

APPLICATION OF CHEMISTRY MASTERY TEST AND PERFORMANCE OF SENIOR SECONDARY ONE STUDENT (SSS1) IN FEDERAL GOVERNMENT COLLEGES IN RIVERS AND BAYELSA STATES**NGOZI, B. EBERE****DEPARTMENT OF EDUCATIONAL PSYCHOLOGY, GUIDANCE & COUNSELLING,
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UNIVERSITY OF PORT HARCOURT, RIVERS STATE, NIGERIA****Abstract**

This study is on Application of Chemistry Mastery Test and Performance of Senior Secondary One students (Sss1) In Federal Government Colleges in Rivers and Bayelsa States. The study adopted the descriptive research design. The population for this study is made up of all 1701 SS1 students from Unity schools in Rivers and Bayelsa State. A sample size of 400 SS1 students was drawn for the study using multi-stage sampling technique. The instrument for data collection is the Chemistry Mastery Test (CMT) which was used for data collection. Each item in the CMT tested student's ability to define, recognize, explain, analyze or synthesize a problem. Validation of the instrument was done using table of specification, research experts and convergent validation process. A convergent validity index of 0.87 was realized indicating similarities in high correlation between already established instruments. In terms of reliability, Kuder Richardson formula 20 was used to analyze the items. A reliability coefficient of 0.79 was realized indicating that the instrument is highly reliably. The Angoff method was used in analyzing research question one while t-test was used in analyzing research question 5 and 6 with their corresponding hypotheses. Finally, ANOVA was used to analyze research question seven and its corresponding hypotheses. All the hypotheses were tested at 0.05 alpha levels. Result of the study shows that mastery cut-off was 60% and 264 students were categorized as masters whose scores were above 60% mark while 136 were categorized as non-masters who fell below the cut-off mark. Also, there is a significant difference in the mean performance of students by gender ($p=0.00<0.05$) and location ($p=0.009<0.05$). On the other hand, there was no difference ($p=0.19>0.05$). Recommendation based on the findings amongst others was that Students should be seen as having mastery over chemistry test only when their performance is above 60%.

Keywords: Performance, Chemistry,

Introduction

There are serious indications that Science and technology advances are evident in every facet of our society. Nja, Cornelius-Ukpepi, Edoho and Neji (2020) stated that this can be seen even in the local as well as modern society. It can be found in the health care delivery system where humans no longer rely on herb for treatment of diseases and man has come to terms with the fact that diseases are not caused by only

purely means. Ojukwu (2016) stated that education helps individuals to adapt to a new environment. In Nigeria, education is seen as the only means of getting to the top hierarchy in any endeavor. Thus, poor academic performance usually brings about sadness and frustration to the individual concerned and to his/her parents as well as other members of the family. As a matter of fact, it gives parents and students feelings of satisfaction and joy when children excel

academically (Fehintola, 2009). To this end, the importance attached to good academic success or performance by the students as well as their parents and the difficulty experienced by these students have resulted in wide-spread failures, low grades, examination malpractices, cheating, and so on. These are the cases with the students taking the Senior Secondary Certificate Examination (SSCE) of the West African Examination Council (WAEC) and National Examination Council (NECO) (Ojukwu, 1994).

According to Ababio (2015), Chemistry as a branch of science deals with matter, its properties, structures, composition as well as its uses. Chemistry is seen as a branch of science which deals with the study of the nature, composition and properties of matter and the changes matter may be subjected to under different conditions. Following the authors above, the researcher sees Chemistry as the branch of science that deals with the study of matter and all that affect matter. Chemistry is one of the subjects taught in the senior secondary schools in Nigeria. It is one of the science subjects offered by science students in the Senior Secondary Schools Certificate Examination (SSCE), National Examination Council (NECO), National Business and Technical Examination Board (NABTEB) and Joint Admission and Matriculation Board (JAMB) for candidates wishing to study sciences, medicines, pharmacy and other related science courses in Nigerian Universities, Polytechnics, Colleges of Health Sciences and School of Nursing. "Chemistry is the mother of all sciences"

Chemistry as a global part of human activities is characterized by chemical reactions going on around us and within complex system within our bodies. For example as anyone sits down at his computer and begins to type his body

undergoes a huge amount of chemical reactions to make his eyes and hands move, and to make his brain think.

Chemistry is viewed as an important subject because it is associated with more academic and career opportunities (Jayanthiet' al. 2014), while Okereke and Ugwuegbulam (2014) have the opinion that chemistry prepares and stimulates the learner of all the science subjects, Chemistry is vital for preparing scientists and technologists both at middle and upper manpower levels. Chemistry is one of the basic sciences which are essentially the pre-requisites for technological breakthrough. Hence, the need for effective Chemistry education in Nigeria appears very crucial and therefore, demands considerable attention. For instance, Chemical Technologists and Technical workers are needed in all those Chemistry-related fields mentioned above.

In the higher manpower requirement, 18 experts are needed in chemical engineering. These fields cannot be effectively studied without Chemistry as it serves as pre-requisite to them. This implies that Chemistry is an important science subject needed for higher education in virtually all the science related professions such as Medicine, Pharmacy, Agriculture, Engineering, food and nutrition.

So these aspects of the importance of Chemistry explain why schools, governments, students and parents are worried over students' poor achievement in Chemistry in senior school certificate examination. Chemistry is one of the most important disciplines in the school curriculum; its importance in the general education has world-wide recognition. It is worth to emphasize that the field of chemistry, science and technology are related to the economic heart of every highly-developed, industrialized and

technologically advanced society (Burmeister, 2012). Teaching and learning of science have significant roles towards technological development in a developing nation since chemistry is embedded in our life and society, economical, ecologic and societal influences (Hofstein 2011). The performance is also measured through the result of a particular subject like Chemistry (Hijazi & Naqvi, 2006).

As noted earlier, chemistry is an important school subject and its importance has been widely reported through the applications of principles in scientific and technological development of any nation (Asiyai, 2005). The importance of Chemistry to humanity cannot be over-emphasized (Anne, 2005). According to Smita as cited in Jason (2013), the three basic needs of human namely food, shelter and cloth are made by chemical processes using chemicals and fibres. This therefore, means that Chemistry is always present around us and it is involved in the manufacture of all man-made objects and things. Chemistry is required for variety of science and technology degrees, including all medical-related fields, engineering, and science majors.

However, in spite of the strategic position occupied by Chemistry in sciences and other disciplines, the performance of students in the subject has been observed not to be encouraging over the years. Studies (Nbinna, 2012, Ojerinde, 2013) have shown that the performance of Nigerian students in the subject is poor.

Chemistry has contributed greatly and is still contributing towards providing our basic needs and improving the quality of our life. The usefulness of chemistry is in food production. Fertilizers and insecticides have helped to increase food production greatly. Chemical processes are designed

especially to preserve and store food for long periods, so that it can be exported to distant countries and is available to more people. Again clothing, man-made textile fibers, produced as a result of intensive chemical research, have made available a wide range of clothing materials, which can be bought cheaply.

Chemistry contributes to the discovery and description of the theoretical bases for the behavior of chemical substances such as explosives used by the military. The gun-powder used in the earliest guns was made by mixing sulphur, charcoal, and potassium trioxonitrates (v), compounded by early Chemists (Ababio 2015). Building and housing are been constructed by materials like cement, concrete, steel, bricks and tiles which are produced by chemical industries. These are applications with the use of knowledge of chemistry.

The healthy life that many of us enjoy today is due to the variety of medicines that are available as a result of chemical research and technology. The pharmaceutical firms have been researching on new and better drugs for peoples' health. Modern transportation is an essential feature of today's world. This rapid development from carts pulled by animals to the latest aircraft was made possible by chemists producing suitable fuels and structural materials like alloys which are light, strong and heat-resistant. These principles are not just applied in our urban areas, even in our local villages Chemistry is been practiced.

For example, in most villages, local soap is made from ashes of burnt palm fruits fibers, often people in the rural areas use alum to purify their drinking water, virtually all the cooking practices are based on the phenomenon of chemistry. Considering the necessity of chemistry to human life, this

subject is highlighted as an important choice for learners who wish to have their careers in Medicine, Engineering, Pharmacy, Nursing etc. Chemistry is an important subject to consider for successful science oriented examinations that may lead to award of certificates like West African School Certificate (WASC), National Examination Council (NECO), National Business and Technical Examination Board (NABTEB).

The importance and application of Chemistry as a major pre-requisite for the attainment of national development have been recognized worldwide. In Nigeria, as well as in most developing countries, Chemistry is considered as an important subject and is taught in the senior secondary school level. Chemistry occupies a very important position in plants, animals and the life of man and society in general. Furthermore, applications of chemical sciences have contributed significantly to the advancement of human civilization. With a growing understanding and ability to manipulate chemical molecules, the post-World War II Chemist was considered a societal problem solver. They synthesized crop-enhancing agricultural chemicals to ensure a constant and viable food supply. They played a significant role in the eradication of deadly diseases by developing life-saving pharmaceuticals and chemical pesticides.

Chemists also developed innovative plastics and synthetic fibers for industrial and domestic use. In the scope of this subject, Chemistry occupies an intermediate position between Physics and Biology. It is sometimes called the central science because it provides a foundation for understanding both basic and applied scientific disciplines at the fundamental level. Nwaogugwu (2004) reported that Chemists are used as public analysts in

ministry of health to examine food manufactured locally and imported to certify them for human consumption. Chemistry plays a pivotal role in engineering, sustainable economic development and growth in any nation. In fact there is no aspect of human endeavor on natural phenomena that Chemistry does not feature. It features prominently in the areas of oil and gas, agriculture, health, environment, solid minerals, textile, cosmetics, water supply, sanitation, crime detection, paper, waste management (Adamu, Boris, & Kenni, 2013).

Chemistry plays important role in enhancing the quality of teaching and research as well as ensuring that students are equipped with good knowledge to produce intensive goods and services to meet human needs for food, health care products and other materials aimed at improving the quality of life. Every single material thing in the universe is chemical and the ability to understand and manipulate these chemicals is responsible for everything from modern food and drugs to plastics and computers.

Chemistry education is needed in the professional development of chemical industries required in the establishment of modern technology and operation of chemical industries. Presently, man is experiencing an era in scientific and technological development that affects his life in one way or the other.

A Chemistry Mastery Test (CMT) is a test designed to measure students' mastery of the meaning of Chemistry such as properties, structures, composition, chemical symbols, and uses of matter. The mastery learning is more work for teachers, especially in the beginning, as the intended class is the foundation class (SS1) the teacher needs to decide what is absolutely

essential to be mastered, creates parallel forms of mastery test, invents activities and scoring keys for mastery of performances and enrichment activities, organizes and orders units or lessons to facilitates transfer of learning, publishes and able to defend the grading scheme.

Chemistry mastery test can be influenced significantly by students', teachers', parents' and their socio-economic status. Today, most teachers after assuming to have covered the chemistry curriculum will resorts to assessing students with unreliable chemistry mastery test that lack psychometric properties. Most teachers hurriedly copy questions from any past question papers to compose their final examination mastery test. This implies that teachers do not establish validity and reliability for such test.

According to Omoruan (2017), Mastery Testing is based on the Criterion-Referenced Tests (CRT) measurement category that satisfy the demands on the construction, frequency of testing, scoring and analysis of educational tests that are different from the traditional measurement known as Norm-Referenced Tests. Mastery tests are therefore developed to assess each student at the end of a small learning unit to provide teachers and students with quick feedback. Such tests are meant to separate students who mastered the unit from those who did not.

Hambleton and Eignor in Guskey (2010) define a mastery or competency test as the test that is directed at determining an examinee's level of performance about each competency being measured. Competency means not only learning content, but also the ability to apply that content to solve problems or communicate about it. Competency-based learning identifies specific and measureable learning objectives

that students must master before moving ahead. Competency-based learning is a student-centered method of teaching and learning that focuses on mastering specific skills or standard rather than completing course work over a specific period of time, (Guskey, 2010). A student's achievement on a test in this case chemistry mastery test for SS1 (CMT), could be termed "master"/competent". The student could be rated thus when his or her scores on the set of test items included in the competency test are equal to or above the prior-set mastery (criterion) score. Consequently, a student will be termed "non-master"/non-competent" when his or her scores on the set of test items included in the competency test are below the prior-set mastery (criterion) score.

Applications of mastery tests are keyed to specific instructional objectives, and they are diagnostic in nature. They involve a prior judgment as to acceptable performance levels and whether or not an individual student has attained this performance level. A class teacher who intends to apply a CRT to enhance students' mastery in any subject, particularly in chemistry, first sets a criterion scores for the separation of students into mastery and non-mastery groups. The students select a learning unit from appropriate curriculum embedded objectives. Hence, a unit post-test is given to the students. This is the process of formative test or a diagnostic-progress test (Omoruan 2017).

The test is designed to cover the objectives over the unit of instruction taken. According to Omoruan, if a student happens to pass all skills in the unit taken, the student then has free study time or tutoring others. At the end, the student is allowed to take the next or subsequent unit(s). If the student is successful in all units of instruction, the

student is allowed to take the final (summative) test, based on curriculum testing. This is a mastery test based on student's position on the ability continuum and not about other students in the course; such testing gives constant feedback and information to the teacher about the students' progress. The students who were unable to meet the criterion score(s)/sets (non-masters) will be given an additional learning.

Based on the usefulness of mastery based test as complimentary to the normal testing in chemistry, mastery based test is student-centered method of teaching and learning that focuses on mastering specific skills or standard rather than completing course work over a specific period of time. In mastery testing, students continue to work in specific skills or knowledge until they can demonstrate their understanding and the ability to apply them. Again, this mastery based test can motivate passive students who do not learn well in traditional/normal classroom to learn well (Guskey, 2007).

Academic performance of students relates to the extents individuals perform in the course of carrying out academic activities or programmes. Academic performance cannot be said to be consistent. That is, it can vary depending on circumstances, situations and even at times to the individual students involved. It is noted by Lassiter (1995) that student's academic performance is the outcome of education, it is the extent which a student has achieved educational goals. Academic performance relates to the degree of efforts which students put towards academic success.

Furthermore, students' academic performance may vary significantly across subjects depending on some hidden factors. According to Bell (2011), "even when

academic performance can be influenced by circumstances regarded as environments, the individual student has to determine if it is good or bad". On the whole, the concept of academic performance can only be viewed based on some factors surrounding it.

Performance in school is evaluated in a number of ways. For regular grading, students demonstrate their knowledge by taking written or oral test, performing presentations, turning in homework and participating in class activities and discussion. In the secondary school systems in Nigeria, Obinna (1998) noted that students are being evaluated through home works, assignments, test, examinations, etc. In terms of students' performance in chemistry, it is noted that students perform differently upon application. While it is observed that some students will perform significantly well, some on the other hand may fail to attain some level of mastery.

The consequences of poor performance of students in Chemistry are enormous. The performance of students in Chemistry at the lower level has been poor (Ebuoe, 2016). As a result of the poor performance, when they get to senior secondary school three (SS3) they may as well perform poorly especially in public examinations due to lack of understanding of chemistry concepts. It is suspected that lack of proper understanding of Chemistry concepts at lower level such as Senior Secondary one (SS1) accounts for low performance in the subject when faced with external examination like West African Examination Certificate (WAEC), National Examination Council (NECO) and National Business and Technical Examination (NABTEB).

Furthermore, it is seen that there is employments of unqualified teachers who

only struggle with the theoretical aspects of the subject and deliberately dodge the practical sessions because of lack of knowledge in the subject area. It could be true that chemistry as a subject seems abstract and challenging to students at lower level when there is low emphasis on practical session and more emphasis on theoretical approach thereby making the students to develop low interest in the subject that make them perform lowly when faced with external examinations where both practical and theory are needed. This attitude of not exposing SS1 students who are the foundation class to laboratory practical work in the subject is quite unfortunate for SS1 students and the society in general.

With the identification of mass failure of students in Chemistry in public examinations due to poor foundation arising from lack of understanding of Chemistry, the point to ponder is that it could be as a result of lack of adequate measuring instruments. Further, there is also an observed disparity in terms of the performance of the students from various demographic settings. This may have also contributed to school dropout as well as zero interest in the subjects. This has created a wide gap between what should be in terms of student's performance in chemistry and what is actually on ground. Hence, the problem of the study is, are there certain factors that affect the applicability and performance of these students in chemistry? This unanswered question which has continued to create problems for students formed the gap which the current study seeks to address.

Aim and Objectives

In the light of this, this paper aims at the application of Chemistry Mastery Test and the observation of student's

performance. In specific terms, the study intends to;

1. Determine the attainment base (cut-off scores) of Chemistry Mastery Test (CMT) for detecting mastery and non-mastery students.
2. To determine if there is gender differences in the mean scores of students on Chemistry Mastery Test (CMT).
3. To determine if there are differences in the means scores of students from various location on Chemistry Mastery Test (CMT).
4. To determine the means scores of students' academic performance on Chemistry Mastery Test (CMT) based on their parental education level.

Research Questions

The following research questions guided the study:

- What is the attainment base (cut-off scores) of Chemistry Mastery Test (CMT) for detecting mastery and non-mastery students?
- What is the difference between the mean scores of male and female students on Chemistry Mastery Test (CMT)?
- What is the difference in the mean scores of urban and rural students on the Chemistry Mastery Test (CMT)?
- What is the difference in Chemistry Mastery Test (CMT) mean scores of students from different parental educational level? Based on their parental education level?

Research Hypotheses

The following hypotheses corresponding to research question 2, 3 and 4 were formulated to guide the study;

1. There is no significant difference in the mean scores of male and female

- students in Chemistry Mastery Test (CMT).
2. There is no significant difference in the mean scores of students from urban and rural students mean score in Chemistry Mastery Test (CMT).
 3. The scores of students from different parental educational level in Chemistry Mastery Test (CMT) do not differ significantly

Methodology

The study adopted the descriptive research design. Nwankwo (2006), noted that “descriptive research design involves collecting and analyzing data from some variables which are already in place (without manipulating any of them) in order to find out how some of them influence, or are related to other variables”. This design is important to this study as the effects of gender, school location, and parental-level of education. The researcher also stated that the independent variables on SS1 students’ mastery of chemistry skills cannot be directly manipulated in this study. The study was conducted in Rivers and Bayelsa States of Nigeria. Both states are located in Niger Delta or South-South Geo-Political zones. Bayelsa state was created out of Rivers state in 1987. By statistics, Rivers and Bayelsa States are two of the six States in the South-South Geo-Political Zones of Nigeria experiencing poor performance in Chemistry in the external examinations.

In West African Examination Council May June 2012 results statistics by Rivers and Bayelsa States had poor performances in chemistry. This made the researcher to embark on this work. The population for this study was made up of all 1701 SS1 students in Unity schools in Rivers and Bayelsa State, Nigeria. This included students from Federal Government College Rumuokoro Port

Harcourt (FGC), Federal Government Girls College Aboluma, (FGGC), Federal Science and Technical College Ahoada (FSTC), Federal Government College Odi, (FGC), Federal Government Girls College, Imiringi, (FGGC) and Federal Science and Technical College, Tungbo (FSTC) in Bayelsa State. This population was used because as at the time of the study, they could provide adequate data needed to complete the study. From this population, a sample size used for the study is 400 SS1 students were drawn for the study using drawn multi-stage sampling technique. First, census sampling techniques was used to sampling all the federal colleges in both Rivers state and Bayelsa states.

Also, the researcher used Taro Yemen formula to determine the size using the formula, $n = N/1+N(e)^2$, where n = corrected sample size, N = population size and e = margin of error ($e = 0.05$ based on the research condition). This gave a total of 324. However, since this was the minimum sample, the researcher increased the number to 400. Finally, the non-proportionate sampling technique was used to draw 67 students from each of the six schools in both Rivers and Bayelsa States. This gave a total of 402 students. The instrument for data collection was the Chemistry Mastery Test (CMT) which was used for data collection. Each item in the CMT tested student’s ability to define, recognize, explain, analyze or synthesize a problem. The instrument was made up of two sections A and B. Section A was designed to elicit personal information from the respondents such as age, gender, school location, parental level of education, while section B contained objectives-based instructional programmes for diagnosing students’ learning deficiencies in mastery.

This contained 56 items with 4-options (multiple-choice) Chemistry Mastery

Test (CMT). Validation of the instrument was done using table of specification. Also, the researcher also gave the instrument to subject specialist for face validity to check for errors in spelling of concept etc. Thereafter, the researcher reviewed the items in line with the experts and subject specialist advice and comments. Furthermore, validation of the instrument was also done using convergent validation process. Copies of CMT were given to a sample of 25 students drawn using simple random sampling process. The researcher administered the instrument alongside the Chemistry Mastery Test (CMT) of Ayibapiriyekkon (2019). The two instruments were collated and correlated. A convergent validity index of 0.87 was realized indicating similarities in high correlation between already established instruments.

In terms of reliability, the researcher administered the instrument to 30 respondents who were not part of the original population. After their response, Kuder Richardson formula 20 was used to analyze the items. A reliability coefficient of

0.79 was realized indicating that the instrument was highly reliably. In terms of scoring, the instrument was dichotomously scored, that is 1 mark for right response and zero for wrong response. The final score for an individual was the total number of correct answer. The researcher gave the final score for each individual to enable the researcher to determine mastery state of each student in the CMT skills according to gender, school location and parental-level of education.

Finally, the Angoff method was used in analyzing research question one while t-test was used in analyzing research question 5 and 6 with their corresponding hypotheses. Finally, ANOVA was used to analyze research question seven and its corresponding hypotheses. All the hypotheses were tested at 0.05 alpha levels.

Results Presentation

Research Question One:

What is the attainment base (cut-off scores) of Chemistry Mastery Test (CMT) for detecting mastery and non-mastery students?

Table 1.1: Shows Angoff method of attainment base determination as rated by 5 judges

Item S/N	JUDGE 1	JUDGE 2	JUDGE 3	JUDGE 4	JUDGE 5	AVERAGE SCORE
1	50	60	50	55	50	53
2	45	45	50	40	40	44
3	50	60	75	70	65	64
4	65	70	60	65	50	62
5	55	45	50	50	40	48
6	40	50	65	50	45	50
7	40	45	45	50	50	46
8	50	60	55	40	60	53
9	55	35	55	40	40	45
10	40	35	40	40	55	42
11	50	45	55	50	45	49
12	65	50	45	50	45	51

13	50	60	50	85	60	61
14	40	45	50	50	45	46
15	55	45	40	35	50	45
16	60	70	85	70	70	71
17	75	70	55	85	70	71
18	70	85	70	75	85	77
19	50	45	40	40	50	45
20	60	85	65	60	70	68
21	50	40	35	40	45	42
22	50	45	40	40	45	44
23	70	70	70	70	75	71
24	70	65	70	70	80	71
25	85	50	85	85	55	72
26	75	70	56	55	78	67
27	45	85	80	70	70	70
28	50	60	75	70	65	64
29	65	70	60	65	50	62
30	55	70	85	50	80	68
31	90	85	65	70	65	75
32	70	75	85	70	60	72
33	70	70	60	70	70	68
34	40	45	30	45	50	42
35	70	70	70	55	85	70
36	85	85	85	70	75	80
37	55	56	70	70	65	63
38	45	35	45	55	40	44
39	30	75	55	50	40	50
40	40	45	40	45	40	42
41	50	85	70	70	70	69
42	70	65	65	70	70	68
43	85	85	50	85	85	78
44	60	75	60	80	55	66
45	70	70	70	85	85	76
46	50	56	40	40	50	47
47	55	65	55	70	70	63
48	70	50	70	70	85	69
49	50	45	50	40	35	44
50	65	80	65	60	70	68
51	50	60	50	85	60	61
52	70	85	70	60	85	74
53	40	40	50	45	30	41
54	60	70	85	70	70	71
55	45	55	65	50	40	51

56	70	85	70	75	85	77
Average Mean						60

As noted above, in determining the cut-off score using Angoff method, each of the experts examined every item on the test, with regards to item content, in order to determine the maximum number of items an examinee must answer correctly in order to be considered in the mastery group. The sum of the percentage across the set of items was computed by the five experts and the average of the scores across all the experts were used to establish a minimally acceptable performance for the CMT. A cut-off score of 60% was reached for the CMT.

Based on this cut-off, the table below shows the number of students that met this criterion. This was the basis of classification

of the student into mastery and non-mastery groups and the classification in summary produced 264 students were categorized as masters whose scores were above 60% mark while 136 were categorized as non-masters who fell below the cut-off mark.

Research Question Two:

What is the difference between the means scores of male and female students on the Chemistry Mastery Test (CMT)?

Hypothesis One:

There is no significant difference between male and female students' mean score on the Chemistry Mastery Test.

Table 1.2: Shows t-test analysis of the difference between male and female students' means score on the Chemistry Mastery Test.

Gender	N	Mean	Std	df	Mean Diff	α	t-cal	Sig.	Result
Male	188	43.14	6.76	398	3.64	0.05	4.87	0.000	Significant (Reject H0)
Female	212	39.50	8.04						

From the analysis in the table above, it is revealed that male were 188 while females were 212. Their mean and standard deviation values were 43.14; 6.76 and 39.50; 8.04 respectively. This means values show that male respondents though less in number had higher mean score than the female respondents. This created a mean difference of 3.64. Calculated t value was 4.87 while sig. value was 0.000. Hence, since sig. ($p=0.000<0.05$) is less than 0.05 alpha at 398 degrees of freedom, the null hypothesis is rejected meaning that there is a significant

difference between male and female means students mean score on the Chemistry Mastery Test.

Research Question Three:

What is the difference between the means scores of urban and rural students on the Chemistry Mastery Test (CMT)?

Hypothesis Two:

There is no significant difference between urban and rural students mean score on the Chemistry Mastery Test.

Table 1.3: Shows t-test analysis of the difference between male and female means students mean score on the Chemistry Mastery Test

Location	N	Mean	St.D	Df.	Mean	α	t-cal	Sig.	Result
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		Diff						
Urban	235	42.05	6.69					
				398	2.04	0.05	2.63	0.009
Rural	165	40.01	8.77					Significant (Reject H0)

From the analysis in the table above, it is revealed that respondents from urban areas were 235 while those from rural areas were 165. Their mean and standard deviation values were 42.05; 6.60 and 40.01; 8.77 respectively creating a mean difference of 2.04. The mean values also show that students from urban areas perform better than those in the rural areas. Calculated t value was 2.63 while sig. value was 0.009. Hence, since sig. ($p=0.000<0.05$) is less than 0.05 alpha at 398 degrees of freedom, the null hypothesis is rejected meaning that

there is a significant difference between the mean scores of rural and urban students on the Chemistry Mastery Test.

Research Question Four:

What is the difference in the CMT mean scores of students from different parental educational level?

Hypotheses Three:

The scores of students from different parental educational level does not differ significantly.

Table 1.4: Shows One-Way ANOVA of the difference in CMT scores of students based on parental educational level

Educational Level	N	X	St.D
Below B.sc	164	41.63	6.71
B.sc/B.ed/Equiv	84	39.86	9.49
Masters & Above	152	41.49	7.49

ANOVA						
	Sum of Sq.	d.f	Mean Sq	F	Sig	Result
Between Group	195.450	2	97.72			Insignificant
Within Group	23306.328	379	58.70	1.67	0.19	(Retain Ho)
Total	23501.77	399				

The table shows that respondents with Below B.sc, B.sc/B.ed/Equiv and Masters and above were 164, 84 and 152 respectively. Their means values were 41.63, 39.85 and 41.49 respectively. The mean values show that respondents whose parents have Below B.sc scored highest in CMT followed by those whose parents have Master’s degree and lastly by those whose parents have B.sc and its equivalent. Summary of the ANOVA shows calculated F of 1.67 and sig. value of 0.19. Hence, since

sig. ($p = 0.19 > 0.05$) is greater than .05 alpha, the null hypothesis is retained meaning the scores of students from different parental educational level does not differ significantly.

Discussions of Findings

The first finding shows that the attainment base or standard scores of the test is 60% as determined by 5 judges using the Angoff method. It shows that in all, 264 students were identified as masters while

136 were identified as non-masters. The method was used here in identifying and classifying these students into mastery and non-mastery. The findings here may come because majority of the students may have studied well as such attain the mastery cut-off score of 60%. On the other hand, it could be that those with minimal scores who were categorized as non-masters did not study much or probably were not exposed to better learning facilities or effective teaching. This study is in agreement with the finding of Otuoku (2009), where he had a standard of minimally acceptable performance of 45%, where he used Contrasting group's method to establish minimally acceptable performance of 45% as cut-off score in the Development and Validation of Mathematics (MT) Test for SS1 Students. The study also coincides with that carried out by Opara and Magnus-Arewa (2017) who reported related cut-off scores of 54% in mathematics using 5 experts.

The study have also revealed through the hypotheses testing evidences that there is a significant difference in the performance of male and female students in CMT. This finding means that gender is a factor that influences the performance of the students. It also implied that the academic performance of the students can be gender relative. That is, either the males performed more than the females or the females performed more than the male. In specific terms, the finding revealed that male had a higher mean scores compared to female students. This finding means that male students are either more attentive to the teachings or have higher attitude in chemistry than the female students.

The present finding may come because most subjects are assumed to be gender sensitive. While (except on rare cases) male students are often observed to

perform better in mathematical related subjects, it is observed that the females are also very good at literal areas. This could be the reason why male students here may have outperformed the females. The finding of the study is not so surprising because just as observed, some subjects could be more gender sensitive than others. The present finding is in line with that reported by Omoruan (2017), who found a significant difference in the performance of male and female students performance in mathematics mastery test. Similarly, Udo and Udofia (2014) also reported significant difference in the performance of male and female students.

The findings also revealed that there is a significant difference in the performance of the students from varied location. This means that where an individual leaves or where the school exist either in the township or rural areas could influence the performance of the students especially in chemistry. This finding may come because while some locations can boast of basic amenities like light in the case of urban areas for further learning, others on the other hand cannot boast of such and this may contribute to why the students' performance vary depending on their areas. This finding is very much expected by the researcher because the means scores have revealed, students in the urban areas or students whose schools in the urban areas are exposed to have more experiences than those in the rural areas. This lack of experience by those in the rural areas may be the reason why they under-perform compared to those in the urban areas. The findings of Omoruan (2017), quoted earlier also revealed that location has significant influence on the performance of the students.

Finally, the finding from the hypotheses also revealed that parental educational status has a significant influence in the performance of the students in Chemistry. This is because there is a significant difference in the performance of the students from various parental educational levels. Specifically, the performance of the students from background whose parents had B.sc and below was significantly higher. This finding however is a little bit surprising to the researcher because to the best of her knowledge, she thought that those with higher educational level should perform better due to the experiences of those parents. The finding of the present study is also in line with that as reported by Garcia (1990) who also reported parental educational level as a factor that determined the performance of the students in school.

Summary of Findings

Based on the analysis of the study, the following findings were made;

- The attainment base or cut-off score of CMT is 60%. As such, 264 students were classified as masters while 136 were classified as non-masters.
- There is a significant difference in the mean performance of male and female students in CMT. Hence, gender has significant influence on the performance of the students.
- There is a significant difference in the mean performance of students from rural and urban areas in CMT. Hence, location has significant influence on the performance of the students.
- There is a significant difference in the mean performance of students from various parental educational statuses. Hence, parental educational

status has a significant influence on the performance of the students.

Conclusion

Mastery of the CMT is strictly on 60% score line, hence, a student's failure to reach this should be regarded as non-mastery instead of mastery. Furthermore, as revealed by the hypotheses evidences, there is major difference in scores of respondents by gender, location and parental educational level which can determine the performance of students for classification of mastery or non-mastery.

Recommendations

Based on the outcome of the study, the following recommendations are made;

1. Students should only be seen as having mastery over chemistry test only when their performance is above 60%.
2. As revealed by the hypotheses results, the female students should be given priority while teaching chemistry so as to help them to know the subject more.
3. While teaching chemistry, more concentration should be given to schools or students in the rural areas as it is revealed that their performance is dwindling.
4. Since parental educational status is a factor in determining the performance of the students in Chemistry, it is recommended that parents should pay more attention to their students. For instance, if they see that their educational status cannot help their children, they should employ people that can teach them. On the other hand, those whose educational status can assist the children, they should use that judiciously in guiding their children.

5. Also, developers or users of CMT should pay special focus on gender, location of the student or school as well as the parental educational status.

References

- Ababio, O.Y. (2015). *New school chemistry for senior secondary schools (Revised Edition)*. Onitsha Africana-First Publishers Limited.
- Adamu, A.S., & Boris, O.O., & Kenni, A.M. (2013). Trends in students achievement in senior school certificate examination (SSCE) in Chemistry between 2008– 2012. *International Journal of Science and Research (IJSR) India* Online ISSN: 2319-7064..
- Burmeister, M., & Eilks, I. (2012). An example of learning about plastics and their evaluation as a contribution to Education for Sustainable Development in secondary school chemistry teaching. *Chemistry Education Research and Practice*, 13, 93-102.
- Fehintola, J.O. (2009). The effect of family Background and environmental factors on Academic Achievement of Secondary School Students: A Study of Selected Secondary School Students in Saki West Local Government Area. *International Journal of Distance Education*. 4, 51-64.
- Guskey, T.R. (2007). Closing achievement Gaps: Revisiting Benjamin S. Bloom's Learning for mastery". *Journal of Advanced Academics* 19:8-31.
- Hijazi, S., T. & Naqvi, S. (2006). 'Factors Affecting Students' Performance: A Case of Private Colleges'. *Bangladesh e-Journal of Sociology*: 3, (1).
- Hofstein, A., Eilks, I., & Bybee, R. (2011). Socio-scientific issues as a necessary base for sustainable chemistry education. *International Journal of Mathematics and Science Education*, 9, 1459-1483.
- Jayanthi, S. V., Balakrishnan, S., Ching, A., S., Latiff, N., A., & Nasirudeen, A.M.A. (2014). "Factors Contributing to Academic Performance of Students in a Tertiary Institution in measurement advances. *Psicothema*.6 (3) 535–556.
- Nbina, J. B. (2012). Analysis of poor performance of senior secondary students in chemistry in Nigeria. *An International Multidisciplinary Journal*, 6 (4) 324-334.
- Nja, C. O. Cornelius-Ukpepi, B. Edoho, E. A. & Neji, H. A. (2020). Enhancing students' academic performance in Chemistry by using kitchen resources in Ikom. Calabar. *Educational Research and Reviews*, 15, (1) 19 – 26.
- Nwaogwugwu (2004). *Effect of peer consultation and individualistic instructional strategies on students' cognitive achievement in integrated science*. Unpublished manuscript.
- Ojerinde, D. (2013). Classical Test Theory VS Item Response Theory: An evaluation of the classroom and models for change? Connecting Research in Physics Education with Teacher Education. physics.ohio-state.edu/~jossem/ICPE/TOC.html.
- Ojukwu, M.O. (1994). Worry Locus of Control and Perceived Control as correlates of College Students'

- Success.(Unpublished Master's Degree Thesis), University of Ibadan, Ibadan Oyo State.
- Ojukwu, M.O. (2016). Perception of Students on Causes of Poor Performance in Chemistry in External Examinations in Umuahia North Local Government of Abia State. *International Journal of Education & Literacy Studies*. 4 (1) 67-73.
- Okereke, C. & Ugwegbulam C.N. (2014). *Effect of competitive learning strategies on secondary school students' learning outcome: Implication for Counselling. Singapore.*" *American Journal of Educational Research*, vol. 2, no. 9 (2014): 752-758. doi: 10.12691/education-2-9-8.