# ASSESSMENT OF ANXIETY LEVEL AMONG SENIOR SECONDARY SCHOOL CHEMISTRY STUDENTS IN KUDAN LOCAL GOVERNMENT OF KADUNA STATE, NORTHERN NIGERIA

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## Abstract

*The quest for an anxious free approach towards the learning of Chemistry is of paramount importance among students in developing countries. This research was conducted to determine the causes and level of Chemistry anxiety among Secondary School Students in Kudan Local Government of Kaduna State, Northern Nigeria, using a survey design and simple random sampling. The instruments used for data collection were Chemistry Anxiety Scale (CAS) and Chemistry Anxiety Questionnaire (CAQ). Pearson's Product Moment Co-efficient was used to determine the r = 0.79 using test re-test method for instrument I (CAQ) while Spearman brown was used to determine r = 0.76 using split half method for instrument II. Results obtained revealed that Chemistry anxiety exist among these students (mean=3.61). The results also indicated that there is no significant gender disparity on anxiety level among the Students (P = 0.49 >0.05). This research therefore recommends that teachers should observe anxious students while teaching and use effective instructional strategies like ethno-chemistry to reduce anxiety levels of these students. By this way, a more effective learning environment can be created*.

**Keywords**: Assessment, Anxiety, Level, Chemistry, Gender, Students

## Introduction

The persistent underperformance of Secondary School students in West African Senior Secondary Certificate Examinations (WASSCE), National Examinations Council (NECO), and Joint Admission and Matriculation Board (JAMB) Examinations necessitates a comprehensive investigation. In the 21st century, high-level Science, Technology, Engineering, and Mathematics (STEM) talent is crucial for national competitiveness and addressing complex sustainability challenges. Chemistry, as a fundamental natural science, holds substantial importance in various STEM careers including medicinal chemistry, materials chemistry, environmental chemistry, bioengineering, and food safety (Buriak & Jillian, 2015; Huryn *et al*., 2017; Spitzer & Gro¨ger, 2018).

However, the declining interest in STEM careers, particularly in chemistry, impedes sustainable economic development globally (Diekman & Benson-Greenwald, 2018;

Salonen et al., 2018; Simon et al., 2017). Many countries are facing a shortage of talent in STEM fields, with chemistry-related careers being perceived as unappealing options (Avargil *et al*., 2020). This shortage commences with a lack of motivated chemistry teachers in secondary schools (Salta et al., 2012), leading to fewer students pursuing chemistry majors in higher education. Consequently, there is a scarcity of qualified chemists and chemical engineers (Christensen & Knezek, 2017; Smith & White, 2019).

The implications are substantial as numerous students may fail to gain admission into tertiary institutions due to poor performance in Core Chemistry (D-F). Those able to retake and achieve a passing grade gain access to universities or other institutions for further studies. However, the overall shortage of educated individuals in chemistry-related programs poses a threat to human resource bases and could soon lead to deficits (Ardura & Pe´rez-Bitria´n, 2018).

According to the American Society for Chemistry (ACS), chemistry is the study of matter and its transformations under varying environmental conditions. It seeks to understand not just the properties of matter, such as mass or composition of chemical elements, but also the mechanisms behind their changes (Lim & Biggs, 2021).

In Nigeria, chemistry is categorized as a science subject alongside physics, biology, and mathematics, offered in Senior Secondary Schools and combined for the award of NCE by Colleges of Education. In universities, degrees like Bachelor of Science (B.Sc), Masters of Science (M.Sc), and Doctor of Philosophy (PhD) are awarded in various disciplines of chemistry (Shamsuddin et al., 2017). Chemistry is an essential subject across courses including medical/pharmaceutical and health science, engineering, environmental technology, agriculture, and computer science/engineering (JAMB, 2021). Chemistry education fosters scientific habits that are transferable to daily life, encouraging critical thinking and respect for diverse opinions (Siwale *et al*., 2020).

There's a growing perception that contemporary secondary school students experience anxiety regarding the study of chemistry. Chemistry anxiety can be described as an unpleasant emotional state of unease, nervousness, and fear towards chemistry or chemistry courses, often accompanied by observable physiological reactions such as avoidant behavior among students (Senocak & Baloglu, 2014). The term "anxiety" originates from the Latin word "angere," meaning to cause distress (Sharma & Sharma, 2015). Anxiety is characterized by feelings of tension, worried thoughts, and physical changes, including increased blood pressure (American Psychological Association, 2022). Anxious individuals may experience recurring intrusive thoughts, avoid certain situations, and exhibit physical symptoms like dizziness, sweating, trembling, or rapid heartbeat (Burila *et al*., 2015). Anxiety significantly affects school performance and academic success, making learning, remembering, and writing more challenging, leading to lower academic achievement (Von der Embse *et al*., 2018).

Individuals with high anxiety levels often perform similarly to those with lower anxiety, but at a greater cost in terms of effort or long-term stress. Students with moderate anxiety levels might perform the best (Fan *et al*., 2019). Chronic anxiety detrimentally impacts academic success, particularly when individuals are uncertain

about the outcomes of their endeavors (Von der Embse *et al*., 2018; Huntley *et al*., 2019).

This research aligns with Attentional Control Theory (ACT) formulated by Eysenck *et al*. (2007). According to ACT, anxiety is linked to compromised attentional control, resulting in performance deficits in tasks associated with the central executive of the working memory system (Eysenck *et al*., 2007). ACT specifically addresses anxiety's impact on cognitive performance, highlighting that anxiety affects attentional control—the individual's ability to regulate what they focus on and what they ignore. In this context, anxiety may divert a student's attention away from the task at hand (such as studying) towards other stimuli, like worrying thoughts or distracting elements unrelated to the task (Derakshan & Eysenck, 2009).

Previous studies investigating anxiety towards learning chemistry in secondary schools were primarily conducted in the Southern and Eastern regions of Nigeria (Jegede, 2007; Nja *et al*., 2022). However, to our knowledge, there hasn't been an investigation into student anxiety levels towards learning Chemistry in suburban secondary schools in Northern Nigeria. Furthermore, few studies have explored the causes and extent of chemistry-related anxiety overall. This research aims to assess the causes and level of anxiety, as well as potential gender differences in anxiety levels among Secondary School Chemistry Students in Kudan, Nigeria.

## Objectives of the Study

The study aimed to achieve the following objectives:

1. Assess the causes and extent of anxiety among Secondary School Chemistry Students in Kudan local government, Kaduna state.
2. Evaluate the anxiety levels among Secondary School Chemistry Students in Kudan local government, Kaduna state.
3. Investigate potential gender differences in anxiety levels among Secondary School Chemistry Students in Kudan local government, Kaduna state.

## Research Questions

Research Questions for the study are as follows:

RQ1: What are the causes and levels of anxiety among Secondary School Chemistry Students in Kudan local government area, Kaduna state?
RQ2: What is the overall level of anxiety among Secondary School Chemistry Students in Kudan local government area, Kaduna state?
RQ3: Is there a gender disparity in anxiety levels among Secondary School Chemistry Students in Kudan local government, Kaduna state?

## Research Hypotheses

The following null hypotheses were postulated to guide the study:

$HO_1$: Causes of anxiety have no significant effect on the level of anxiety among secondary school chemistry students in Kudan local government area of Kaduna state.

$HO_2$: There is no significant difference in chemistry anxiety level between secondary school boys and girls in Kudan local government area of Kaduna state.

## Research Methodology

### Research Design

The research design adopted in this study was a survey design. The design was adopted because it is an efficient way of gathering data to help answer a research question. It is also critical in determining the quality of a research.

### Population and Sample for the study

The study population comprises all Senior Secondary Two (SSII) chemistry students, totaling 573 individuals, across the four public secondary schools in Kudan Local Government Area, Kaduna State, Nigeria, during the year 2018. SSII students were chosen due to their familiarity with some topics in SS1 chemistry, providing prior knowledge in the subject. To account for gender differences, the population was stratified into co-educational and single-sex schools. Following Krejcie and Morgan's (1970) Sample Size Table, a sample of 226 students was selected from the four previously identified schools for the study.

**Table 1: Sample of the study**

| SN | School codes | Male | Female | Total |
|---|---|---|---|---|
| 1 | A | 9 | 2 | 11 |
| 2 | B | 13 | 4 | 17 |
| 3 | C | 49 | 48 | 97 |
| 4 | D | 57 | 44 | 101 |
| | **Total** | **128** | **98** | **226** |

### Instrumentation

The research employed two instruments—a questionnaire and an Anxiety Scale—to collect data from the students. The questionnaire, adapted from the works of Woldeamanuel (2013) and Burns (1999) and titled "Assessment of Chemistry Anxiety for Senior Secondary School (ACASQ)," comprised 30 items. Students were instructed to rate these items by marking (√) their opinions. The questionnaire utilized a five-point Likert rating scale: Strongly Agree (SA) – 5, Agree (A) – 4, Undecided (U) – 3, Disagree (D) – 2, and Strongly Disagree (SD) – 1.

Additionally, the Chemistry Anxiety Scale (CAS), adapted from Kurbanoglu and Yucel (2015), consisted of 12 items. Students were required to choose the option that best aligned with their beliefs. This scale also employed a five-point Likert rating scale: Very High Anxiety (VHA) – 5, High Anxiety (HA) – 4, Undecided (U) – 3, Low Anxiety (LA) – 2, and Very Low Anxiety (VLA) – 1.

**Validation of the instruments**

The instruments underwent a validation process where they were reviewed by two Science education experts with PhD qualifications, along with an additional expert holding a PhD in the Department of Psychology at Ahmadu Bello University (ABU), Zaria, Nigeria. These experts evaluated the suitability, comprehensiveness, and clarity of the questionnaire items. Their feedback, critiques, and suggestions were instrumental in enhancing the content validity of the instruments. Every comment was thoroughly considered, leading to necessary adjustments and improvements being implemented in the instruments.

**Reliability of the instruments**

The reliability of the two instruments was determined by administering to Senior Secondary II Chemistry Students from a school close to the study population. Pearson's Product Moment Co-efficient was used to determine the r=0.79 using test re-test method for instrument I (ACASQ) while Spearman brown was used to determine r=0.76 using split half method for instrument II; indicating that both instruments were reliable.

**Procedure for Data Collection**

A Letter of Introduction was collected from the Directorate for Professional Diploma in Education (PDE) to the Principals of the selected schools at Kudan Local Government Area. Letter of Permission to carry out the study in the selected schools was also given to the researcher from Local Government Area Secretariat in Kudan. The ACASQ questionnaire and CAS scale were administered in the selected schools within duration of two weeks, by the researcher with the assistance of the chemistry teachers in the sampled schools. Adequate time allowed for students to fill in the ACASQ and CAS was determined also by taking the average between the first student to finish and the last for each instrument during pilot study. The duration of ACASQ was 45 minutes while that of CAS was 30 minutes. 226 questionnaires were given out and all were filled and returned.

**Procedure for Data Analysis**

The data were analyzed using Mean, Standard Deviation and t-test at $P \leq 0.05$ level of significance, using SPSS version 22.

**Results**

The study aimed to evaluate Secondary School Chemistry Students' opinions regarding the causes of Chemistry anxiety in Kudan Local Government Area of Kaduna State, Nigeria. The overall mean response across all items was 3.45, surpassing the benchmark mean of 3.00, with a standard deviation of 1.20, indicating acceptable responses. Specifically, a majority of respondents expressed that the school's chemistry laboratory lacked essential chemicals and reagents for practical work. This particular item received the highest mean response of 4.35, accompanied by a standard deviation of 1.16. Details revealed that 202 respondents agreed with this perspective, while only 24 disagreed. Consequently, the majority of items, 23 out of

the 30 identified as causes of chemistry anxiety (Table 2), received positive responses from the respondents.

**Table 2: Causes of Chemistry Anxiety among secondary school chemistry students in Kudan local government area of Kaduna state**

| S/N | Item | SA | A | U | D | SD | Mean | Std.Dev. | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | I have a natural fear for chemistry subject | 16 | 49 | 30 | 80 | 51 | 2.55 | 1.25 | Disagreed |
| 2 | I perceive chemistry as unreal and strange | 21 | 32 | 20 | 105 | 48 | 2.44 | 1.23 | Disagreed |
| 3 | I experience difficulty in explaining scientific laws in my own words | 40 | 79 | 30 | 49 | 28 | 3.24 | 1.31 | Agreed |
| 4 | I feel tired or easily exhausted during chemistry lessons | 32 | 84 | 25 | 52 | 33 | 3.13 | 1.32 | Agreed |
| 5 | I feel detached or disengaged during Chemistry lessons | 20 | 46 | 39 | 80 | 41 | 2.66 | 1.24 | Disagreed |
| 6 | I feel afraid and insecure when writing my Chemistry assignments | 15 | 85 | 22 | 66 | 38 | 2.88 | 1.26 | Disagreed |
| 7 | I panic before/during a chemistry test | 44 | 67 | 19 | 55 | 41 | 3.08 | 1.43 | Agreed |
| 8 | I get confused and mix up answers during a chemistry test | 32 | 100 | 25 | 43 | 26 | 3.31 | 1.25 | Agreed |
| 9 | I recall the correct answers after am out of the test/examination hall | 67 | 122 | 10 | 11 | 16 | 3.94 | 1.08 | Agreed |
| 10 | I experience fear that something bad is about to happen when awaiting my chemistry test/examination results | 47 | 87 | 12 | 51 | 29 | 3.32 | 1.37 | Agreed |
| 11 | I am afraid that having a poor grade in Chemistry | 87 | 106 | 14 | 9 | 10 | 4.11 | 1.00 | Agreed |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | might affect my future career | | | | | | | | |
| 12 | I am afraid of disappointing my parents because they want me to offer chemistry and be in Science | 103 | 109 | 6 | 6 | 2 | 4.35 | 0.74 | Agreed |
| 13 | Chemistry syllabus is too wide | 60 | 135 | 10 | 17 | 4 | 4.02 | 0.88 | Agreed |
| 14 | Chemistry has too many concepts or ideas | 58 | 123 | 27 | 8 | 10 | 3.93 | 0.96 | Agreed |
| 15 | Chemistry demand too much calculations | 91 | 107 | 12 | 14 | 2 | 4.20 | 0.86 | Agreed |
| 16 | Chemistry requires the learning of too many unrelated facts | 52 | 89 | 48 | 27 | 10 | 3.65 | 1.10 | Agreed |
| 17 | I am afraid of my Chemistry teacher | 32 | 77 | 16 | 52 | 49 | 2.96 | 1.43 | Disagreed |
| 18 | Chemistry teachers are too thorough in their assessment | 93 | 97 | 5 | 21 | 10 | 4.07 | 1.10 | Agreed |
| 19 | I am afraid of criticism or disapproval from my chemistry teacher when submitting chemistry assignments | 57 | 61 | 34 | 50 | 24 | 3.34 | 1.35 | Agreed |
| 20 | I am afraid of the harmful effects of chemicals and reagents | 71 | 120 | 15 | 9 | 11 | 4.02 | 0.99 | Agreed |
| 21 | My friend's opinions always make me to believe that chemistry is a difficult subject | 38 | 68 | 19 | 57 | 44 | 3.00 | 1.42 | Agreed |
| 22 | I am concerned about looking foolish or inadequate in front of others when confronted with chemistry assignments | 25 | 104 | 25 | 48 | 24 | 3.26 | 1.22 | Agreed |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 23 | Chemistry is easier for males | 70 | 72 | 20 | 50 | 14 | 3.59 | 1.30 | Agreed |
| 24 | Chemistry is more difficult for females | 59 | 62 | 29 | 48 | 28 | 3.33 | 1.40 | Agreed |
| 25 | My chemistry teacher does not use teaching aids while teaching | 36 | 63 | 22 | 62 | 43 | 2.94 | 1.40 | Disagreed |
| 26 | My chemistry teacher lacks the ability to simplify chemistry topics while teaching | 15 | 64 | 46 | 79 | 52 | 2.61 | 1.29 | Disagreed |
| 27 | My chemistry teacher does not cover the whole syllabus/curriculum for the term | 24 | 86 | 31 | 63 | 22 | 3.12 | 1.21 | Agreed |
| 28 | Students are not exposed to chemistry practical until the final certificate examination approaches | 77 | 98 | 4 | 30 | 17 | 3.83 | 1.24 | Agreed |
| 29 | My school's chemistry laboratory does not have enough equipment | 135 | 65 | 6 | 8 | 12 | 4.34 | 1.06 | Agreed |
| 30 | My school's chemistry laboratory lacks the required chemical and reagents for practical | 144 | 58 | 0 | 6 | 18 | 4.35 | 1.16 | Agreed |
| | Cumulative | | | | | | 3.45 | 1.20 | Agreed |

Benchmark Mean: Mean ≥3.00 = Agreed; Mean < 3.00 = Disagreed

The study aimed to assess the level of Chemistry anxiety among secondary school Chemistry students in Kudan Local Government Area of Kaduna State, Nigeria. The cumulative mean response across all items was 3.61, indicating a standard deviation value of 1.02, surpassing the benchmark mean of 3.00. This suggests that the respondents' opinions held significant weight. Specifically, a majority who expressed high anxiety disagreed with the notion that identifying equipment and materials required for experimental setups in chemistry contributed to lower anxiety levels. This item received the lowest mean response of 2.45, accompanied by a standard deviation of 0.98. Details revealed that 143 respondents reported experiencing low anxiety concerning this aspect, while 83 respondents indicated high anxiety. Consequently,

the outcome portrayed in Table 3 suggests that secondary school students in Kudan LGA of Kaduna State have a high level of anxiety in Chemistry.

**Table 3: Level of Chemistry Anxiety among Secondary School Chemistry Students in Kudan Local Government area of Kaduna state**

| S/N | Item | VHA | HA | U | LA | VLA | Mean | Std. Dev. | Remark |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Entering Chemistry lessons | 121 | 41 | 18 | 38 | 8 | 3.30 | 0.90 | HA |
| 2 | Using Chemicals in Chemistry | 109 | 24 | 33 | 54 | 6 | 3.21 | 1.01 | HA |
| 3 | Using equipment in Chemistry | 91 | 26 | 18 | 76 | 15 | 2.91 | 1.00 | HA |
| 4 | Preparing for Chemistry lessons | 66 | 23 | 17 | 83 | 37 | 2.96 | 1.11 | HA |
| 5 | Working with other students in Chemistry classes | 71 | 30 | 18 | 101 | 10 | 2.92 | 1.07 | HA |
| 6 | Making an experimental set-up in Chemistry Lab | 99 | 74 | 6 | 34 | 13 | 2.86 | 0.97 | HA |
| 7 | Having little time for doing an experiment | 117 | 33 | 33 | 31 | 12 | 3.39 | 1.22 | HA |
| 8 | Presence of chemicals around me in Chemistry lab | 68 | 64 | 42 | 40 | 12 | 3.50 | 1.24 | HA |
| 9 | Preparing a solution with required concentration in Chemistry | 93 | 46 | 31 | 37 | 19 | 3.21 | 1.19 | HA |
| 10 | Identifying equipment and materials required for an experimental setup | 62 | 21 | 7 | 92 | 44 | 2.45 | 0.98 | LA |
| 11 | Recording data in Chemistry | 90 | 11 | 10 | 75 | 40 | 2.46 | 0.98 | LA |
| 12 | Interpreting data obtained in Chemistry | 98 | 33 | 15 | 76 | 4 | 2.96 | 0.90 | HA |
| | Cumulative | | | | | | 3.61 | 1.02 | HA |

Benchmark Mean: Mean ≥3.00 = High Anxiety (HA); Mean < 3.00 = Low Anxiety (LA)

Summary of t-test on the difference in anxiety level between secondary school boys and girls in Kudan LGA of Kaduna State revealed that there is no significant difference between the anxiety level of secondary school boys and girls with P-value of 0.49 > 0.05 implying that no significant gender disparity was found on anxiety

level among the Secondary School Chemistry Students in Kudan (P = 0.49 > 0.05), which is statistically insignificant as shown in Table 4.

**Table 4: Summary of t test analysis in the Level of Chemistry Anxiety between Males and Females in Secondary School Chemistry Students in Kudan, Kaduna State**

| Gender | N | | S.D | df | t-cal | t-crit | *p* | Remark |
|---|---|---|---|---|---|---|---|---|
| Boys | 122 | 34.79 | 5.16 | | | | | |
| | | | | 224 | 0.49 | 0.14 | 0.49 | N.S |
| Girls | 104 | 34.54 | 4.81 | | | | | |

*Not Significant at P ≤ 0.05, (P = 0.49 > 0.05) is statistically insignificant

The analysis of the disparity in anxiety levels revealed a marginal difference between boys and girls in secondary schools within Kudan Local Government Area of Kaduna State. Specifically, males exhibited a mean score gain of 0.25 compared to their female counterparts. Examination of the mean scores indicated that boys had a slightly higher average compared to girls. To ascertain the significance of this difference, an independent t-test was conducted at a 0.05 level of significance, as illustrated in Table 5.

**Table 5: Difference in the Level of Chemistry Anxiety among Males and Females in Secondary Schools in Kudan local government area, Kaduna state**

| Gender | N | Mean | S.D | Mean Difference |
|---|---|---|---|---|
| Males | 122 | 34.79 | 5.16 | |
| | | | | 0.25 |
| Females | 104 | 34.54 | 4.81 | |

## Discussion

This study focused on assessing the causes and levels of anxiety among senior secondary school students in Kudan LGA, Kaduna State, Northern Nigeria. The investigation identified several causes of chemistry anxiety, such as the perceived complexity of the subject, students' innate fear, insufficient teaching aids and poorly equipped laboratories, and limited exposure to practical work until nearing entrance examinations (as indicated in Table 2). These findings parallel the work of Woldeamanuel *et al*. (2013) in Ethiopian Universities, where 96% of respondents expressed fear of chemistry due to extensive calculations, and 75% cited inadequate laboratory conditions. About 72% of these students reported minimal exposure to practical work until final exams, aligning with previous studies indicating that scientific anxiety stems from various factors including classroom activities, examination stress, perceptions of the subject, teacher attitudes, and parental influences (Kaya & Yildirim, 2014).

Moreover, this research revealed the presence of chemistry anxiety among senior secondary II chemistry students in Kudan LGA, Kaduna State. Similar findings were reported by Mazzone et al. (2007), who observed an average of 65% anxiety among students, exceeding normal anxiety symptoms, potentially affecting their normal functioning. Syokwa *et al*. (2014) also found high anxiety levels (79%) among students in Lang'ata district, Kenya, supporting these findings.

Surprisingly, this study found no significant gender disparity in anxiety levels among Secondary School Chemistry Students in Kudan LGA, Kaduna State ($P = 0.49 > 0.05$), indicating statistical insignificance. This finding contradicts traditional beliefs suggesting that boys exhibit less anxiety in pursuing academic achievements compared to girls. However, this lack of disparity might be attributed to challenges in comprehending technical terms in Chemistry, requiring skilled teachers to translate or explain these concepts from English to the indigenous language of suburban students. These outcomes align with Crişana & Copacib's (2015) research showing no significant difference in anxiety levels between school boys and girls. Similarly, Afolayan *et al*. (2013) found no significant relationship between gender and academic anxiety among Niger Delta University students (P-value = 0.54). Conversely, Mazalan et al. (2015) reported contrasting results, indicating that males exhibited lower anxiety than females, suggesting a positive correlation between gender and anxiety levels (60% for females and 40% for males) among International Islamic University Malaysia students.

## Conclusion

The research findings highlight a strong positive correlation between the identified causes of anxiety and the level of anxiety experienced by students. Factors such as the demanding nature of the subject's content, inadequate infrastructure and teaching materials, and limited practical engagement in Chemistry exhibit a direct association with decreased academic performance and a waning interest in studying Chemistry, potentially deterring students from pursuing related courses in the future. Furthermore, the study revealed no significant disparity in the level of chemistry anxiety between boys and girls in Secondary Schools within Kudan Local Government Area, Northern Nigeria. As a recommendation, it is advised that Secondary School educators in Kudan, as well as across Nigeria, address chemistry anxiety by implementing collaborative and active learning methodologies. Strategies involving interactive teaching methods, the integration of animated learning materials, and fostering a supportive learning environment can help alleviate student anxiety and enhance their engagement and understanding of Chemistry. These efforts aim to reduce anxiety levels among learners and foster a more conducive atmosphere for studying chemistry.

## Recommendation

It is recommended that Chemistry teachers in senior secondary schools cultivate a positive and engaging classroom atmosphere. Encouraging an optimistic approach within the learning environment can foster students' interest in Chemistry. Additionally, to alleviate Chemistry anxiety, there should be a focus on providing essential infrastructure and adequate materials necessary for effective teaching and learning of the subject. Employing experienced educators who utilize diverse and student-friendly teaching methodologies can significantly impact students' comprehension. Incorporating ethno-chemistry, or relating Chemistry concepts to students' cultural contexts, can enhance understanding and mitigate anxiety surrounding the subject. These steps aim to create a supportive and comprehensible learning environment that helps students overcome anxiety and engage more effectively with Chemistry.

# APPENDICES

## Appendix A

**Reliability test results of ACASQ (Assessment of chemistry anxiety among senior secondary school questionnaire)**

| Case Processing Summary | | | |
|---|---|---|---|
| | | N | % |
| Cases | Valid | 39 | 97.5 |
| | Excluded[a] | 1 | 2.5 |
| | Total | 40 | 100.0 |
| a. Listwise deletion based on all variables in the procedure. | | | |

| Reliability Statistics | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| 0.798 | 0.798 | 30 |

## Appendix B:

**Reliability test results of CAS (Chemistry anxiety scale )**

| Case Processing Summary | | | |
|---|---|---|---|
| | | N | % |
| Cases | Valid | 42 | 97.7 |
| | Excluded[a] | 1 | 2.3 |
| | Total | 43 | 100.0 |
| a. Listwise deletion based on all variables in the procedure. | | | |

| Reliability Statistics | | |
|---|---|---|
| Cronbach's Alpha | Cronbach's Alpha Based on Standardized Items | N of Items |
| 0.667 | 0.693 | 12 |

## APPENDIX C:

## ASSESSMENT OF CHEMISTRY ANXIETY FOR SENIOR SECONDARY SCHOOL STUDENTS QUESTIONNAIRE (ACCASQ)

I am a postgraduate student from the Directorate for professional diploma in Education, Federal College of Education, Zaria. I am carrying out a study on assessment of chemistry anxiety level in Kudan local government of Kaduna state. You are therefore selected to participate in the research to determine the causes of chemistry anxiety among secondary school students. This is essentially an academic research exercise and your responses will be treated confidentially.
Thank you.

Hauwa Salisu Usman
EZ/17/PDE/D/072

Biodata
School name :
LGA:
SEX : MALE [ ] FEMALE [ ]
Age: 14-20yrs [ ] 21-30 yrs [ ] 30 yrs and above [ ]
Class:
Instructions:

Following each of the 30 statements below, please tick the option that best fits your belief. Please answer truthfully, the results will be kept confidential.
SA= Strongly Agree A = Agree U = Undecided D = Disagree SA = Strongly Disagreed

**CAUSES OF CHEMISTRY ANXIETY**

| Item | Statement | SA | A | U | D | SD |
|---|---|---|---|---|---|---|
| 1 | I have a natural fear for chemistry subject | | | | | |
| 2 | I perceive chemistry as unreal and strange | | | | | |
| 3 | I experience difficulty in explaining scientific laws in my own words | | | | | |
| 4 | I feel tired or easily exhausted during chemistry lessons | | | | | |
| 5 | I feel detached or disengaged during chemistry lessons | | | | | |
| 6 | I feel afraid and insecured when writing my chemistry assignments | | | | | |
| 7 | I panic before/ during a chemistry test | | | | | |
| 8 | I get confused and mix up answers during a chemistry test | | | | | |
| 9 | I recall the correct answers after am out of the test/examination hall | | | | | |
| 10 | I experience fear that something bad is about to happen when awaiting my Chemistry test/examination results | | | | | |

| | |
|---|---|
| 11 | I am afraid that having a poor grade in Chemistry might affect my future career |
| 12 | I am afraid of disappointing my parents because they want me to offer chemistry and be in Science |
| 13 | Chemistry syllabus is too wide |
| 14 | Chemistry has too many concepts or ideas |
| 15 | Chemistry demand too much calculations |
| 16 | Chemistry requires the learning of too many unrelated facts |
| 17 | I am afraid of my Chemistry teacher |
| 18 | Chemistry teachers are too thorough in their assessment |
| 19 | I am afraid of criticism or disapproval from my Chemistry teacher when submitting chemistry assignments |
| 20 | I am afraid of the harmful effects of chemicals and reagents |
| 21 | My friend's opinions always make me to believe that chemistry is a difficult subject |
| 22 | I am concerned about looking foolish or inadequate in front of others when confronted with chemistry assignments |
| 23 | Chemistry is easier for males |
| 24 | Chemistry is more difficult for females |
| 25 | My chemistry teacher does not use teaching aids while teaching |
| 26 | My chemistry teacher lacks the ability to simplify chemistry topics while teaching |
| 27 | My chemistry teacher does not cover the whole syllabus /curriculum for the term |
| 28 | Students are not exposed to chemistry practicals until the final certificate examination approaches |
| 29 | My school's chemistry laboratory does not have enough equipment |
| 30 | My school's chemistry laboratory lacks the required chemical and reagents for practicals |

End of questionnaire. Thank you!

## APPENDIX D:

## CHEMISTRY ANXIETY SCALE (CAS)

Biodata
School name :
LGA:
SEX : MALE [ ] FEMALE [ ]
Age: 14-20yrs [ ] 21-30 yrs [ ] 30 yrs and above [ ]
Class:

Instructions:

Following each of the 12 statements below, tick how ANXIOUS you feel about each statement . Please answer truthfully, the results will be kept confidential.

VHA = Very high anxiety, HA = High Anxiety , U = Undecided , LA = Low Anxiety and VLA = Very Low Anxiety

| S/N | Item | VHA | HA | U | LA | VLA |
|---|---|---|---|---|---|---|
| 1 | Entering Chemistry lessons | | | | | |
| 2 | Using Chemicals in Chemistry | | | | | |
| 3 | Using equipment in Chemistry | | | | | |
| 4 | Preparing for Chemistry lessons | | | | | |
| 5 | Working with other students in Chemistry classes | | | | | |
| 6 | Making an experimental set-up in Chemistry Lab | | | | | |
| 7 | Having little time for doing an experiment | | | | | |
| 8 | Presence of chemicals around me in Chemistry lab | | | | | |
| 9 | Preparing a solution with required concentration in Chemistry | | | | | |
| 10 | Identifying equipment and materials required for an experimental setup | | | | | |
| 11 | Recording data in Chemistry | | | | | |
| 12 | Interpreting data obtained in Chemistry | | | | | |

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