

Test Anxiety as a Predictor of Upper Basic Education Students' Academic Achievement in Basic Science in Anambra State

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ABSTRACT

The study investigated test anxiety as a predictor of upper basic education students' academic achievement in basic science in Anambra state. Two research questions guided the study and two null hypotheses were tested at 0.05 level of significance. The design adopted for the study was predictive correlation design. The population of the study was 19,172 senior upper basic two students offering basic science out of which 2000 students drawn using random and purposive sampling techniques. The instrument for data collection was Test Anxiety Inventory (TAI) validated by three experts and reliability 0.74 established using Cronbach Alpha. The students' achievement scores in Basic science were obtained from the teachers' score folder. The data obtained were analyzed using simple and multiple linear regressions. The findings of the study revealed among others that students' test anxiety predicted 0.6 percent of the variance in their Basic science scores decreasing it by 0.132 with every unit rise. Also, was found to be a significant predictor of upper basic students' academic achievement score in basic science. It was recommended that continuous evaluation that may not be used in students' assessment may be conduction time after time to acquaint students with test situations and to train them to manage test anxiety.

KEYWORD: Test-anxiety, basic-science, academic, achievement, Anambra

INTRODUCTION

Basic science came as a concept in science teaching in Nigeria to replace integrated science, owing to the fact that the scientific, vocational and technological aspects of education were not effectively implemented in the school system. It was a basic training in scientific skills required for human survival, sustainable development and societal transformation (Nwoko, 2015). It is defined as the scientific disciplines of mathematics, physics, chemistry, and biology combined. The upper Basic science lessons cover a broad scope of topics including ecology, the biosphere, land, forest, soil, water, energy and resources, societies and policies. Some of the goals of the subject includes: understanding how systems in the natural world are interconnected; examining the natural cycles of energy flow and evaluating how human interaction affects these cycles, defending the best choices to protect the environment with changing trends in human population; interpreting evidence and learning

to report in environmental conditions and hazards. Since Basic science formally known as integrated science, was introduced into the syllabus in 1970 with proper study, so many problems like incompetence of the teachers, lack of teaching materials and improper teaching methods have continued to evolve leading to non-learning interest by students and test anxiety during tests (Ezugwu, Nwani, Agbo and Mbonu-Adigwe, 2019).

Anxiety is an intense, excessive and persistent worry and fear about everyday situations which results in feeling uneasiness. Anxiety relating any test situation is known as test anxiety and can also be labeled as anticipatory anxiety, situational anxiety or evaluation anxiety. Test anxiety is a combination of physical symptoms and emotional reactions that interfere with students' ability to perform well on tests (Ejelue and Osuafor, 2021). Ejelue and Osuafor asserted that text anxiety measures borders on students' worry, emotionality, interference and lack

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of confidence. Worry assesses disruptive concerns about individual performance and the consequences of failure, emotionality assesses emotional and physical tension, interference assesses distraction from the task by irrelevant thoughts, and lack of confidence measures low confidence to master academic challenges (Akanazu and Okoli, 2019).

Test anxiety might look different from student to student with positive anxiety levels being positively associated with academic performance, whereas negative anxiety levels are negatively associated with academic performance (Ilo and Unachukwu, 2020). Test anxiety does not just affect students during their test; test anxiety can also affect students as they prepare for the examinations. This can cause poor understanding and association of content, which inhibit the student's ability to recall information. It was found that a significant negative relationship exists between test anxiety scores and students' academic achievement scores. Study by Spielberg and Vagg (2015) showed that the cognitive factor (worry) contributes more in test anxiety than the affective factors (emotional). Ejelue and Osuafor (2021) however found that the order of negative effects of test anxiety on academic achievement is lack of self-efficacy followed by interference, worry and then emotionality.

The students' ability to study Basic science is often by the test anxiety associated with learning the material and all these may predict students' academic achievement. However, the predictive power of test anxiety on academic achievement in Basic science specifically is not widely understood or researched. The lack of in-depth knowledge and consistent findings on the predictive powers of the variables on academic achievement in Basic science is lacking in literature especially for upper basic education students in Anambra state and therefore instigates the need for further investigation.

Purpose of the Study

The purpose of the study is to investigate test anxiety as a predictor of upper basic education students' academic achievement in Basic science in Anambra state. The study specifically sought to investigate the;

1. Extent to which test anxiety predicts upper basic education students' academic achievement in Basic science;
2. Relative contribution of the dimensions of test anxiety (worry, emotionality, interference and lack of confidence) to the prediction of upper basic education students' academic achievement scores in Basic science.

Research Questions

The following research questions guided the study:

1. To what extent does test anxiety predict upper basic education students' academic achievement in Basic science?
2. What are the relative contributions of the dimensions of test anxiety (worry, emotionality, interference and lack of confidence) to the prediction of upper basic 8 (eight) students' academic achievement scores in Basic science?

Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

1. Test anxiety is not a significant predictor of upper basic education students' academic achievement scores in Basic science.
2. The relative contributions of the dimensions of test anxiety (worry, emotionality, interference and lack of confidence) to the prediction of upper basic education students' education achievement scores in Basic science is not significant.

Method

The design adopted for the predictive correlation design. Correlational studies according Nworgu (2015) are those studies that establish relationships that exist between two or more variables of interest to a researcher or group of researchers (Nworgu, 2015). Such studies on a general note indicate the direction and magnitude of the relationship between the variables. However, Nworgu further noted that in such studies, it is more appropriate to employ a special group of statistics known as correlation coefficients or regression analysis which are used to determine: the coefficient of determination, predictive powers, bivariate and multiple correlations and for test significance of predictive powers. The assertion by Nworgu highlights the point that all predictive studies are correlational studies. Correlation design was therefore adopted as the researcher intends to determine the predictive correlation between the predictor variables and predicted variable using regression analysis.

The study was carried out secondary schools in Anambra state, Nigeria. The state lies between latitude 5° 42' N and 6° 47' N and longitude 6° 37' E and 7° 23' E, being made up of 127 communities divided into 21 Local Government Areas. According to the National Bureau of statistics (2022), Anambra State in the Federal Republic of Nigeria is the most densely populated state in the southeastern part of the country. The State is bounded in the West by River Niger and Delta State, in the North by Kogi State and a part of Enugu State; in the East by Imo State and another part of Enugu State, and in the South by Imo

State. The state has its capital at Awka. Anambra state has six education zones namely; Aguata, Awka, Nnewi, Onitsha, Ogidi and Otuocho with 258 public secondary schools.

The population of the study comprises 19, 172 upper basic two (Upper Basic 2) Basic science students in the six education zones in Anambra state. The sample size for the study was 2,000 upper basic two basic science students. The sample was obtained using a multi-staged sampling procedure. The first stage involved the selection of four education zones in Anambra state at random (balloting without replacement). At the second stage, the researcher selected ten upper basic education schools at random from each of the four education zones obtained at the first stage, giving a total of forty schools. At the third stage, a minimum of 30 upper basic two students were selected purposively from each school. The rationale behind their selected would be because their scores in Basic science for the past three terms were readily available at the time of the data collection and because they are available also to respond to the instruments.

Three instruments used for data collection was Test Anxiety Inventory (TAI). Test Anxiety Inventory (TAI) was adapted from Frances, Diana, Tobias, Sonja and William (2015). TAI was designed on four subscales measuring worry, emotionality, interference and lack of confidence. Its measure of students' performance and the effects of failure are evaluated through the dimensions of worry, emotionality, interference, and lack of confidence. Worry assesses physical and emotional tension, interference evaluates thoughts that divert attention from the task at hand, and lack of confidence evaluates low confidence in one's ability to succeed academically. There were 20 total items in the survey, and 5 of them measured worry, 5 emotionality, 5 interference, and 5 lack of confidence. TAI is designed on a four-point scale ranging from 1, "almost never" through 2, 'never', 3, 'always' to 4 "almost always". The scores of the students in Basic science were collected using a profoma. The students' scores in Basic science for two most recent terms were collected and the mean was computed and used as the students' academic achievement.

The title, instrument, purpose of the study, research questions, hypotheses and scope of study were given to two lecturers from Department of Science Education and Department of Educational Foundations Nnamdi Azikiwe University, Awka and one other from Federal College of Education (Technical), Umunze. The validators were asked to scrutinize the instrument in terms of clarity of

language, sentence structure and items relatedness to the construct being measured and appropriateness for the level of students under study. They were requested to write 'R', 'M' and 'D' against any items they needed them to Retain, Modify and Delete respectively, after which the corrections, recommendations and suggestions given by the validators were effected in the instruments.

The reliability of TAI was established using Cronbach Alpha as the instruments were polytomously scored. The instruments were administered once to 40 students in Ezenifite, who were not part of the study and applied the Cronbach Alpha formula to the generated score which yielded a coefficient of internal consistency of 0.74. The instruments was administered with the aid of four research assistants who received a brief instruction and training on how to administer the instruments. The research assistants worked closely with the Basic science teachers of the schools chosen for the study. They first obtained permission from the appropriate authority. They then proceeded to the Basic science teachers from whom they obtained the scores of students in Basic science for the last two terms. The scores were arranged according to the orderly sequence of the serial arrangement in the diary. The TAI was administered via a google form using a hyper link pasted on an internet enabled android tablet. The research assistant concerted with the Basic science teacher invited students one by one to respond to the questionnaire that was opened online by clicking on the hyperlink. This is to ensure that sample mortality is eliminated as students were able to submit their responses when any items are omitted. Again, their response patten and the aggregate of scores obtained from the negative and positive items were sent automatically to the e-mail address designated by the researcher as a collection point for data generated from the study. The data from the e-mail and the academic achievement scores collected by the research assistants were organized for data analysis.

Data generated from the study were analysed using simple linear and multiple regressions. The r-value was used to determine the magnitude and direction of relationship while the r-square value indicated the variance in Basic science academic achievement that is caused by the predictor variables. The prediction powers and relative contribution was determined using the unstandardized beta coefficients. The significance of the prediction powers of the variables was tested using Analysis of Variance (ANOVA) whereas the significant of the predictive powers of the dimensions of each predictor variable was tested

using the t-values and P-values. The interpretation of the correlation coefficient was according Nworgu (2015) who provided a three-way guide for interpreting correlation coefficient values when a large number of pairs of scores have been correlated. They are as follows: $r = \pm .80$ and below, low relationship; $r = \pm .30$ to below ± 0.80 , moderate

relationship and $r = \mp .80$ and above, high relationship. All null hypotheses were tested at 0.05 level of significance. The criteria for rejecting or not rejecting any null hypothesis was that whenever Pvalue is less than or equals 0.05 ($P \leq 0.05$) the null hypothesis was rejected and was accepted whenever Pvalue is greater than 0.05 ($P > 0.05$).

Results

Research Question 1: To what extent does test anxiety predict upper basic education students' academic achievement score in Basic science?

Table 1: Prediction of Students' Achievement score in Basic Science by Test Anxiety

| Model | R | R ² | Adjusted R ² | Unstandardized coefficients (b) | Std. Error |
|--------------|--------------------|----------------|-------------------------|---------------------------------|------------|
| Constant | -.080 ^a | .006 | .006 | 81.530 | 14.600 |
| Test Anxiety | | | | -0.132 | |

a. Predictors: (Constant), Test Anxiety

Table 1 shows that a negative correlation ($R = -0.080$) exists between students' test anxiety and their achievement score in Basic Science. The R-Square value of 0.006 indicates that 0.6percent of the variance in Basic Science scores is predicted by test anxiety. The unstandardized coefficient β of -0.132 shows that a unit rise in test anxiety decreased academic achievement score in Basic science by -0.132.

Research Question 2: What are the relative contributions of the dimensions of test anxiety (worry, emotionality, interference and lack of confidence) to the prediction of upper basic 8 (eight) students' academic achievement scores in Basic science?

Table 2: Contributions of the Dimensions of Test Anxiety in the Prediction of Achievement scores in Basic Science

| Model | Unstandardized Coefficients | | Standardized Coefficients | t | Pvalue | |
|------------|-----------------------------|------------|---------------------------|--------|--------|------|
| | β | Std. Error | β | | | |
| (Constant) | 69.619 | 1.875 | | 37.134 | .000 | |
| 1 | Worry | .121 | .113 | .026 | 1.067 | .026 |
| | Emotionality | -.062 | .110 | -.015 | -.568 | .070 |
| | Interference | .175 | .111 | .039 | 1.580 | .014 |
| | Lack of Confidence | -.162 | .116 | -.037 | -1.396 | .013 |

a. Dependent Variable: Basic Science Achievement score

Table 2 shows the standardized beta coefficient which indicates predictive correlation between variables. The unstandardized beta coefficient shows the predictive value of each dimension of test anxiety which indicates their relative contribution to achievement score in Basic Science. The table shows that worry has a positive predictive correlation ($R = 0.126$) with students' achievement score in Basic Science, emotionality has a negative predictive correlation ($R = -0.015$) with achievement score in Basic science, while interference has a negative predictive correlation ($R = -0.175$) with achievement score in Basic science, and lack of confidence has a negative predictive correlation ($R = -0.162$) with achievement score in Basic science. Table 2 also shows that, with a unit increase in a students' worry over a test, achievement score in Basic science increases by 0.121. However, when emotionality increases by a unit, achievement score in Basic science decreases by 0.062, interference decreases achievement score in Basic science by 0.175 when a students' cognitive interference by a unit, and as the students' lack of confidence increases by a unit rise, achievement score in Basic science is further decreased by 0.162. Thus, the order of relative contribution to achievement score in Basic Science from the highest to lowest by each dimension of test anxiety therefore is; interference (-0.175), followed by lack of confidence (0.162), worry (0.121) and then emotionality (-0.062).

Hypothesis 1: Test anxiety is not a significant predictor of upper basic education students' academic achievement scores in Basic science.

Table 3: ANOVA on Significance of Prediction of Achievement score in Basic Science by Students' Test Anxiety

| Model | | Sum of Squares | df | Mean Square | F | P value |
|--|------------|----------------|------|-------------|--------|-------------------|
| 1 | Regression | 2751.072 | 1 | 2751.072 | 12.906 | .000 ^b |
| | Residual | 425883.403 | 1998 | 213.155 | | |
| | Total | 428634.476 | 1999 | | | |
| a. Dependent Variable: Achievement score | | | | | | |
| b. Predictors: (Constant), Test Anxiety | | | | | | |

Table 3 shows that test anxiety is a significant predictor of achievement scores in Basic Science, $F(1, 1998) = 12.906, p < 0.05$. The null hypothesis was therefore rejected meaning that test anxiety is a significant predictor of students' achievement scores in Basic Science.

Since test anxiety is a significant predictor of achievement scores in Basic Science, the regression model ($Y = a + bX$) for the prediction of achievement score in Basic Science as derived from Table 1, where constant = 81.530 and b value = -0.132 is:

$$ASBS = 81.530 - 0.132(TA)$$

Where, ASBS = Achievement score in Basic Science and TA = Test Anxiety score.

Hypothesis 4: The relative contributions of the dimensions of test anxiety (worry, emotionality, interference and lack of confidence) to the prediction of upper basic education students' education achievement scores in Basic science is not significant.

Table 4: ANOVA on Significance of Prediction of Achievement score in Basic Science by the Dimensions of Test Anxiety

| Model | | Sum of Squares | df | Mean Square | F | Pvalue |
|--|------------|----------------|------|-------------|-------|-------------------|
| 1 | Regression | 1210.699 | 4 | 302.675 | 1.413 | .027 ^b |
| | Residual | 427423.777 | 1995 | 214.248 | | |
| | Total | 428634.476 | 1999 | | | |
| a. Dependent Variable: Basic Science Achievement score | | | | | | |
| b. Predictors: (Constant), Lack of Confidence, Interference, Worry, Emotionality | | | | | | |

Table 4 shows that the dimensions of test anxiety jointly predicted the students' achievement scores in Basic Science significantly, $F(1, 1995) = 1.413, p < 0.05$. However, data contained in Table 2 shows the significance of the contributions of the individual dimensions of test anxiety to the prediction of achievement scores in Basic Science.

Table 2 shows that worry is a significant predictor of achievement scores in Basic Science, $t(1, 1995) = 1.067, p < 0.05$; Emotionality is not a significant predictor of achievement scores in Basic Science, $t(1, 1995) = -0.568, p > 0.05$, interference is a significant predictor of achievement scores in Basic Science, $t(1, 1995) = -1.580, p < 0.05$, lack of confidence is a significant predictor of achievement scores in Basic Science, $t(1, 1995) = -1.396, p < 0.05$. Thus, the significant contributors to the achievement score of students in Basic Science in order of significance are interference, lack of confidence and worry. However, since the joint prediction of all the dimensions of cognitive engagement in the prediction of achievement score in Basic Science is significant, the regression model ($Y = a + bX_1 + cX_2 + dX_3 + eX_4$) for the prediction of achievement score in Basic Science as can be derived from Table 4 is:

$$ASBS = 69.619 + 0.121(WRY) - 0.062(EMT) - 0.175(INT) - 0.162(LOC)$$

Where, ASBS = Achievement score in Basic Science and WRY = worry, EMT = Emotionality, INNT = Interference, LOC = Lack of Confidence.

Discussion

A moderate level of anxiety can be advantageous for the learning process as it motivates students to engage in the requisite academic tasks essential for achieving success in their educational pursuits. It is common for individuals to experience a certain level of anxiety prior to a significant examination or presentation, and

this worry tends to diminish once the event has concluded. Nevertheless, a persistent and elevated state of worry might impede the process of acquiring knowledge, as it has the potential to grip the cognitive faculties and effectively impede their functioning. Severe anxiety can be considered a sort of learning disability due to its significant impact on a student's

capacity to effectively acquire, assimilate, and recall material. Individuals who have anxiety-related difficulties often exhibit diminished levels of academic performance and self-confidence. Individuals who experience high levels of anxiety may encounter challenges in maintaining focus on the material that requires comprehension and retention.

Despite the potential for test anxious students to maintain a degree of attentiveness in the classroom, their cognitive capacities are frequently over-relaxed by anxiety, resulting in a superficial level of engagement. The individuals in question do not incorporate previously acquired knowledge when assimilating new material, resulting in a lack of expansion or enrichment of their prior learning. Furthermore, due to the intermittent nature of attention and concentration, students frequently possess incomplete knowledge within a specific domain.

The domains/dimensions of test anxiety that significantly contributed to achievement in Basic science are interference, loss of confidence, and worry. Interference has the potential to exert a detrimental impact on academic attainment due to its propensity to impede cognitive processes. Insufficient elaboration on new information may result in inadequate storage. Consequently, students may encounter difficulties in retrieving knowledge from their long-term memory. If a student experiences difficulty in retrieving previously acquired knowledge, their performance on a test may be adversely affected, despite having studied and possessed the knowledge beforehand. Students may experience the phenomenon known as "test anxiety," which can have a detrimental impact on their capacity to acquire knowledge. The presence of intrusive thoughts during academic situations has been identified as a manifestation of test anxiety, which has the potential to hinder task performance among those experiencing anxiety.

Cognitive interference poses a hindrance to optimal performance as it operates in direct opposition to cognitive accessibility. The individual's focus on the work at hand is reduced. Cognitive interference pertains to the occurrence of intrusive thoughts that arise in an individual's mind during tests, although do not serve any functional purpose in effectively addressing the cognitive task at hand. Individuals with high levels of test anxiety tend to encounter cognitive responses that hinder their performance when faced with demanding or complex tasks. These responses often involve a divided focus of attention between oneself and the task at hand. The phenomenon results in an elevation of task-irrelevant

cognitions, leading to a burden on the working memory system and subsequently diminishing the overall cognitive capacity at hand.

Self-confidence plays a crucial role in enabling students to engage in risk-taking behaviour within their educational pursuits, as well as facilitating their ability to recover and persevere in the face of setbacks or challenges. The absence of self-assurance among students engenders a sense of uncertainty over their capacity to achieve, hence causing them to exhibit reluctance in actively participating in the learning process or undertaking suitable academic challenges. Individuals who possess a greater level of self-assurance exhibit a greater propensity to engage in the learning process, embrace challenging tasks, and demonstrate enhanced adaptability when confronted with demanding transitions, such as transitioning between educational institutions. Indeed, confidence has been shown as a significant predictor of academic ability. The possession of self-confidence enables students' to engage in actions aligned with their personal convictions. The presence of a strong sense of self-confidence among students facilitates the expression of their viewpoints and the ability to make proactive decisions, particularly in the context of learning. Consequently, self-confidence plays a crucial role in helping students' attainment of academic success.

Confidence has a significant role in fostering learner engagement with both their educational pursuits and the broader external environment. It is widely recognised that bolstering confidence can effectively cultivate a learner's belief in their capacity to succeed and mitigate their apprehension of failure. This serves as a driving force for individuals to consistently participate in educational institutions, ensuring regular attendance, heightened concentration during instructional sessions, and the diligent completion of academic assignments and assessments to the fullest extent of their capabilities.

Worry is considered a fundamental cognitive trait associated with the manifestation of generalised anxiety disorder. This endeavour signifies an attempt to actively participate in cognitive processes aimed at resolving an issue that is characterised by ambiguous or uncertain outcomes. Worry is considered a fundamental cognitive trait associated with generalised anxiety disorder. This endeavour signifies an attempt to actively participate in cognitive problem-solving pertaining to a problem that exhibits ambiguous or uncertain outcomes. Worry is considered a fundamental cognitive trait associated with generalised anxiety disorder. This endeavour signifies an attempt to actively participate in

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Excessive preoccupation with various routine occurrences is a fundamental cognitive trait associated with generalised anxiety disorder. Another fundamental component of anxiety is emotionality, which refers to heightened physiological arousal and symptoms, as well as affective reactions. Worry is defined as a series of recurring, negatively charged mental images and ideas that are challenging to regulate. Worry can be understood as a cognitive process aimed at engaging in problem-solving activities pertaining to a situation that is characterised by ambiguous or unknown outcomes. Typically, it entails a deliberate anticipation of potential adverse consequences or apprehension around the prospect of not succeeding.

Individuals who are afflicted with test anxiety tend to allocate a significant portion of their cognitive resources towards the generation and analysis of distressing ideas. This phenomenon can provide significant challenges in maintaining a focus on positive ideas and can result in considerable fatigue for students, so impeding their capacity to acquire knowledge and skills. The phenomenon induces pupils to manifest unfavourable dispositions towards their academic pursuits, which is evidenced by subpar scholastic achievements, inadequate assignments, diminished enthusiasm for acquiring knowledge, compromised cognitive reasoning abilities, impaired working memory, and heightened distractibility. Anxiety and worry have been found to have detrimental effects on working memory, cognitive regulation, attentional focus, and overall performance in testing contexts. The decrement in working memory capacity leads to a subsequent decline in problem-solving proficiency and overall performance.

The detrimental effects of worry are contingent upon the presence of elevated metacognitive beliefs. Moreover, the act of worrying might be seen as an indication of the individual's concern or investment in the matter at hand. It signifies a cognitive reaction related to the apprehension and evaluation of difficult and demanding circumstances. Hence, it is plausible that concern is generally more strongly associated with test performance than to emotionality. The presence of moderate levels of concern is essential in academic environments as it fosters the development of challenge and drive. Preparing for examinations necessitates a heightened sense of accountability, which can elicit emotions of apprehension, concern, and a compulsion to engage in studying. However, if these sentiments become overwhelming, they may have an adverse effect on one's academic performance.

The findings of the study is in line with the findings of Oluochi, Aloka and Odongo (2018) and Akanazu and Okoli (2019) that there was statistically significant negative correlation between test anxiety and chemistry academic and that test anxiety accounted for 18.7% of the variation in performance in chemistry Academic. The findings of the study collaborates with the finding of Ilo and Unachukwu (2020) that test anxiety is a predictor of academic achievement of students in English language and Mathematics. The findings of the study does not support the findings of Ihekwoaba, Chinweuba-eze and Nduji (2020) that the variation in students' academic achievement in biology that can be attributed to their test anxiety is not significant

Conclusion

The study concludes that test anxiety is significant predictor of students' achievement in basic science. The study also establishes that Interference, lack of confidence and worry dimensions of test anxiety are the most significant contributors to achievement in Basic science.

Recommendations

The following recommendations are made based on the findings of the study:

1. Orientation programme should be conducted for basic science students on how to manage test anxiety, and develop better and effective study habit.
2. Continuous evaluation that may not be used in students' assessment may be conduction time after time to acquaint students with test situations and to train them to manage test anxiety.

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