathematics in Calabar Education zone, Cross River state, Nigeria. *American Journal of Creative Education*, 3(1), 21-31.
- [19] Pekrun, R. (2006). The control-value theory of achievement emotion: Assumptions, corollaries, and

- implications for educational research and practice. *Educational Research and Practice*, 18: 315-341.
- [20] Shokrpour, N., Zareii, E., Zahedi, S. & Rafatbakhsh, M. (2011). The impact of cognitive and meta-cognitive strategies on test anxiety and students' educational achievement. *European Journal of Social Science*, 21, 177 – 188.
- [21] Ugwuanyi, C.S., Okeke, C.I.O. & Terpase, A.A. (2020). Motivation and self-efficacy as predictors of learners' academic achievement. *Journal of Social Anthropology*, 11(3-4), 215-222.
- [22] Victor, M. & Abdulwahid, U. (2018). Mediating influence of academic self-efficacy nexus between cognitive engagement and learning outcome of secondary school students. *Asian Journal of Education and Social Studies (AJESS)*, 2(1), 1-8.

IJIRAS