Journal of Education and Practice
ISSN 2222-1735 (Paper) ISSN 2222-288X (Online)
Vol.4, No.27, 2013

Extent Of Lab-Works Taught/Exposed To Senior Secondary School III Chemistry Students Before External Examinations In Enugu State.

Dr. Mrs. Ezeano, C. A.
Science and Computer Education, Enugu State University of Science Technology (ESUT), Enugu.Email:chidykeeze@yahoo.com

Abstract:
This study considered the extent of lab-works exposed to SSIII chemistry students before their external examinations. Two research questions guided the study. The study adopted survey research design and the sample size was 85 SSIII chemistry teachers. The instrument used for the study was 44 item questionnaires. The items have four options of varying levels extent and agreement, with the weightings: 4, 3, 2, and 1 respectively, giving an average mean cut-off of 2.50. The data collected were analysed using simple mean. The results of the analyses showed that the lab-works exposed to SSIII chemistry students were just to a moderate extent.
Keywords: Lab-work, taught, senior, secondary, school III, chemistry, students, external, and examinations.

Introduction:

Science is a broad field of study, involving the study of nature, forces (heat, light, sound etc) and relationship between them, and of matter, its compositions, properties and uses. The study of science, in general, is based on series of empirical evidences resulting from painstaking lab-works. In carrying out the lab-works various science process skills (SPS) are employed to study natural phenomena to satisfy man's curiosity and improve qualities of health, agriculture, transportation, communication, education and life in general. In other words, lab-works are applied to answer questions that may bring about positive changes and improve quality and standard of life in general. Lab-works as used in this work refers to laboratory/practical works embarked upon in the teaching and learning of sciences by teachers, lecturers, students and technicians to inculcate into the learners the desired scientific facts, patterns and principles which are very needful for scientific and technological advancement of any nation.

Science is empirically studied in the laboratories, purposefully equipped with chemicals and equipment, for scientific activities that could lead to solving mans problems. According to Exley, (1999) aims of science laboratory courses are to:

- Instill confidence in the science subject,
- Teach basic practical skills,
- Familiarize students with important standard apparatus and measurement techniques,
- Train students to acquire observation skills,
- Train students to make deductions from measurement and interpretation of experimental data,
- Use experimental data to solve specific problems,
- Train students in working experimental reports,
- Train students in keeping a day to day laboratory diary,
- Train students in simple aspects of experimental design,
- Provide closer contacts between staff and students,
- Stimulate and maintain interest in the subject,
- Develop skills in problem solving in the multi-solution situation,
- Provide a stimulant to independent thinking,
- Broaden students ideas to see practical as processes of discovery,
- Provide motivations to acquire specific knowledge and
- Help bridge the gap between theory and practice.

According to her, the outlined aims for effective practical teaching involves careful planning and organisation and rely heavily on the preparedness of the teacher and students, and other key players like technical support staff, demonstrators etc. If quality and extensive lab-works are done, then, it is possible to achieve the above listed aims and consequently, improved standard of scientific and technological education in the country. This is because according to Ezeano (2013), scientific concepts and reasoning are better understood through scientific activities (lab-works) which help the confusing and abstract ideas to be clarified. Therefore, effective study of science relies so much on practical activities because science is a field of study that rests on the hypothetical deductive experiment approach (Mbajiorgu, and Reid 2006). Chemistry as a science subject, demands elaborate lab-works in secondary school to prepare the intending scientists to be well grounded in their various fields like laboratory technology, medicine, pharmacy, nursing, radiography, science educators to mention but a few. To be specialized in any area of science that relates to chemistry, a credit pass in secondary

school chemistry is needed and this is not possible when the desired lab-works are not done before the students are exposed to external examinations. Lab-works are indispensable in science teaching and learning as only through them can science process skills be enforced into students, students' interest be aroused, misconceptions be cleared and consequently students' achievement and retention in science/chemistry be enhanced (Ezeano, 2008).

Meaningful development in science and technology requires a steady flux of resources and effective use of such resources (Ezeano and Ezeudu, 2013). The number of students applying for science and science related courses (through which the country will develop scientifically and technologically) is always below the country's approved ratio of 60 to 40 for sciences and arts respectively. Some of reasons are related to poor achievement of chemistry students in external examinations which also stem from their poor practical knowledge (lab-works) before the examinations. Since lab-work contributes to students' overall achievement in external examinations, there is need to x-ray the extent of lab-works taught the SSII chemistry students before their external examinations.

Statement of Problem:

For students to do well sciences, sufficient lab-works should be exposed to them. Science is taught both theoretically and practically but the lab-works help to remove misconceptions or confusion that may arise from wrong conception of some scientific concepts during theory lessons. In addition, they help to arouse and sustain students' interest and retention and improve the overall achievement in external examinations.

Effective science teaching at all levels requires sufficient lab-works which will only be done with laboratory equipment and chemicals. The material requires for lab-works are often inadequately provided in many secondary school laboratories despite their unavoidable importance. Due to insufficiency of most valuable teaching materials, some teachers only demonstrate the practical topics or skip them and only managed to teach some just before external examinations. This may lead to not teaching the required lab-works spelt out in the scheme for SSIII before external examinations. The required lab-works may be exposed to students just before the examinations and such cannot give room for in-depth understanding of the concepts. As lab-works help to students to have mastery of the concepts and skills, instills confidence in the science teachers and students, bridge the gap between theory and practical, stimulate and maintain students' interest in the science subjects, they should be exposed to students on time to enable learn and perform creditably during their examinations. Since sufficient and quality lab-works can go a long way in solving the problems inherent in science in the country, there is need to ascertain the extent to which they taught to SSIII chemistry students before their external examinations.

Research Questions:

1. To what extent are the SSIII chemistry students taught lab-works before their external examinations?
2. What are the measures to be taken to enable the teachers cover the lab- works before external examination?

Methodology:

Survey is the design for this work. Two research questions guided the study and the respondents were 85 SSIII chemistry teachers serving under Post Primary Schools Management Board (PPSMB) of Enugu State. The chemistry teachers used for the study teach SSIII chemistry students and should be able ascertain the extent of lab-works they have covered for the students before their external examinations (WAEC & NECO). The instrument is questionnaire comprising 44 main items on the lab-works the SSIII chemistry students should learn before external examinations and measures to be taken to enable teachers cover the required lab-works for the students before external examinations. The instrument has four options of varying levels of extent: high extent (HE), moderate extent (ME), low extent (LE), and no extent (NE) for research question one. For research question two, the four options are strongly agree (SA), agree (A), disagree (D), strongly disagree (SD). The options are weighted as, 4, 3, 2, and 1 respectively. The instrument was validated by three experts, two from chemistry option, one from measurement and evaluation, all from Science and Computer Education, ESUT. The validators made useful comments and corrections which were used to get the final draft of the instrument.

The data resulting from the research work were analysed using descriptive statistics. Specifically, research questions 1 and 2 were analysed by use of simple mean. From the responses, the average mean score value is 2.50; any mean score equal to or above it is taken as agree for research question two and (3.00 and above) and (2.50-2.99) are high and moderate extent, for research question one.

Research Question 1

To what extent are the SS III chemistry students taught lab-works before their external examinations?

Table I: Extent of lab-works exposed to SSIII chemistry students before their external examinations.

S/No	Lab works taught SSIII chemistry students before external examinations.	High extent(HE) (4)	Moderate extent ME (3)	Low extent LE (2)	Ne extent ME (1)	Mean $\bar{X}$	Decision
1	**Elements, Compound and Mixtures**						
A	Mixtures and compounds	**28**	**26**	**15**	**6**	**2.66**	**HE**
B	Filtration	**50**	**25**	**4**	**6**	**3.40**	**HE**
C	Evaporation	45	24	10	6	3.27	HE
D	Decantation	38	27	16	4	3.16	HE
E	Centrifuging	15	30	15	25	2.41	LE
F	Crystallization	28	29	12	16	2.81	ME
G	Use of separating funnel	40	17	12	16	2.95	HE
H	Re-crystallization	10	35	5	35	2.24	LE
I	Simple Distillation	25	26	10	24	2.61	ME
J	Fractional distillation	22	10	25	23	2.25	LE
K	Precipitation	40	12	15	18	2.87	ME
L	Magnetization	35	25	12	13	2.96	ME
M	Chromatography	20	30	25	10	2.71	ME
N	Sublimation	28	25	14	18	2.74	ME
O	Test for purity of substances	34	12	22	17	2.74	ME
P	Determination of melting points	29	18	19	19	2.67	ME
2	**Structure and components of an atom**						
A	Atomic properties	24	25	8	28	2.53	ME
B	Electron affinity	25	25	7	27	2.54	ME
C	Electro-negativity	23	27	9	26	2.55	ME
D	Chemical bonding	24	26	12	24	2.61	ME
3	**The periodic table and periodicity of elements**						
A	Properties of alkali metals	28	23	15	19	2.71	ME
B	Properties of alkaline earth metals	19	28	8	30	2.42	LE
C	Properties for halogens	25	30	-	30	2.59	ME
D	Properties of transition metals	18	37	2	28	2.53	ME
4	**Laws of chemical compositions**						
A	Law of conservation of mass (matter)	38	13	11	23	2.78	ME
B	Law of definite proportion or constant composition	38	12	13	22	2.78	ME
C	Law of multiple proportion	39	18	14	15	2.98	ME
D	Law of reciprocal proportions	22	21	26	16	2.58	ME
5	**Chemical Bonding**						
A	Covalent Bonding	23	22	28	12	2.66	ME
B	Electrovalent Bonding	22	28	21	14	2.68	ME
C	Dative Bonding	24	29	16	16	2.72	ME
D	Metallic bonding	19	27	19	20	2.53	ME
E	Hydrogen bonding	18	34	18	15	2.65	ME
F	Hybridization of orbital	17	23	22	23	2.40	LE
G	Shapes of simple molecules	15	40	9	21	2.58	ME
6	**Gaseous state &Gas laws**						
A	Diffusion of gases	28	33	7	17	2.85	ME

B	Brownian movement	26	29	9	21	2.71	ME
C	Boyle's law	41	17	13	14	3.00	HE
D	Charles' law	39	19	8	19	2.92	ME
E	Graham's law of diffusion	33	20	14	18	2.80	ME
F	Gay-Lussac's law	26	25	21	13	2.75	ME
G	Dalton's law of partial pressure	28	24	14	19	2.72	ME
H	Avogadro's law.	29	23	13	20	2.72	ME
7	**Acids, Bases and salts**						
A	Tests for Acids	49	24	4	8	3.34	HE
B	Tests for Bases	48	35	3	9	3.35	HE
C	Tests for salts	47	26	4	8	3.32	HE
D	Preparation of acids	50	23	3	9	3.34	HE
E	Preparation of bases	47	26	3	9	3.31	HE
F	Preparation of salts	48	26	2	11	3.35	HE
G	Properties of acids, bases and salts	50	15	5	15	3.18	HE
H	Measurement of acidity & alkalinity (pH scale)	50	16	4	15	3.19	HE
8	**Carbon and its Compound**						
A	Allotropes of carbon	30	14	16	25	2.58	ME
B	General reactions of carbon	29	18	14	24	2.61	ME
C	Uses of carbon	28	18	17	22	2.61	ME
D	Compounds of carbon (CO_2 and CO)	20	24	6	29	2.27	LE
E	Trioxocarbonates	24	34	4	29	2.76	ME
9	**Hydrocarbons**						
A	Quantitative analysis of organic compounds	33	19	13	23	2.80	ME
B	Test for alkanes	29	18	14	24	2.61	ME
C	Test for alkenes	24	23	19	19	2.61	ME
D	Test for alkynes	24	24	13	24	2.56	ME
E	Laboratory preparation of Alkenes (ethane)	38	13	17	17	2.85	ME
F	Laboratory preparation of alkynes (ethyne)	30	16	25	14	2.73	ME
G	Test for benzene	28	14	19	24	2.54	ME
H	Test for aromatic hydrocarbons.	16	28	17	24	2.42	LE
I	Chemical conversion of petroleum	10	20	10	45	1.94	LE
10	**Redox reactions**						
A	Test for redox reactions	20	35	10	20	2.65	ME
B	Test for reducing agents	19	30	16	20	2.56	ME
C	Test for oxidizing agents	21	31	13	20	2.62	ME
11	**Electrolysis and electrochemical cells**						
A	Effect of electricity on substances	9	18	34	24	2.14	LE
B	Static electricity	8	19	28	20	1.94	ME
C	Strong and weak electrolytes	7	27	33	18	2.27	ME
D	Factors affecting products of	12	23	27	23	2.28	ME

	electrolysis						
E	Position of ions in the electrochemical series.	13	19	29	24	2.25	ME
F	Concentration of ions	14	19	34	18	2.34	LE
G	Nature of electrodes	13	24	29	19	2.67	ME
H	Electrolysis of some substances	14	23	29	18	2.36	LE
I	Verification of Faraday's laws	18	14	29	24	2.33	LE
J	Application of electrochemical cells.	23	9	29	24	2.01	LE
12	**Volumetric Analysis**						
A	Preparation of standard solution	44	19	9	13	3.11	HE
B	Determination of molar	45	15	10	15	3.06	HE
C	Volumetric apparatus and their uses	41	16	12	16	2.48	LE
D	Acid-Base titrations	42	16	16	11	3.05	HE
E	Standardization of solutions	44	23	4	14	3.14	HE
F	Precautions to be taken during titration	48	12	10	15	3.09	HE
G	Determination of a mixture by double indicator	34	3	19	29	2.49	LE
H	Analysis of a mixture by double indicator method	33	4	24	24	2.54	ME
13	**Project**						
A	Preparation of CO_2 from potash	8	9	33	35	1.86	LE
B	Preparation of potash from plantain peel.	4	8	39	34	1.79	LE
C	Preparation of standard solutions	13	9	28	35	2.21	LE
D	Determination of molar	14	8	29	34	2.02	LE
E	Mass of a substance using standard solutions.	18	9	28	30	2.18	LE
F	Determination of amount of base in a solution	28	19	10	28	2.55	ME
14	**Rates of chemical reaction**						
A	Measurement of rates of chemical reactions	24	18	14	29	2.44	LE
B	Factors affecting rates of chemical reactions	23	24	9	29	2.48	LE
C	Nature of reactants	24	23	8	30	2.20	LE
D	Concentration of reactants	19	28	9	29	2.44	LE
E	Temperature	18	24	13	30	2.35	LE
F	Surface areas	30	18	8	29	2.78	ME
G	Light	18	24	14	29	2.36	LE
H	Catalyst	19	13	14	39	2.14	LE
15	**Chemical equilibrium**						
A	Reversible and spontaneous reactions	18	24	14	29	2.36	LE
B	Conditions which affect the position of equilibrium	19	24	19	28	2.52	ME
C	Effect of change in concentration	18	29	13	25	2.47	LE

D	Effect of change in pressure	19	34	13	19	2.62	ME
E	Effect of temperature	18	29	18	20	2.53	ME
F	Effect of catalyst	19	23	20	28	2.89	ME
16	**Energy and energy changes**						
A	Exothermic & endothermic changes	33	24	15	13	2.91	ME
B	Conservation of energy	32	28	12	13	2.93	ME
C	Energy changes and effects	29	24	19	13	2.81	ME
D	Determination of heat changes	35	15	20	15	2.82	ME
E	Determination of heat of neutralization	32	18	17	18	2.75	ME
F	Determination of heat of solution	33	14	24	14	2.39	LE
17	**Hydrogen**						
A	Preparation of hydrogen	45	5	14	21	2.87	ME
B	Properties of hydrogen	35	15	15	20	2.73	ME
C	Test for hydrogen	38	14	13	20	2.82	ME
18	**Oxygen**						
A	Preparation of oxygen	43	9	14	19	2.89	ME
B	Properties of oxygen	34	18	9	24	2.73	ME
C	Test for oxygen	43	14	13	15	3.00	HE
D	Preparation oxides	24	23	13	25	2.54	ME
E	Preparation of hydrogen peroxide	24	24	14	23	2.58	ME
F	Properties of hydrogen peroxide	25	20	20	20	3.76	HE
J	Preparation of ozone	19	18	29	19	2.21	LE
H	Properties of ozone	14	23	24	24	2.32	LE
I	Test for ozone	17	22	23	23	2.39	LE
19	**Water and solutions**						
A	Properties of water	21	37	16	11	2.80	ME
B	Purification of water	33	24	19	9	2.95	ME
C	Hardness of water	28	19	14	24	2.60	ME
D	Action of water on metals and non-metals	35	15	20	15	2.82	ME
E	Action of water on metallic & non-metallic oxides	24	29	18	14	2.74	ME
F	Action of water on metallic and non-metallic carbides	20	25	27	23	2.73	ME
G	Conditions necessary for rusting	15	20	25	15	2.18	LE
H	Effects of pollutants on substances	15	30	20	20	2.47	LE
I	Properties of solution, colloids and suspension	18	29	24	14	2.25	LE
J	Solubility of substances	28	29	9	19	2.78	ME
K	Crystallization	26	31	14	14	2.81	ME
20	**Halogens**						
A	Graduation of properties of Halogens	18	25	15	27	2.40	LE
B	Preparation of the halogens	18	24	14	29	2.36	LE
C	Properties of halogens	19	25	13	28	2.41	LE
D	Tests for halogens	19	25	3	33	2.24	LE

21	**Nitrogen family.**						
A	Preparation of nitrogen	24	24	13	24	2.56	ME
B	Properties of nitrogen	23	24	14	24	2.54	ME
C	Preparation of ammonia	34	19	9	23	2.65	ME
D	Properties of ammonia	23	34	9	19	2.61	ME
E	Tests for ammonia	31	24	10	20	2.78	ME
F	Preparation of ammonium salts	25	25	10	25	2.59	ME
G	Properties of ammonium salts	24	26	11	24	2.59	ME
H	Test for ammonium salts	30	14	16	25	2.58	ME
I	Preparation of trioxonitrate (v) acid	24	23	14	24	2.55	ME
J	Properties of trioxonitrate (v) acid	22	23	12	28	2.46	LE
K	Test for trioxonitrate ion (NO_3^-)	23	24	14	24	2.54	ME
L	Actions of heat on trioxonitrate (v)	32	11	16	26	2.57	ME
22	**Suphur and its compounds**						
A	Properties of sulphur	20	25	14	26	2.45	LE
B	Preparation of hydrogen sulphide (H_2S)	27	23	7	28	2.58	ME
C	Properties of H_2S	18	29	14	24	2.48	LE
D	Test for hydrogen sulphide	28	29	14	24	2.48	LE
E	Preparation of sulphur (iv) oxide	23	24	7	31	2.45	LE
F	Properties of sulphur (iv) oxide	24	25	13	23	2.58	ME
G	Test for sulphur (iv) oxide	23	24	14	24	2.54	ME
H	Preparation of trioxosulphate (iv) acid (H_2SO_3)	20	25	10	30	2.41	LE
I	Properties of trioxosulphate (iv) acid	26	32	11	16	2.80	ME
J	Preparation of sulphur (vi) oxide (SO_3)	18	39	14	14	2.83	ME
K	Properties of sulphur (vi) oxide (SO_3)	19	39	14	13	2.31	LE
L	Preparation of tetraoxosulphate (vi)acid (H_2SO_4)	20	38	13	14	2.75	ME
M	Properties of tetraoxosulphate (vi) acid	20	35	15	15	2.70	ME
23	**Alkanols**						
A	Classification of alkanols	27	22	16	22	2.68	ME
B	Preparation of alkanols	30	25	14	16	2.81	ME
C	Properties of alkanols	30	20	20	15	2.76	ME
D	Solubility and dehydration of alkanols	25	24	21	15	2.69	ME
24	**Alkanoic acid and their derivative**						
A	Preparation of ethanoic acid	33	23	12	17	2.84	ME
B	Properties of ethanoic acid	23	28	12	22	2.61	ME
C	Test for alkanoic acids	33	23	17	12	2.90	ME
D	Preparation of ethanoates	24	28	14	19	2.67	ME
E	Properties of ethanoates	15	30	14	16	2.28	LE
F	Properties and tests for Fats and oil	23	29	14	19	2.65	ME

G	Preparation of soap and detergents	18	33	17	17	2.55	ME
H	Preparation of amino acids	8	44	14	17	2.45	LE
I	Preparation of amino acids	12	43	12	18	2.57	ME
J	Preparation of amines	12	43	12	18	2.57	ME
K	Properties of amines	5	37	22	21	2.30	LE
25	**Project**						
A	Extraction of indicator from flower	10	35	20	20	2.41	LE
B	Acid-base titration using flower extract as indicator	16	16	21	32	2.16	LE
C	Electrical conductivity of water	16	16	21	32	2.16	LE
26	**Metals**						
A	Properties of metals	32	21	16	21	2.87	ME
B	Reaction with air	25	26	20	14	2.72	ME
C	Reaction with water	26	25	15	20	2.69	ME
D	Reaction with dilute	21	27	21	16	2.62	ME
E	Preparation of metallic oxides	20	30	15	20	2.58	ME
27	**Alkali Metals**						
A	Properties of sodium	30	15	20	20	2.64	ME
B	Properties of sodium hydroxide	30	15	15	25	2.58	ME
C	Properties of sodium trioxocarbonates	30	20	15	20	2.70	ME
28	**Alkali Earth Metals**						
A	Properties of calcium	15	40	10	20	2.58	ME
B	Properties of calcium oxide	14	21	14	26	2.03	LE
C	Properties calcium hydroxide	13	32	12	28	2.35	LE
D	Properties of calciumtrioxocarbonates(iv)	16	33	15	21	1.97	LE
E	Bleaching property of $CaOCl_2$	18	24	24	19	2.48	LE
29	**Aluminum**						
A	Properties of Aluminum	18	34	14	19	2.60	ME
B	Test for Aluminum (iii)ion	25	31	4	25	2.65	ME
C	Properties of Pb	17	28	12	28	2.40	LE
F	Test for Pb^{2+}	24	24	8	29	2.50	ME
30	**Group (iv) element**						
A	Properties of tin	26	30	14	25	2.90	ME
B	Test for tin	25	20	15	25	2.52	ME
31	**Metals of first transition series**						
A	Properties of transition metals	25	20	10	30	2.47	LE
B	Variable oxidation states	26	19	9	31	2.47	LE
C	Formation of coloured compounds	19	26	8	32	2.36	LE
D	Formation of complexes	20	25	10	30	2.40	LE
E	Catalytic properties	24	29	3	29	2.56	ME
F	Properties of iron Fe)	19	31	4	31	2.44	LE
G	Test for iron	30	25	5	25	2.70	ME
H	Properties of copper	30	20	10	25	2.70	ME
I	Test for copper	25	25	10	25	2.58	ME
J	Properties of Zinc	20	30	10	25	2.52	ME

K	Test for Zinc	25	25	10	25	2.58	ME
L	Reaction of transition metals with mineral acids	20	30	9	26	2.51	ME
32	**Qualitative analysis**						
A	Preliminary tests	40	34	3	8	3.24	HE
B	Confirmatory tests for anions (Cl^-, NO_3^- SO_4^{2-})	49	19	3	14	3.21	HE
C	Tests for cations Pb^{2+}, Fe^{2+}, Fe^{3+}, etc	53	12	2	18	3.17	HE
D	Qualitative organic analysis.	53	22	-	12	3.41	HE
E	Preliminary tests	46	21	6	11	3.17	HE
F	Test for unsaturation	34	24	19	8	2.98	ME
G	Test for functional groups	34	24	13	14	2.91	ME
H	Determination of melting point of organic compounds	23	23	16	23	2.54	ME
I	Test for reducing and non-reducing sugars	39	24	8	14	3.03	HE
J	Tests for protein	35	25	10	15	2.94.	ME

(3.00 and above = HE, 2.50 -2.99 =ME, 2.49 and below = LE)

Results:

Research question I ascertained the extent to which chemistry teachers taught the SSIII students the lab-works before external examinations. The results proved that some topics were covered before external examinations. Under item 1, elements, compounds and mixtures centrifuging (2.41) and re-crystallization (2.25) all have mean scores below the cut off mark of 2.50, signifying that they were not exposed to students before external examinations. All other topics under the item were covered to moderate extent, as all have the mean scores below 3.00.

Items like structures and components of an atom, periodic table and periodicity of elements, laws of chemical compositions, chemical bonding etc were exposed to SSIII chemistry students to moderate extent. Results also revealed that topics electrolysis, rates of reactions and halogens were exposed to SSIII chemistry students practically at very low extent (their mean scores were below 2.50). So all they learnt about them were theoretical without any lab-work. Evidently, almost all the items were just exposed to SSIII chemistry students to moderate extent (mean scores above 2.50 but below 3.00). Only three topics, items under acids and salts, volumetric analysis and qualitative analysis were exposed to SSII chemistry students to high extent. (Mean scores are 3.00 and above).

In summarily, the results depicted that most of the lab-works were not exposed to SS III chemistry students before external examinations. Topics like acids, bases and salts, qualitative and volumetric analyses have mean scores of 3.00 and above signifying that they were exposed to SSIII chemistry students to high extent but the volume of lab-works covered was very small compared to the entire lab-works that need to be covered before their external examinations.

Research Question 2: What are the measures to be taken to enable teachers cover the required lab-works before external examinations?

Table 2: Measures to be taken to enable chemistry teachers cover the required lab works before external examinations.

S/N	ITEMS	SA (4)	A (3)	D (2)	SD (1)	Mean $\bar{X}$	Decision
33	Equip the laboratories with relevant chemicals and equipment	64	14	4	5	363	A
34	Teach lab works as and when due	48	37	-	-	3.56	A
35	Demonstrate the lab works to students in the absence of sufficient teaching materials	10	38	22	15	2.50	A
36	Motivate teachers by honoring those whose students perform will in external examination.	44	29	3	5	3.22	A

37	Prompt supervision to see that practical topics are treated in due time.	44	34	4	3	3.40	A
38	Retraining of teachers, emphasizing the needs for lab-works	64	14	3	4	3.62	A
39	Encouraging students to co-operate with Teachers	34	45	3	3	3.29	A
40	Teachers being resourceful to improvise insufficient or lacking teaching materials assessing students experimental slats	44	29	9	3	3.34	
41	Examining students on every topic exposed to them	34	40	2	9	3.34	A
42	Encouraging students on minds-on and hands-on activities	34	39	4	8	3.16	A
43	Giving quality time for practical activities or lab works	48	28	2	7	3.37	A
44	Igniting and sustaining students' interest with constant lab works.	50	25	5	5	3.41	A

Table 2, ascertained the possible measures that could be employed by chemistry teachers to help them cover the required lab-works for SSIII chemistry students before their external examinations. All the suggested items under Table 2 have mean scores above the 2.50 cutoff, signifying that if they are employed, the lab-works will be exposed to chemistry students before external examinations. Among the items, equipping the laboratories with relevant chemicals and equipment ranked first (3.63). It is closely followed by retraining of teachers, emphasizing the needs for lab-works (3.62) and teaching the lab-works as and when due (3.56), igniting and sustaining students' interest by constant lab-works (3.41), prompt supervision to see that the practical topics/lab-works are treated in due time (3.40) etc. All the suggested measures can help the chemistry teachers to expose the required lab-works to SSIII chemistry students before their external examinations.

Discussion of results:

The results of the study revealed that lab-works were not adequately exposed to SSIII chemistry students before their external examinations. They therefore, lack the required practical experiences needed for lab-works during external examinations and so exhibit various lapses that made them not to do well in the external examinations. This finding is in agreement with West African Examination Council (WAEC) Chief Examiner Report (2008) which revealed that chemistry students have poor practical exposure and omit and use wrong units, average non-concordant titre values, alter titre values to agree with supervisors, failed to express numerical answers in the appropriate number of significant figures, unable to draw logical inference from observations made on prescribed tests and inadequate use practical terminologies, especially, in qualitative analysis.

This finding is also in line with Ezeano, (2008) who opined that chemistry teachers did not sufficiently expose chemistry students to lab-works before external examinations, due to predominant lack of laboratory equipment and chemicals. The finding is also in agreement with those of Okeke,(1986), Okebukola (1987), and Eze (2002) who all discovered that chemistry students were not exposed to lab-works in due time before external examinations. The problem of insufficient laboratory teaching materials and poor exposure of chemistry students to lab-works have been age-long problems of science teaching and need to be addressed urgently.

From Table two, the findings revealed that equipping the laboratories with relevant chemicals and equipment, retraining of teachers on the needs for lab-works, teaching lab- works as and when due, demonstrating to students lab-works in absence of enough teaching materials, prompt supervision to see that practical topics are taught in due time, among other measures, can help the chemistry teachers to expose the required lab-works to chemistry students before external examinations. If these are done in due time, they will help to improve students' achievement in the external examinations. These findings are in line with that of Ezeano (2013) who

maintained that one of the ways of bridging the gaps science teaching is by exposing science students to practical activities as and when due to boast their achievement in science.

Conclusion:

The conclusions, drawn from the study, are as follows:

1. Chemistry teachers did not sufficiently expose chemistry students to required lab-works before their external examinations.
2. The measures that should be employed to help the chemistry teachers to expose students to relevant lab-works before external examinations include; adequately equipping the laboratories with chemicals and equipment, retraining of teachers, teaching lab-works as and when due, demonstrating the required lab-works in absence of sufficient teaching materials etc.
3. From the results of this study, one can conclude that chemistry students' poor achievement in internal and external examinations stem from insufficient lab-works exposed to the students before the examinations.

Recommendation:

The following recommendations were made based on the findings of the study;

1. Effective science teaching should involve sufficient lab-works to enable teachers cover the scheme for required lab-works before external examinations.
2. Science laboratories should be well equipped with relevant chemicals and equipment.
3. Chemistry and other science teachers should be retrained from time to time to equip them on the necessities of lab-works to SSIII science students preparing for external examinations.
4. Science students should be encouraged by rewarding those who perform excellently well in lab-works and also by giving scholarship to best graduating science students from secondary schools and higher institutions for further studies.

Acknowledgement: The researcher is grateful to Post Primary Schools Management Board (PPSMB), Enugu State, for allowing her to use chemistry teachers serving under her. To chemistry teachers who painstakingly filled the instrument used for this research work, the researcher remains thankful. The International Institute for Science, Technology and Education (IISTE) is highly appreciated for publishing this work.

Reference:

Eze, C. U., (2002). Effect of target task approach on students' achievement and interest in senior secondary school physical chemistry. Ph.D Thesis, University of Nigeria, Nsukka.

Ezeano, C. A., (2008). Effect of small scale experiment on students' achievement and retention in chemistry. Ph.D Thesis, University of Nigeria, Nsukka.

Ezeano, C. A., (2013). Science teaching in Nigerian schools. Port Harcourt, Ecnel publisher.

Ezeano, C. A. and Ezeudu, F. O., (2013). Application of laboratory management skill by chemistry teachers in Enugu State. Journal of education and practice. 4 (18) 159-164.

Exley, Kate, (1999). key aspects of teaching and learning in science and engineering. A handbook for teaching and learning in higher education enhancing academic practice. (eds) Fry, H. Steve, K. and Marshal, S.

Mbajiorgu, N. M., (2003). Science, the teachers' perspective. An introduction to science education, Institute for development studied university of Nigeria Enugu Campus Enugu.

Mbajorgu, M. N. and Reid, N. (2006). Pedagogic research into curriculum development in chemistry at the secondary school level. Report of literature search, Centre for science education, University of Glasgow.

Ohia, G.N.C., Amasiatu, G.I, Ajagbe, J.O., Ojokuku, and Mohammed, U. (2007). Comprehensive Certificate Chemistry. University Press PLC, Ibadan, Nigeria.

Okebukola, P.A.O., (1987). Chailkboard science, consequence of intervention model. Journal of Science Teachers' Association of Nigeria, (STAN). 1(6) 1-4.

Okeke, E.A.C., (1986). Remedies of students' poor performance in science. Proceedings of the 27th annual conference of STAN. 118-136

West African examination council (2008). Chief examiners report on senior school secondary certificate examination, Lagos, Nigeria