PERSONAL AND ENVIRONMENTAL VARIABLES AS PREDICTORS OF STATISTICS ANXIETY AMONG UNDERGRADUATES OF UNIVERSITIES IN CROSS RIVER STATE, NIGERIA

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Abstract

The study sought to find out the predictability of statistics anxiety among undergraduate students of universities in Cross River State, Nigeria using personal and environmental variables. To achieve the purpose of the study, one research question and one null hypothesis was formulated and tested at .05 level of significance. A review of related literature was carried out based on the variables of the study. Ex-post-facto research design was adopted for the study. The population of the study was made up of 16,569 three hundred level students from University of Calabar and University of Cross River. Two instruments, Personal and Environment Variables Questionnaire (PEVQ) and Statistical Anxiety Rating Scale (STARS) were used to gather data from 887 students. The instruments were subjected to face validation by the researchers who are experts in the field of

Educational Measurement and Evaluation. Cronbach-alpha reliability method was used to determine the reliability coefficients of the instruments ranging from .610 to .816. The data collected were analysed using multiple regression analysis with the help of SPSS package version 20.0. The research findings revealed that self-concept, student attitude toward learning of statistics, teacher-student relationship, classroom environment and availability of instructional facilities were found to be significant predictors of statistics anxiety among undergraduate students of universities in Cross River State. It was therefore recommended, among others, that statistics teachers should spend class time assisting students to see the day-to-day importance of the worth of statistics and also employ strategies aimed at improving undergraduate attitudes toward learning statistics. Teacher-student relationships in the courses should be considered very important. This will result in improved academic outcomes in statistics.

Introduction

Statistics is an important subject and tool for human life and overall survival of society. This is largely because; there is nothing in the world that is done without elements of statistics. The educated and uneducated make use of statistics knowledge, consciously or unconsciously. The market woman, businessman and woman, and even the child on the street utilizes elements of statistics on a daily basis. The teacher in the classroom cannot make any decision about the progress of a learner without statistics. It would therefore not be an overstatement to assert very emphatically that statistics and its knowledge and application are indispensable in life. Some students have become anxious about statistics courses and some of them have surrendered to the fate that they cannot pass the course. This has made students' statistics anxiety a phenomenon among researchers in recent times. Wei (2005) defined statistics anxiety as anxiety that occurs as a result of encountering statistics in any form and at any level. In the classroom, statistics anxiety is related to test taking and it is noticeably common among students. It is a state of fear, restlessness and negative mindset built against courses in statistics. It is anxiety that is associated with fear of computation, interpretation of data as well as negativities associated with merely having a look at the instruction. It is a state of uneasiness, apprehension due to statistics.

Moreover, statistics anxiety is situation specific, inasmuch as the symptoms only emerge at a particular time and in a particular situation. Thus, many students tend to express this anxiety when confronted with statistics, ideas, problems, issues, instructional situations or evaluative situations. However, statistics anxiety according to Onwuegbuzie (2014) has been conceptualized as a multidimensional construct consisting of six components, namely; worth of statistics, interpretational anxiety, test and class anxiety, computational self-concept, fear of asking for help and fear of statistics teachers. The effect of statistics anxiety is expressed in students' failure in statistics examination, involvement in all manner of examination malpractice, spreading false information about the course, developing a lot of headaches about the course, staying out of class, developing hatred for statistics teachers and creating a deep-seated atmosphere of fear for other students who are about to do the course and lots more. This ugly situation has raised concern from Heads of departments, statistic teachers in a concerted effort to see how this situation can be addressed. For example, many teachers have utilized different methods and reinforcement approaches in order to salvage the situation and yet the problems still persist. The researcher is presuming that some environmental and personal variables could be responsible for this problem.

Environmental variables in this study are variables within the immediate surroundings of an individual that are presumed to have effect or control over the activities of the person. They are variables presumed to influence school activities in general. These variables include, teacher-students' relationship, classroom environment and availability of instructional facilities. Personal variables are those variables within the characteristics of the learners that are presumed to have control or effect over his/her activities. These are attributes within the learner that exhibit tremendous control on the behaviour of the learner. They include age, gender, attitude toward learning statistics and self-concept.

It is against this backdrop that the researcher seeks to ascertain whether personal and environmental variables may influence their statistics anxiety? It is in a bid to answer this research question that this research effort is made.

This research question and hypothesis guided the study:

To what extent do self-concept, student attitude toward statistics learning, teacher-students' relationship, classroom environment and availability of instructional facilities predict overall statistics anxiety?

H0: Self-concept, student attitude toward statistics learning, teacher-student relationship, classroom environment and availability of instructional facilities do not significantly predict overall statistics anxiety.

Methods

The design adopted for this study was ex-post facto. The area of study is Cross River State of Nigeria. The state lies between latitudes 5º32' and 4º27' North of the Equator; and longitudes 7º50' and 9º23 East of the Greenwich meridian.

The population of this study comprised all third-year students in the 2020/2021 academic session in the University of Calabar and Cross River University of Technology (CRUTECH) with a population of 16,569. The purposive sampling technique was applied in this study. The sample for this study consists of 887 students of the 2020/2021 session selected from seven Faculties in the University of Calabar and Cross River University of Technology.

Two instruments were used for data collection, and these are the researcher-designed questionnaire titled Personal and Environmental Variables Questionnaire and a Statistics Anxiety Rating Scale (STARS). The questionnaire was based on a four-point likert type scale of strongly agree (SA), Agree (A), disagree (D) and strongly disagree (SD). Validity of the research instrument was done through face and content validity while, the reliability of the instrument was established through Cronbanch-alpha method and the reliability indices of the variable ranged between 0.61 and 0.89.

Results

Self-concept, student's attitude toward learning of statistics, teacher-students' relationship, classroom environment and availability of instructional facilities do not significantly predict statistics anxiety among undergraduates. The predictor variables are student academic self-concept, social self-concept, physical self-concept, student attitude toward learning of statistics, teacher-students' relationship, classroom

environment and availability of instructional facilities while the dependent variable is statistics anxiety among undergraduates. Multiple linear regression was used to test this hypothesis at 0.05 level of significance.The choice of Multiple Linear Regression (modelling application) was to help explain the linear relationships that exist between and among the predictor variables at $p < 0.05$. The results are presented in Tables 1 and 2.

Table 1: Inter-correlation Matrix of all the Variables

	DV	**ASC**	**SSC**	**PSC**	**SATS**	**TSR**	**CRE**	**INF**
DV	1.00							
ASC	.093	1.00						
SSC	.215	.037	1.00					
PSC	.207	.265	.538	1.00				
SATS	.033	.627	.137	.458	1.00			
TSR	.414	.352	.122	.155	.510	1.00		
CRE	.052	.716	.104	.475	.597	.534	1.00	
INF	.071	.710	.013	.374	.591	.482	.771	1.00
Mean	86.59	11.47	9.90	8.64	11.80	13.28	12.93	13.22
SD	9.07	4.15	2.18	4.04	3.69	3.15	3.93	3.83

KEY: DV = statistics anxiety among undergraduates
ASC = academic self-concept
SSC = social self-concept
PSC = physical self-concept
SATS = student attitude toward learning of statistics
TSR = teacher-students' relationship
CRE = classroom environment
INF = availability of instructional facilities

The regression equation is expressed thus:

$Yi = B_o + B_1X_1 + B_2X_2 + B_3X_3 + B4X_4 + B_5X_5\ B_6X_6 + B_7X_7 + e_i \ldots$ equation 6.

Where:

Y is the predicted value of the DV (statistical anxiety among undergraduates)

$X1\text{-}X_7$ are the predictor variables

Bo = is the Y-intercept and

e_i is the error of prediction known as residuals

The upper part of Table 1 presents correlation matrix while the second part presents the mean values and standard deviations of the variables. The correlation matrix is extremely useful for getting a rough idea of the relationships between predictors and the outcome, and for a preliminary look for multicollinearity. If there is no multicollinearity in the data, then there should be no substantial correlations ($r > .9$) between predictors.

If we look only at the predictors (ignore statistics anxiety among undergraduates) then the highest correlation is between classroom environment and availability of instructional facilities which is significant at .005 level ($r = .771$, $p = <.005$), the correlation is significant. The coefficient is moderate and so it looks as though our predictors are measuring different things (there is little collinearity). We can see also that of all the predictors teacher students' relationship correlates best with statistics anxiety among undergraduates ($r = .414$, $p < .001$) and so it is likely that this variable will best predict statistics anxiety among undergraduates. Table 1 shows that multicollinearity does not exist among the seven (7) predictor variables: student academic self-concept, social self-concept, physical self-concept, student attitude toward learning of statistics, teacher-students' relationship, classroom environment and availability of instructional facilities, this is because the zero-order correlation are less than 0.85. More importantly, none of the correlations between the predictor variables is greater than 0.

Table 2: Regression Model Summary of all the predictor variables: self-concept, student attitude toward learning of statistics, teacher-students' relationship, classroom environment and availability of instructional facilities on statistics anxiety among undergraduates

Model	R	R square	Adjusted R square	Std error of the estimate	
1	.577	.333	0.327	7.444	
Source of Variance	Sum of Squares	df	Mean square	F	Sig.
Regression	24287.308	7	3469.615	62.597	.000*
Residual	48720.768	879	55.427		
Total	73..8.007	886			
Variables	Regression weight				
	B	Std error	Standard. Coef. (β)	t-value	Sig.
(Constant)	82.840	1.622		51.064	.000
Academic self-concept	-.462	.104	-.211	4.445	.000
Social self-concept	-.900	.145	-.217	-6.190	.000
Physical self-concept	-.156	.096	-.069	-1.619	.106
Students attitude towards statistics	-.443	.105	-.180	-4.229	.000
Teacher students' relationship	1.672	.107	.582	15.593	.000
Classroom environment	.013	.124	.006	.108	.914
Availability of instructional facilities	.189	.114	.080	1.668	.096

The first part of Table 2 shows the regression model summary, the second part of the table shows an ANOVA that tests whether the model is significantly better at predicting the outcome than using the mean as a 'best guess'. Specifically, the F-ratio represents theratio of the improvement in prediction that results from fitting the model, relative to the inaccuracy that still exists in the model. The F-ratio is calculated by dividing the average improvement in prediction by the model (MS_M) by the average difference between the model and the observed data (MS_R). If the improvement due to fitting the regression model is much greater than the inaccuracy within the model, then the value of F will be greater than 1. While the third part of the table gives us estimates for b-values and these values indicate the individual contribution of each predictor to the model.

The result in Table 2shows that, the predictor variables had moderate positive correlation with statistics anxiety ($R = .577$, $p < .05$). The combination of all the predictor variables (student academic self-concept, social self-concept, physical self-concept, student attitude toward learning of statistics, teacher-students' relationship, classroom environment and availability of instructional facilities) are joint predictor of statistics anxiety among undergraduates. Overall, the model accounts for 33.3% of the variance in statistics anxiety among undergraduates and is a significant fit of the data (or, put another way, the 33.3% of variance that can be explained is a significant amount).

Furthermore, the regression ANOVA revealed that, there was a moderate joint linear association (contribution) of the predictor variables to statistics anxiety among undergraduates given by the F-ratio $(7, 879) = 62.59$; $p < 0.05$. We can interpret these results as meaning that the model significantly improved our ability to predict the outcome variable, (because the F-ratio is significant)

The adjusted R^2 (0.327) shows some shrinkage of the unadjusted value (0.333) indicating that the model could be generalized on the population. Based on the result, it was revealed that when all the predictor variables (student academic self-concept, social self-concept, physical self-concept, student attitude toward learning of statistics, teacher-students' relationship, classroom environment and availability of instructional facilities) are used together, statistics anxiety among undergraduates will be significantly managed.

The b-values tell us about the relationship between statistics anxiety and each predictor. If the value is positive, we can tell that there is a positive relationship between the predictor and the outcome, whereas a negative coefficient represents a negative relationship. For these data four predictors have positive b-values indicating positive relationships while three predictors have negative b-values indicating negative relationships. So, as student academic self-concept, social self-concept, physical self-concept, student attitude toward learning of statistics increases, statistics anxiety among undergraduate's decreases.

Surprising, statistical anxiety among undergraduates increases, teacher-students relationship; classroom environment, and finally, instructional facilities increase too. In terms of the individual variable prediction: only, academic self-concept, social self-concept, students' attitude towards statistics and teacher student relationship alone significantly predicts statistics anxiety among undergraduates. The b-values tell us more than this, they also tell us to what degree each predictor affects the outcome if the effects of all other predictors are held constant:

Academic self-concept (standardized $\beta = .211$): This value indicates that as academic self-concept increases by one standard deviation (2.18), statistics anxiety decreases by 0.211 standard deviations. The standard deviation for statistics anxiety is 9.07 and so this constitutes a change of 1.91 in statistics anxiety (0.211×9.07). This interpretation is true only if the effects of social self-concept, physical self-concept, students' attitude toward learning of statistics, teacher-students' relationship, classroom environment and availability of instructional facilities are held constant.

Teacher-students' relationship (standardized $\beta = .582$): surprisingly this value indicates that as teacher students' relationship increases by one standard deviation (3.15), statistics anxiety also increase by .582 standard deviations. The standard deviation for statistics anxiety is 9.07 and so this constitutes a change of 5.27 increase in statistical anxiety (0.582×9.07). This interpretation is true only if the effects of academic self-concept, social self-concept, and physical self-concept, student attitude toward learning of statistics, classroom environment and availability of instructional facilities are held constant.

Social self-concept (standardized β = .217): This value indicates that as social self-concept increases by one standard deviation (4.04), statistics anxiety decreases by 0.217 standard deviations. The standard deviation for statistical anxiety is 9.07 and so this constitutes a change of 1.96 in statistical anxiety (0.217 × 9.07). This interpretation is true only if the effects of academic self-concept, physical self-concept, students' attitude toward learning of statistics, teacher-students' relationship, classroom environment and availability of instructional facilities are held constant.

Students' attitude towards statistics (standardized β = .180): This value indicates that as students' attitude towards statistics increases by one standard deviation (3.69), statistical anxiety decreases by 0.180 standard deviations. The standard deviation for statistical anxiety is 9.07 and so this constitutes a change of 1.63 in statistical anxiety (0.180 × 9.07). This interpretation is true only if the effects of social self-concept, academic self-concept, physical self-concept, teacher-students' relationship, classroom environment and availability of instructional facilities are held constant.

In multiple regression, a significant value of t indicates a measure of whether the predictor is making a significant contribution to the model. Therefore, if the t-test associated with a b-value is significant then the predictor is making a significant contribution to the model. For this model, social self-concept ($t(879) = 6.190$, $p < .005$), teacher-students relationship ($t(879) = 15.59$, $p < .005$), academic self-concept ($t(879) = 4.445$, $p < .005$), and students attitude towards statistics ($t(879) = 4.229$, $p < .005$) are all significant predictors of statistics anxiety. From the magnitude of the t-statistics we can see that teacher-students' relationship had a higher impact, whereas social self-concept and academic self-concept and students' attitude towards statistics had moderate impact. While physical self-concept ($t(879) = 1.619$, $p > .005$), classroom environment ($t(879) = 0.108$, $p > .005$) and availability of instructional facilities ($t(879) = 1.668$, $p > .005$) are all not significant predictors of statistics anxiety. If we replace the b-values in equation 6.0, we find that we can define the model as follows:

Statistics anxiety = b_0 + $b_1$social self-concept + $b_2$academic self-concept + $b_3$students attitude towards statistics + $b_4$teacher students' relationship equation…. (7.0)

= 82.840 + (0.900social self-concept) + (0.462academic self-concept) + (0.443students attitude towards statistics) + (1.672teacher students' relationship).

Discussion

The research finding in respect of the hypothesis revealed that self-concept, student attitude toward learning of statistics, teacher-student relationship, classroom environment and availability of instructional facilities statistically significantly predicts statistics anxiety among undergraduates.

This study is in agreement with Hay, Ashman and Van-Kraayenoord in Sayid (2011), who showed that students self-concept is a valid predictor of their academic performance. Zhao (2011), found a negative correlation between statistics self-efficacy as measured by the current statistics self-efficacy (CSSE) scale and statistics anxiety. This suggests that when students are confident in their ability to complete certain statistics tasks or problems anxiety prior to taking a statistics exam.

Again, Perney and Ravid in Ebenuwa – Okoh's (2010) study result indicated that attitude toward statistics was positively related to math self-concept, as well as to attitude toward tests. This finding seen to suggest the students may actually view statistics as a math class, and consequently their math self-concept is involved. For student attitude toward statistics learning, and statistics anxiety in terms of worth of statistics, a body of research indicates that, there is a relationship between statistics anxiety and attitude towards statistics with college students.

For teacher-student relationship as predictor of statistics anxiety in terms of worth of statistics, computational self-concept and test and class anxiety sub-scale, most research regarding teacher-student relationship investigates the elementary years of schooling, perceive social support of students and teacher-learner relationship etc. example, the research that teacher-students' relationships count in education. Therefore, it is significant where such relationship turns negative in the study of statistics, it breeds unnecessary anxiety especially on the part of students. The findings by Diener Emmons, Larsen, and Griffin in William (2010), revealed that the higher the levels of perceived social support, from teachers, friends and family, the higher the life satisfaction of the student. The findings implies that the higher the perceived social support from

statistics teachers by the students, the higher the satisfaction of students on the statistics course and the lower the anxiety level.

In respect of classroom environment, as predictor of statistics anxiety in terms of worth of statistics, computational self-concept and test and class anxiety, available research studies were on the influence of learning environment on students' academic achievement in mathematics, effects of classroom physical environment on the academic achievement scores of secondary school students and so on. Shamaki (2015), for example, carried out a study on the influence of learning environment on students' academic achievement in mathematics: A case study of some selected secondary schools in Yobe State – Nigeria and the result revealed that there was a significant difference between the mean performance of students taught in an ideal learning environment and that of students taught in a dull learning environment.

Conclusion

Based on the above research findings, the following conclusions were made. That: personal and environmental variables are very important in predicting statistics anxiety among undergraduates. This means that students who desires to show how anxiety in statistics courses and individuals or educators who are interested in solving statistics anxiety problems should take cognizance of the fact that they are attributes within and immediate surroundings of the students that have tremendous control over his or her activities or behaviour. Identifying variables that may help students in a statistics class particularly for undergraduates of universities in Cross River State, will be an indispensable step for decreasing statistics anxiety and developing positive attitudes in them towards statistics.

Recommendations

1. Educators should give adequate and sufficient attention to self-concept, teacher-student relationship, classroom environment, attitude toward statistics learning variables and how applicable these are in predicting statistics anxiety of students.
2. Teachers should be offered methodological guidance in order to work on these predictive variables throughout the educational process so that students could see the worth, usefulness and worth of statistics.

3. Government should employ more teachers to teach statistics, build more classrooms to reduce statistics anxiety and provide among others adequate instructional materials across the various levels of education.

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