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Correlation between test anxiety and students' chemistry achievement

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Abstract: This research examined the correlation between test anxiety and chemistry students' achievement. It also looked at the moderating effect of school location and gender on the correlation between these two variables. In the study, a descriptive survey design was used. Using stratified random sampling, 222 chemistry students from senior secondary schools were selected. The instruments used were test anxiety questionnaire and chemistry achievement test. Pearson correlation and coefficient of determination were used for data analysis. The study indicated a significant negative correlation between test anxiety and chemistry achievement among students. In addition, there was no correlation between test anxiety and students' performance in chemistry when school location and gender were moderated for. It was therefore concluded that an increase in students' test anxiety will decrease their achievement in chemistry and vice-versa, irrespective of their school location and gender. Consequently, it was recommended, among others, that the teachers, parents, curriculum planners and education stakeholders use cognitive, affective and behavioural approaches to minimize students' test anxiety to increase their achievement.

Keywords: Achievement, chemistry, secondary school students, test anxiety

Hubungan antara kecemasan ujian dengan prestasi kimia siswa

Abstrak: Penelitian ini berfokus pada menyelidiki hubungan antara kecemasan ujian dan prestasi kimia siswa. Riset juga melihat pengaruh moderasi lokasi sekolah dan jenis kelamin pada hubungan antara kedua variabel ini. Dalam penelitian ini, desain survei deskriptif digunakan. Menggunakan stratified random sampling, 222 siswa kimia dari sekolah menengah dipilih sebagai sampel. Instrumen yang digunakan adalah kuisioner kecemasan dan tes prestasi belajar kimia. Korelasi Pearson dan koefisien determinasi digunakan untuk analisis data. Temuan penelitian mengungkapkan hubungan negatif yang signifikan antara kecemasan tes dan prestasi siswa dalam kimia. Selain itu, tidak ada hubungan yang antara kecemasan ujian dan prestasi siswa dalam kimia yang dimoderatori oleh lokasi sekolah dan jenis kelamin. Oleh karena itu disimpulkan bahwa peningkatan kecemasan ujian siswa akan mengakibatkan penurunan prestasi mereka dalam kimia dan sebaliknya terlepas dari lokasi sekolah dan jenis kelamin mereka. Oleh karena itu, direkomendasikan antara lain bahwa guru, orang tua, perencana kurikulum dan pemangku kepentingan pendidikan harus menggunakan pendekatan kognitif, afektif dan perilaku untuk meminimalkan kecemasan ujian siswa untuk meningkatkan prestasi mereka.

Kata Kunci: Prestasi, kimia, siswa sekolah menengah, kecemasan ujian

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INTRODUCTION

In the education sector, the use of the test is one of the major practices of determining students' academic progress, achievement, knowledge, attitude and skills acquired in the learning. Therefore, for chemistry learners to have been certified to have acquired the needed knowledge, attitude and skills, they must have passed through effective assessment through test. Chemistry, through its components in many disciplines like medicine, astronomy, pharmacy, and agricultural sectors, has provided the needed manpower of a nation. Chemistry is a discipline of science that focuses on the investigation of matter, including its composition, characteristics, and how it transforms (Gordon, 2021; Nwafor et al., 2022). The skills and knowledge acquired through chemistry helps human in making better decisions towards effectively tackling issues that affect them, his community or the world at large. Therefore, the importance of chemistry in economic, scientific and technological development cannot be overemphasized. Consequently, a solid foundation in secondary schools, particularly in Nigeria, needs a solid foundation for effective and efficient chemistry education.

However, empirical studies have shown poor data with respect to students' achievement in chemistry. For instance, the West African Examination Council Chief Examiner 2015-2018 showed that students' achievement in the subject has been poor and fluctuating which could affect the country's desire for scientific and technological breakthroughs. In their study of the factors influencing secondary school student's academic achievement in chemistry. Sibomana et al. (2021) identified eight categories of factors that affect students' chemistry performance: content area factors, leadership styles, teachers, students, and school factors, innovative teaching strategies, socioeconomic status of the family, and class size effect. According to Apuh (2020), students' attitudes, resource availability, interpersonal relationships of students and teachers, and students attendance regularity affect on chemistry academic achievement of secondary school students. Moreover, Wondu (2018) averred that self-efficacy, motivation, stress and test anxiety are some of the psychological factors that can affect academic achievement. Therefore, students' test anxiety which is an emotional and psychological variable, may be an essential factor for effective chemistry curriculum delivery and could contribute to students' achievement in the subject.

Test anxiety is usually an unpleasant, emotional and psychological response which is often associated with a sense of fear and worry. It is a psychological situation in which people experienced extreme hardship and poor test/achievement scores. According to Onyeizugbo (2010), test anxiety is a worry feeling, anxiousness, or disquiet that occurs when a learner confronts any type or level of test or examination. Cherry (2022) asserted that test anxiety refers to a psychological situation in testing situations in which individuals suffer from extreme hardship and anxiety (worries). For this reason, test anxiety, according to Farooqi et al. (2012), the students' increasing sense of unease and worry, which can be disastrous and impair performance. Operationally, test anxiety is a collection of symptoms that interfere with one's desire or capacity to perform well on tests which can be physical, psychological, emotional, or mental. Test anxiety has four basic components: behavioral, cognitive, emotional, and physical (Zeidner, 1998). The mental activity occurring during the testing setting is included in the cognitive component, which includes among others negative thoughts, fear of failure and its consequences, poor understanding of question and

difficulty in reading. Under the emotional component according to the studies by Jing (2007), Oludipe et al. (2009), and Sansgiry and Sail (2006), we have fear, tension, apprehension, test/examination nervousness and somatic symptoms like shortness of breath, rapid heartbeat, stomach aches, headaches, excessive sweating, nausea, perspiration among others. Some of the behavioral components are feeling of restlessness and fidgeting while the physical component includes procrastination, dodging of work and poor study skills (Onyeizugbo, 2010). Therefore, there is the need to comprehensively look at all the test anxiety components towards improving students' achievement in schools.

At the all stages of education including secondary schools level, test and examination have been regarded as a crucial instrumen for decision-making in our society especially with respect to evaluating/assessing students' achievement, skills and abilities (Habibullah & Ashraf, 2013; Musa et al., 2021). Students' overall education goal is mainly determined by their test performance. Hence, Ng'ang'a et al. (2018) opined that test anxiety remains one of the important difficulties students faced in their education. Though Oluoch et al. (2018) acknowledged the need for little anxiety to motivate and propel the students to learn during test/examination, the researchers noted that too much anxiety will affect students' achievement negatively. Therefore, according to Barrows et al. (2013), students with best test anxiety "achieve academically less than students who have lesser test anxiety, although it is unclear if test anxiety contributes to reducing students' achievement." Unusual bodily movements, abdominal pain, difficulties concentrating, tremors, restlessness, weariness, muscle contractions, and insomnia are some psychiatric symptoms linked to pupils with significant test anxiety (Habibullah & Ashraf, 2013). These symptoms, as seen in many Nigerian students at all levels, have led to extreme anxiety, a high propensity for exam cheating, and ultimately low academic accomplishment (Ngwoke et al., 2013). Akinsola and Nwajei (2013) averred that the brain of someone who suffers from anxiety never ceases to think which could lead to discomfort, lower quality of life and anxiety in testing situations. Hence, anxiety can include negative thinking, fear, worry and restlessness.

Existing research on the correlation between test anxiety and student achievement is briefly summarized. Learners' achievement scores are negatively correlated with test anxiety (Khesht-Masjedi et al., 2019). Rizwan and Nasir (2010) investigated the correlation between test anxiety and performance among Pakistani postgraduate students and discovered a significant inverse link between test anxiety and achievement scores. Researchers concluded that test anxiety contributes to poor performance of students, but that it can be mitigated by providing students with the appropriate training on how to manage situations that induce test anxiety. In addition, Jerry et al. (2019) discovered a relation between test anxiety and mathematics performance among students. However, Özgan et al. (2019) investigated the relation between exam anxiety and student achievement. They found that the correlation between test anxiety and achievement was not statistically significant. Therefore, high scores of anxiety among students are not related to their academic performance. Likewise Ndirangu et al. (2010) have examined the relation between exam anxiety and student achievement in Kenya. Their research revealed that test anxiety was not correlated with academic achievement.

Using Junior Secondary III (JSIII) pupils in Ogun State, Onyekuru and Ibegbunam (2014) have examined the effect of exam anxiety on science students' performance levels. Students with low test anxiety outperformed those with high test anxiety, according to their

results. Conversely, Ilo and Unachukwu (2020) have conducted research in Anambra State on exam anxiety as a predictor of senior secondary school students achievement in English and Mathematics. According to the research, test anxiety predicts students' academic success in the subjects of English and mathematics. Yousefi et al. (2010) discovered that the Iranian adolescents' exam anxiety and academic achievement were related in their investigation. From the foregoing, it could be observed that substantial studies have been done on test anxiety by researchers, however, the construct has not been studied with respect to its relationship with secondary school students' chemistry achievement in Anambra State: most especially, with particular reference to the moderation of school location and gender in the correlation. Hence, the gap for the present study.

School location is a geographical area which can be rural or urban. In the view of Ntibi and Edoho (2017), it refers to in the physical environment areas (which can be urban or rural) where schools are suitated. In Nigeria, the urban schools are usually favour by the availability of social amenities like water, electricity, health care, educational resources among others which could enhance learning while the rural schools lack these basic amenities and most often lack enough teachers strength. These implies that learning could be affected based on school location, irrespective of students gender as Nwogu (2010) discovered that location has an impact on how people learned science. Apart from school location, gender was another moderating variable that was considered in this study.

Gender is that which distinguishes between the roles of boys and girls based on culture and society. According to Tolland and Evans (2019), gender is that social construction based on masculinity and femininity which is related to behaviours and attributes. Therefore, the roles as constructed by the society could influence individuals. Boy and girl students experience test anxiety differently, and this affects their performance differently (Alemu & Feyssa, 2020). While both genders experience test anxiety to varying degrees, Ndirangu et al. (2009) showed that gender had no impact in the connection between test anxiety and performance on tests. Test anxiety was not shown to be a significant predictor of average success scores for boy or girl students (Jerry et al., 2019).

Nevertheless, all over the world and Nigeria in particular, the impact of gender on students' achievement has continued to attract interest among science education researchers due to its generated controversies; as Almasri et al. (2021) averred that science subjects are boy dominated due to the gender stereotyped by educational administrators. Empirically, the moderating impact of gender on learners' science achievement has been contradictory. While other research, such as those by Cotner et al. (2020), Shahzad et al. (2022), are in favor of girls. Makarova et al. (2019) revealed that boy students achieve higher than their girl According to research by Rangga (2021), men pupils do better academically than their girl classmates. In addition, Kingdom-Aaron et al. (2019) stated that gender has no appreciable impact on students' science performance, specifically chemistry. The present study established the moderating effect of school location and gender on the correlation between test anxiety and students' chemistry achievement based on these disagreements and a dearth of literature on the topic. This research aims at determining the correlation between test anxiety and students' chemistry achievement.

METHOD

The study employed a survey-based correlational research design. All 1,482 senior secondary chemistry students in Awka South LGA (Local Government Area), Anambra State, Nigeria, were included in the study. The sample size was two hundred and twenty-two (222) chemistry students. The samples were selected using a stratified random sampling technique. Three (3) schools each were randomly chosen from the urban and rural areas respectively. The six schools chosen were mixed schools. The reason for the selection of this sample size was based on the recommendation of Mkpa (1997) who suggested that for a total population in few thousands, a sample size of 5% to 20% is appropriate for a study. Hence, the researchers used 15% of the total population.

The Test Anxiety Questionnaire (TAQ) and the Chemistry Achievement Test to use in this study. Three experts validated the instruments: one measurement and evaluation specialist from the Department of Educational Foundation and two from the Science Education Department. Cronbach's alpha was used to measure TAQ and CAT's internal consistency dependability. The reliability indices for TAQ and CAT were 0.87 and 0.72, respectively. The researchers gave the students the instruments, which were then immediately collated.

The r^2 (coefficient of determination) and r (Pearson's correlation) was used to analyze the data and draw conclusions. A 5-way guide was used for interpreting r as follows: 0.00 - 0.20 (correlation is very low), 0.21 - 0..40 (correlation is low), 0.41 - 0.60 (correlation is medium), 0.61 - 0.80 (correlation is high), 0.81 and above (correlation is very high). At a significance level of 0.05, simple linear regression (Regression ANOVA) and the Hayes Process were utilized to test hypotheses.

RESULTS

The result in Table 1 reveals that the correlation coefficient between Test Anxiety (henceforth TA) and Students' Chemistry Achievement (henceforth SCA) was -0.236 indicating a negative relationship. The coefficient of determination (r^2) of 0.056 was obtained which means that 5.6% variation in students' chemistry achievement can be accounted for by their test anxiety. There is a significant ($P<0.05$, $r = -0.236$ which indicates a negative connection) between TA and SCA. Hence, adding more predictor variable (test anxiety) to the model does not improve students' achievement in Chemistry.

Table 1. Correlation analysis result of the correlation between TA and SCA

R	r Square	P	Remark
-0.236	0.056	0.000	Sig.

Table 2 reveals the relation between test TA and SCA from both urban and rural backgrounds. Results demonstrate that both urban and rural students experience modest levels of connection between TA and SCA ($r = 0.018$ and $r = 0.046$, respectively). The coefficient of determination (r2) of 0.000 and 0.002 were obtained which means that 0.0% and 0.2% variations in urban and rural students' chemistry achievement, respectively associated with their test anxiety.

Table 2. Regression analysis of the correlation between TA and SCA of urban and rural areas.

School location	R	r Square
Urban	0.018	0.000
Rural	0.046	0.002

Table 3 reveals that the moderating influence of school location on the correlation between TA and SCA is not significant (P = 0.5023). This suggests that school location does not affect the correlation between TA and SCA.

Table 3. Hayes's process analysis of the moderating effect of school location on the correlation between TA and SCA.

r	r^2	MSE	F	Df_1	Df_2	P
0.1035	0.0107	39.8250	0.7870	3.0000	218.0000	0.5023

The result in Table 4 indicates the correlation between TA and SCA of girl and boy in chemistry. It shows that the correlation coefficient between test anxiety and chemistry achievement of boy and girl students are 0.100 and 0.023, respectively, indicating a very low relationship. The coefficient of determination (r^2) of 0.010 and 0.001 were obtained, showing that 1.0% and 0.1% variations in boy and girl students' chemistry achievement were associated with their test anxiety.

Table 4. Regression analysis of the correlation between TA and SCA of boy and girl

Gender	R	r Square
Boy	0.100	0.010
Girl	0.023	0.001

The correlation between test anxiety and overall achievement on chemistry exams (Table 5) does not vary significantly between boy and girl students. This is due to the fact that the p-value of 0.6235 is higher than the significance threshold of 0.05. This finding suggests no effect in the relation between students' test anxiety and their chemistry performance based on gender.

Table 5. Hayes's process analysis of the moderating effect of gender on the correlation between TA and SCA

r	r^2	MSE	F	Df_1	Df_2	P
0.0896	0.0080	39.9332	0.5880	3.0000	218.0000	0.6235

DISCUSSION

The findings revealed a negative correlation between TA and SCA. The coefficient of determination indicated that test anxiety accounts for 5.6% of the variance in students' performance in chemistry. The null hypothesis was denied after additional analysis demonstrated a significant negative correlation between TA and SCA. This suggests that a rise in test anxiety among students will result in a decline in their chemistry achievement.

As observed by the researchers, this could be because at every point of mentioning test in chemistry, students' anxiety level increases which could affect their achievement in the subject. These findings are in line with Ali et al. (2013), who concluded that there was a negative correlation of TA and SCA. However, this is against the finding of Ndirangu et al. (2009), and Özgan et al. (2019), who asserted that there exists no connection between TA and SCA. On the other hand, the findings disagree with that of Barroso et al. (2021), which showed a positive relationship between TA and SCA, which was statistically significant.

The study's findings showed a very low correlation between TA and SCA in urban and rural areas, respectively. The coefficient of determination obtained showed that 0.0% and 0.2% variations in students' urban and rural achievement in chemistry, respectively, can be attributed to their test anxiety. Further investigation indicated no significant statistical correlation between TA and SCA. This implies that school location has no significant influence on the correlation between TA and SCA. This could be because both urban and rural chemistry students have developed this misconception about the subject's abstract nature, which increases their anxiety whenever the chemistry test is being taken. In contrast to the findings of Lufi et al. (2004), who asserted that the test environment, the atmosphere of the examination hall, nature, difficulty of the evaluative task, and time restrictions for completing test tasks, as well as the way the test is administered and physical settings, are also contributing factors that cause anxiety in students, this finding demonstrates that test anxiety is not caused solely by the test itself.

According to our study's findings, boy and girl chemistry students exhibited a very weak correlation between TA and SCA. The coefficient of determination revealed that test anxiety accounts for variances of 1.0% and 0.1% in the chemistry achievement of boy and girl learners, respectively. In addition, there is no statistically significant gender-moderating effect on the correlation between TA and SCA. The results indicate that in the Awka LGA of Anambra State, Nigeria, the link between TA and SCA is the same for both genders. This could be because of the fear of chemistry test exhibited both boy and girl students as both gender would like to do well in the test and invariably leading to increase in anxiety and decrease in their chemistry achievement. These results backed with Getachew (2015) assertion that there was no significant difference between boy and girl students' test anxiety levels. The findings, however, contradict those of Ali et al. (2013), and Rezazadeh and Tavakoli (2009) who found that test anxiety is much more common in girl students than in boy students.

CONCLUSION

The researcher concluded that there is a significant negative correlation between TA and SCA. In addition, neither gender nor school location moderates the correlation between TA and SCA. In light of this, it was established that students' achievement in chemistry will decline when their test anxiety increases, and vice versa, regardless of their school's location and gender.

The researchers recommended in light of the findings of research and conclusions that chemistry students should be encouraged to get themselves ready for the test ahead of time to reduce test anxiety and be counseled to disregard the misconception that chemistry is abstract. This can be done by making them to appreciate the importance Chemistry in our daily life, thereby, reducing their test anxiety. The teachers, parents, curriculum planners

and education stakeholders should device means of using cognitive, affective and behavioural approaches to minimize students test anxiety in order to increase their achievement. Some of the methods are by embedding practical activities in every chemistry lesson and ensuring a stress free chemistry classroom environment. Moreover, chemistry teacher are encouraged to effectively plan in organizing any form of test (continuous assessment, examination) by using techniques that can reduce students test anxiety such as group work and cooperative learning.

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