**EFFECTS OF PRACTICAL ACTIVITIES ON STUDENTS ACQUISITION OF BASIC SCIENCE PROCESS SKILLS IN CHEMISTRY IN UYO LOCAL GOVERNMENT AREA**

**BY**

**EKAANEM, NSIMENE COSMAS**

**15/ED/SE/1316**

**A RESEARCH PROJECT**

**SUBMITTED TO**

**THE DEPARTMENT OF SCIENCE EDUCATION**

**FACULTY OF EDUCATION**

**UNIVERSITY OF UYO,UYO**

 **OCTOBER, 2019**

**DECLARATION**

I declare that this research project “Effects of practical activities on students acquisition of basic science process skills in chemistry in Uyo Local Government Area of Akwa Ibom State” is an original and authentic record carried out by me.

Ekanem, Nsimene Cosmas

**CERTIFICATION**

We certify that this research project on “Effect of practical activities on students acquisition of basic science process skills in chemistry in Uyo Local Government Area” is an original work carried out by Ekanem, Nsimene Cosmas RegNo.: 15/ED/SE/1316 of the Department of Science Education, University of Uyo, Uyo, under the supervision of Dr J.T.Mkpanang of the Department of Science Education, University of Uyo.

This work is in partial fulfillment for the Award of Bachelor of Science Education B.Sc (Ed) degree in Chemistry of University of Uyo, Uyo.

…………………… ….…………………

Dr. J. T. Mkpanang Signature/Date

Supervisor

…………………… …………………….

Dr. J. T. Mkpanang Signature/Date

Coordinator

…………………… ………………………

Dr. U. S. Stephen Signature/Date Head of Department

…………………… ………………………

Prof. Koko Ekpo Signature/ Date

External supervisor

**DEDICATION**

This work is dedicated to the Almighty God for His undiluted love and grace bestowed on me to accomplish this work. I also dedicate this work to the most loving and caring parent, Mr & Mrs Cosmas Jimmy Ekanem whose upbringing care, prayer and financial support have been of immense help toward my success in life and academics and for always being there to love, support and encourage me.

**ACKNOWLEDGEMENTS**

A work of this magnitude and scope could not have been made possible without the help, sacrifice and co-operation of some individuals and God . I sincerely want to thank God Almighty, the giver of wisdom, strength and courage he bestowed on me to be able to pass through this daunting challenges in this program.

I deeply and humbly appreciate my understanding, clever and patient supervisor Dr. J. T. Mkpanang for his gentle, loving and fatherly counsels and guidance. God bless you sir. My special appreciation and thanks goes to my Examination officer Dr(Mrs) N. M. Udoh and Dr(Mrs) T. M. Udofia for their encouragement and support.

My heartfelt gratitude and appreciation goes to my beloved parents Mr & Mrs Cosmas Jimmy Ekanem, my siblings Cornelius, Mfondie and Udukime to my cousin Ukeme George for their unwavering sacrifices and co-operations to ensure I excel throughout my academic days.

I also wish to say a big thank you to my super wonderful friend Ofonime Edmund for his unfailing motivation and to my 015 colleagues. To Uwem, Deborah, Nseobong, Rebecca and Ama-Abasi, I would not have done it without you all. Thank you for making my dream a reality. God bless you all.

**TABLE OF CONTENTS**

**Title Pages**

Title page - - - - - - - - i

Declaration - - - - - - - - ii

Certification - - - - - - - - iii

Dedication - - - - - - - - iv

Acknowledgement - - - - - - - - v

Table of content - - - - - - - - vi

List of tables - - - - - - - - ix

List of Appendices - - - - - - - - x

Abstract - - - - - - - - xi

**CHAPTER ONE: INTRODUCTION**

1.1 Background of the Study - - - - - - 1

1.2 Statement of the Problem - - - - - - 3

1.3 Purpose of the Study - - - - - - 4

1.4 Research Questions - - - - - - 5

1.5 Research Hypotheses - - - - - - 5

1.6 Significance of the Study - - - - - - 89

1.7 Delimitation of the Study - - - - - - 89

1.8 Limitations of the Study - - - - - - 89

1.9 Definitions of Terms - - - - - - 89

**CHAPTER TWO: REVIEW OF RELATED LITERATURE**

2.1 Theoretical Framework - - - - - 89

2.2 Conceptual Framework - - - - - 89

2.3 Empirical Study Reviews - - - - - 89

2.4 Summary of Literature Review - - - - - 89

**CHAPTER THREE: RESEARCH METHOD**

3.1 Research Design - - - - - 89

3.2 Area of Study - - - - - 89

3.3 Population of the Sample - - - - - 89

3.4 Sample and Sampling Technique - - - - - 89

3.5 Instrumentation - - - - - 89

3.6 Validation of the Instrument(s) - - - - - 89

3.7 Reliability of the Instrument(s) - - - - - 89

3.8 Scoring - - - - - 89

3.9 Research Procedure - - - - - 89

3.10 Method of Data Analysis - - - - - 89

**CHAPTER FOUR: RESULTS AND DISCUSSION**

4.1 Results - - - - - - - 89

4.2 Discussion of Results - - - - - - - 89

4.3 Summary of Findings - - - - - - - 89

**CHAPTER FIVE: SUMMARY, CONCLUSION AND**

**RECOMMENDATIONS**

5.1 Summary - - - - - - - - 89

5.2 Conclusion - - - - - - - - 89

5.3 Implications of the Findings - - - - - - 89

5.4 Recommendations - - - - - - - 89

5.5 Suggestions for the further study - - - - - 89

REFERENCES - - - - - - - 89

APPENDICES - - - - - - - 89

**LIST OF TABLES**

Table 1: t-test analysis of students taught with practical

activities and non-practical activities. - - - 89

Table 2: t-test analysis of post scores of observation process

skills of students taught separation techniques as

a practical activity and those without

observation skills - - - - - - - 89

Table 3: t-test analysis of post scores of communication

process skills of students taught separation techniques

as a practical activity and those

without communication skills - - - - - 89

Table 4: t-test analysis of post scores of experiment process

skills of students taught separation

techniques as a practical activity and those

without experiment skills - - - - - 89

**LIST OF APPENDICES**

Appendix A: Letter of introduction - - - - - - 89

Appendix B: Science process skill acquisition practical test(SPSAPT) - - 89

Appendix C: Science process skill acquisition rating scale(SPSARS) - - 89

Appendix D: table of analysis for hypothesis one

Appendix E: table of analysis for hypothesis two

Appendix F: table of analysis for hypothesis three

Appendix G: table of analysis for hypoithesis four

Appendix H: lesson note for experimental group

Appendix I: lesson note for control group

**ABSTRACT**

*This study investigated effects of practical activities on students’ acquisition of basic science process skills in Chemistry in Uyo Local Government area of Akwa Ibom State. The design adopted was a pre-test and post-test experimental design. Two schools were selected for the study. The study used purposive sampling to select the schools. This was based on schools with standard laboratory, standard chemistry teachers and schools that are ready to allow their students to participate.*

**CHAPTER ONE**

**INTRODUCTION**

This chapter introduces the study in the following sub-headings; the background of the study, statement of the problem, purpose of the study research questions, research hypothesis, significance of the study, delimitation of the study, and limitations of the study.

* 1. Background of the study:

 Science education is the application of principles of education in the development and acquisition of process skills required to help others acquire scientific and technological knowledge for ready application to everyday living. Science education at secondary school level is expected to be taught as a process of inquiry involving development in students’ cognitive skills, affective skills and psychomotor skills of science (Adeyemo, 2009)

The cognitive skills are the subject matter of any course in science including its rules, principles, contents, propositions, hypothesis, ideas, theories, concepts and so on. Affective skills include a host of positive or negative constructs such as attitude, values, beliefs, opinions and motivation demonstrated towards the study. Adam (2009) noted that the psychomotor skills involves technical laboratory activities such as manipulating science equipment, observations etc. Psychomotor skills are important in science process skills in learning chemistry.

Chemistry is the scientific study of the interaction of chemical substances that constituted atoms of the subatomic parotids protons, electrons and neutrons (Adesoji and Ogini, 2012). Chemistry as a subject offered as senior secondary schools in Nigeria, takes a central position in science, technology and industry. The key role of chemistry in equipping the individual and developing the entire society is made dear in the chemistry curriculum at the senior secondary school level which include: to show chemistry and its link with industry, hazards, everyday life benefits and how to provide a course which is complete for individuals not proceeding to higher institution.

 Chemistry practical activities are investigations that is carried at in the field or classroom laboratory which provide students the opportunities of becoming more knowledgeable with science practical skills practical activities here mean an state of being active in the class room teaching where students use manipulative skills in learning of science concept

 According to Ibe (2004), the American Association for the Advancement of science (AAAS) came up with fifteen (15) science process skills. Ango (2011), science process skills can be classified into two categories as basic and integrated science process skills. The basic science process skills include: observing communicating, classifying measuring, inferring, controlling variables, formulating models, questioning designing experiment, hypothesizing, interpreting data, defining operationally, using number, using, space/ time relationship and predicting. The integrated science process skills are controlling and manipulating variable, hypothesizing, defining operationally formulating models, designing experiment and interpreting data. However, this study will be concerned with three (3) basic science process skills out of the fifteen proposed by AAAS. The three basic science process skills are observation, experimentation and communication. These skills seem to be very important individually as well as when they are integrated together. Ajaja (2010) stated that basic science process skills are fundamental to science which allows the students to conduct investigation and reach conclusions.

 Chemistry practical skills are science process skills. They are taught as part and parcel of the chemistry curriculum. They are the aspect of science learning which is retained after cognitive knowledge has been forgotten. The skills in chemistry practical activities (quantitative and qualitative analysis) cannot be completed without creativity. The West African Examination council (WAEC) makes use of practical test/ examination to assess students’ acquisition of various basic science process skills. In these examination/ test, students are required to carry out certain chemistry practical activities following some instruction. The scores of the student obtained though the marking of their practical works indirectly indicate the level of basic science process skills in chemistry they demonstrated during the practical examination.

 Furthermore, science process skills are inseparable in practice from the conceptual understanding that is involved in learning and applying science. Omajuwa (2011) reported that out of the 15 science process skills recommended for science curricula, about 70% of the students skills experience difficulties in science process skills question practical activities implies bringing apparatus for students to carry out the activity with the supervision of the teacher not necessarily in the laboratory in order to help students develop science process skills, understanding the nature of science develop teamwork abilities.

**1.2 Statement of the problem**

 The teaching and learning of science requires the acquisition of science process skills, which enhance student performance in science generally, but chemistry in particular. All the secondary school level, academic performance and student acquisition of science process skills in Nigeria senior secondary school has been a subject of concern to stakeholders such as educators, parents, administrators and researched process skills are very fundamental to science which allows students to conduct investigations and reach conclusions, but there is still a serious education gap in this area both in bringing these skills into the classroom and in the training of teachers to use them effectively. However, there is consistent poor achievement in chemistry practical at senior secondary school level. Achievement in chemistry practical activities is related to the acquisition of basic science process skills and if the acquisition of these skills is low, achievement is consequent low. Most importantly, the acquisition of these skills is through practical activities in chemistry.

It has been argued that location is among the major factors that influence student acquisition of basic science process skills with respect to separation technique. Reports indicate that schools in urban areas are better equipped with apparatus than schools in the rural areas. Likewise, there is on common consensus as to whether gender is another factor that affect the acquisition of basic science process skills in separation technique and this tends to suggest that the basic science process skills of male and female chemistry student may vary. The problem of this study is. Is there any effect of practical activities on student’s acquisition of basic science process skills?

**1.3 Purpose of the study:**

 Purpose of the study is to identify the effect of practical activities on student’s acquisition of basic science process skills in chemistry. Specifically, it intends to:

1. Determine the difference in the mean scores of students taught with practical activities and non practical activities.

2. Ascertain the difference in the acquisition of basic science process skills of observation in the mean acquisition scores of basic science acquisition skills of chemistry students.

3. Find out the difference in the acquisition of basic science process skill of communication in the mean acquisition skill of chemistry students.

4. Ascertain the difference in the acquisition score of basic science process skill of measuring in the mean acquisition skill of chemistry students

**1.4 Research Questions**

 The following research question would guide the study.

1. What is the significant difference in the mean scores of students taught with practical activities and non-practical activities.

2. What is the significant difference in the acquisition of basic science process skill of observation in the mean acquisition score of basic science acquisition skills of chemistry students.

3. What is the significant difference in the acquisition of basic science process skill of communication in the mean acquisition score of basic science acquisition skills of chemistry students.

4. What is the significant difference in the acquisition of basic science process skill of measurement in the mean acquisition score of basic science acquisition skills of chemistry students.

**1.5 Research hypotheses**

 The following null hypotheses would be tested at an alpha of on the skills of observation, measuring and communicating.

1. There is no significant difference in the mean scores of students taught with practical activities and non-practical activities.

2. There is no significant difference in the mean observation process skills of students taught separation technique in chemistry using practical activities and those taught without.

3. There is no significant difference in the mean communication process skills of students taught separation techniques in chemistry using practical activities and those taught without.

4. There is no significant difference in the mean measurement process skills of students taught separation techniques in chemistry using practical activities and those without

**1.6 Significance of the study.**

 The Significance of the study is that extensive use of practical activities will facilitate acquisition, retention; recall of lessons learned and equally arouse and sustain the interest of the students as they participate in the activities.

Significance of this study spans through teachers, students, parents, curriculum planners, examination bodies and science educators.

 The study will help to urge teachers to improve in substituting practical work for theoretical work with proper assessment technique. This will help the teachers to find the extent of achievement of set out goals of instruction- hence, the effectiveness of the instruction method used. Identification of practical chemistry skills will help teachers to reduce examination malpractice that has flooded our educational system at least in practical chemistry. This is because the chance of copying another person’s work is ruled out since it is based on direct observation.

 The finding will be of immense benefit to students opting to study professional courses in the universities. It is expected that basic science process skills acquired in filtration separation technique will enhance performance of science students, meaning that more students will be available for enrollment in science professional courses in the universities.

 The finding of this study will help curriculum planners and policy makers in planning and decision-making process which must come from needs of the students as well as society in gender. It will help the curriculum developers and education researchers to develop proper instrument for assessment of all type of educational domains respective

 Examination bodies like WAEC, National Business and Technical Board (NABTEB) and National Examination council (NECO) will benefit in assessing senior secondary school students in practical chemistry skills through the use of direct observation of these skills from chemistry students. The examination bodies can adopt the instrument and organize workshops for teacher on the importance of it

 Further more, the findings of this study will help science educators in training of the science teachers in secondary schools in line with the competencies required for inculcating these science process skills in students. Moreover, these results will enable the science educators to find the needed solution to the problems involved in the acquisition of science process skills as well as creating awareness of necessary factors that could promote the acquisition of these basic science process skills.

1.7 **Delimitations of the study.**

 This study is conducted in two selected secondary schools in uyo

Local Government Area. It is delimited to the topic filtration separation technique according to the secondary school curriculum for SSII. Only three basic science process skills out of the bight basic science process skills identified by the America Association for the Advancement of science (AAAS).

1.8 **Limitation of the study.**

 This work has been limited by some factors such as financial constraints, disruption due to examination at the time of the research and short time within which the research was carried out.

**Chapter two**

**Review of related literature**

The review of literature for this study is presented under the following sub-heading; Theoretical frame work, conceptual frame work, review of empirical studies and summary of literature reviewed.

**2.1** **Theoretical frame work**

**2.1.1** Gagne’s Theory of hierarchical learning assumes that learning of a new capability in its ideal sense requires that prior learning of subordinate capabilities that are involved in the new ability. Gagne (1956) thus maintains that the acquisition of knowledge is a process in which every new capability builds on a foundation established by previously learning capabilities.

Gagne advocated that any terminal tasks to be acquired must be carefully analyzed into a progression of subordinator tasks or learning until eventually a hierarchy or tasks know as a learning heraldry is constructed which maps out what should be learned. Thus, for Gagne, instruction is a smoothly guided four up a carefully constructed hierarchy of learning, which are no mapped out to ensure that at each step of the way, the students are adequately prepared for the next step. Gagne’s work contributed to acquisition of basic (simple) science process skills for students

 Following Gagne’s view about learning, it is imperative that the learners understands the process by which specific knowledge is acquired one of the themes of Gagne’s theory is distinguishing the types of outcomes that learning has categories of learned capabilities observed as human performances that have common characteristics. Gagne described five categories of human performances established by learning.

* Intellectual skills (knowing how or having procedural knowledge)
* Verbal information (being able to state ideas. knowing that or having dedicative knowledge)
* Attitudes (mental state that influence the choice of personal actions)
* Motor skills (executing movement in a number of organized motor acts such as play sports).
* Cognitive strategies (having certain techniques of thinking, ways of analyzing problem and having approaches to solve problems).

The five acetones of each learning outcomes provided the foundation for describing how the conditions of learning apply to each category for effective result oriented. This theory is used in this study because of the interest of learning from simple to complex through different stages.

2.1.2 **Jerome Brunner is Theory of constructivism**

 The study of basic science process skills can be traced down to Jerome Brunner’s theory of constructivism. Jerome Brunner’s theory (1966) is a theory of knowledge that argues that humans generate knowledge and meaning from an interaction between their experiences and ideas. It is a theory that suggests that learners construct knowledge out of their experience. Constructivism is a kind of learning strategy that lays emphasis on active role of the learners in process of constructing their own knowledge as being constructed by the learners in the bid to integrate their experience into the existing knowledge structure in memory. According to the theory the learner must engage actively in constructing knowledge into the already existing frame work for meaningful learning to occur. Hence, the child’s development is centered on the instructional process. The implications of the constructivist theories of learning are as follows: the teacher should organize information around the different kind of problems in order to engage student’s interest. The teacher should allow the students to ask questions, carryout experiments and come up with conclusions on their own. This theory will be advantageous in that, the students are actively involved in learning process, gives students opportunity to develop basic science process skills in practical activities. The theory relates to the present work in the sense that the students will apply the experience they have acquired in the theoretical concepts of chemistry in practical concept.

2.1.3 **Jean Piaget Cognitive Learning Theory**

 Piaget (1957) observed that the basis of learning is the child’s own activity as he interacts with his environment. Piaget observed that certain periods are critical in the child’s mental development and they have to be considered during curriculum planning. In addition to this, heredity and the environment also have effect on the cognitive of a child. Piaget pointed out in his work that cognitive development is in stages where each stage has some distinctive properties and structure. The child form birth progresses though cognitive development stages interacting with his/her environment. Piaget observed that within these stages, there are rapid and critical changes in thinking capabilities of the children as they would have as this stage attained both concrete and formal operational level of thinking. The child is able as this level to carry out classification of activities, arrange data in serial order, generalize and abstract from their experience and formulate hypothesis from their observation of events. Piaget is of the opinion that the acquisition of basic science process skills among children accurse stage by stage. Therefore, children develop and acquire these skills in line with their cognitive development when they are exposed to practical activities. This theory relates to the present study because both involve different stages of learning in which the development of the first stage helps in the next.

2.2 **conceptual frame work**

**2.2.1 Science and practical Activities**

Science has been viewed variously by different authors. Science to define as a relentless continuous attempt to find more accurate description of things and event and phenomena in nature (ibe, 2013.). Science as an organized body of knowledge gotten through investigation and experiment. (Nworgu, 2019). Therefore what science does is to expose one to the knowledge of the natural phenomenon and the use of practical efforts to transform it to reality in the teaching and learning situations. The advantages of science however should not only be considered from its utilization value at the more abstract and intellectual place the inner spirit of science. Acquisition of these basic science processes approached that led to the advocating this approach that to science teaching as opposed to the used content approach.

 Practical work consists of those learning experience in which there are interactions with apparatus/chemicals as to improve the power of observation of the instance of scientific principle or concepts practical work simply means students physically manipulating pieces of equipment, observing reactions, taking measurements, etc and investigating aspects of chemistry through the use of wide range of written source materials.

Practical activities provide valuable training in the identification; assessment and control of risk-procedures which can be applied to the management of other activities are indispensable for their mastery of the subject. It is aimed at enabling the learners acquire basic science process skills needed for proficiency in scientific enterprise. Practical exercises are normally conducted in a laboratory using pieces of apparatus and chemical reagents. Report from WEAC chief examiners (2012, 2013 & 2014)revealed that candidate responses have not been encouraging. It depicts lack of acquisition of required basic science process skills which may stem for inadequate exposure of learners to the uses of laboratory apparatus.

2.2.2 Basic Science process skill Acquisition

 Science process skills are mental and physical abilities and competencies which serve as tools needed for the effective study of science as well as problem solving and individual social development (American Association for the Advancement of science, AAAS, 2007). Akinbobola and Afolabi (2010) view basic science process skills as cognitive and psychomotor skills employed in problem solving, problem identification, data gathering, transformation, interpretation and communication. Sevilay (2011) affirmed that basic science process skills help the students to develop a sense of responsibility in their own learning increase permanency of learning as well as teaching them research methods. According to Opateye (2012) basic science process skills are helpful on the development of favorable scientific altitudes and a disposition in the learners. Furthermore, it has been maintained that the basis of learning how to recognize, define and to some extent, solve individual and social problems is learning how to acquire the basic science process skills. This means that basic science process skills are inseparable in practice from the conceptual understanding that is involved in learning and applying science. In practical term, students’ low acquisition of science process skills could result in their failures in science examination. Therefore, one could say acquisition of those skills would offer student’s ability to independently solve individual and science problems. The American Association for the Advancement of science (AAAS), identified fifteen process skills. Mender (2002) identified eight as basic science process skills. These are: observing, measuring, classifying, interring, predicting, use of number/recording, communicating and questioning. Mender (2002) asserted that the above eight (8) process skills suit the teaching of science, generally that effective participation in various practical, demonstration and discussion activities are sure ways of becoming more and more acquainted with the application of various basic science process skills. This study will focus on three basic science process skills out of the right basic skills which are:

1. Observing:

This refers to using the sense to gather information about an object or event. It is made by using the five senses. Good observations are essential in learning the other science process skills. Example;

1. Experimenting:

This has to do with being able to conduct on experiment, asking appropriate questions, stating hypothesis etc. Experiment follows the scientific method; problem →hypothesis →predictions→ test for prediction →evaluation of hypothesis.

The purpose of experimenting is to determine whether a hypothesis is rejected or accepted or to set a standard whereby the judgment is made.

1. Communicating: this involves representing observations, ideas, theoretical model or conclusions by taking, writing, drawing and giving a report of the experiment that was done.

The acquisition of basic science process skill will enable the students understand the concept of chemistry easily irrespective of gender.

**2.23Concept of Separation Techniques**

 Separation technique is the method used in separation of mixtures of two or more different substance. Each constituent of a mixture still retains its individual properties. Thus, the technique employed in separating mixture makes use of the physical properties of their constituents.

Type of Separation Techniques

1. Decanting: A mixture containing a liquid and solid particle separate into two distinct layers on standing. This is a circle way of separating insoluble solid from liquid, as the l8iquid is poured away and collected in another container. A tower solid layer and an upper clear layer. Using a glass rod, the upper layer of clear liquid can be carefully poured or decanted into a second container. This method is not effective for obtaining clear liquid from the mixture especially when the insoluble solid is very fine and light.
2. Filtration:

Filtration is a process used to separate solids from liquids or gases using a fitter medium that allows the fluid to pass but not the solid. They key equipments are:

1. Stirring rod
2. Beaker
3. Fitter paper
4. Funnel
5. Conical flask
6. Retort stand.

In suspension of chalk dust in water is poured onto a filter paper, the water passes through, leavening the chalk particles on the filter paper. The filter paper is folded and placed on the funnel. The liquid that passes through the filter paper is called the filtrate while the solid left on the filter paper is called the residue.

1. Evaporation: In this case the solvent is boiled off and escape into the air while the solute is left behind in the holding container. This method is not suitable for use on solutes which can decompose by heating.
2. Magnetization: This method involves the separation of magnetic substances from non-magnetic substances by a means of magnet.
3. Sieving: This is used to separate solid particles of different size. The mixture is placed on a sieve with a mesh of s particular size. Particles smaller than the mesh size of the sieve will pass through the sieve while the bigger particles remain on the sieve.
4. Sublimation: To separate a mixture of solids containing one which sublimes and one (or more than one) which does not, by heating the mixture. A cotton-stopped inverted funnel is placed over the mixture. When the mixture is heated, the heat-liable solid sublime and turn into a gas, and travel to the top of the inverted funnel. Once the hot gas touches the collar funnel, it solidifies back to a solid. The solid can then be scrapped off and collected in another container from the funnel.

**2.3 review of empirical studies**

**2.31 studies on practical activities**

Ugwuanyi(2011) studied the extent of use of practical activities in teaching and learning chemistry in senior secondary schools in Nsukka local government area. Four research questions were used for the study. The research design was a descriptive survey. The studies found that: the teachers do not use practical activities in teaching and learning chemistry effectively, students are not fully involved in practical activities, chemistry scheme of work is not adequately covered and chemistry practical start late with low rate. The above study is related to the present study in terms of chemistry practical activities. But it differs in instrument for data collection, design of study, method of data analysis and some variables like gender, school location and school type. The present study will identify the effect of practical activities on students’ acquisition of basic science process skills.

Abonyi (2013) conducted a study on the effect of practical activities on students achievement in senior secondary school chemistry Concepts in Nsukka Local Government Area. Three research questions and two research hypotheses were used for the study. The research design was a quasi-experimental. The study found that: the impact of practical activities on achievement of chemistry concepts is high; students taught with practical activities had s higher mean score than those taught with lecture method; male gender had a higher achievement, there is significant difference in favor of male students than the female. The above work is related to the present study in terms of practical activities, subject area, method of data analysis and gender as a variable.

Muhammad (2014) conducted study on evaluation of efficacy of conceptual instructional method of teaching practical chemistry within Zaria education zone of Kaduna state. The research design was quasi-experimental research. The study found that. Academic Achievement of subjects exposed to conceptual instructional method was significantly higher than those exposed to lecture method of instruction. The above work is related to the present study in terms of practical activities, subject area, and research design but differ in variable of school location and geographical scope of study. Thou this study will fill the gaps through identifying the basic process skills acquired by students’ using practical activities.

 From the reviewed literatures’. The findings are related to the present work in terms of practical activities in chemistry. But the findings of the studies are rather centered on the achievement of students comparing lecture method and laboratory method of teaching. None was done in identification of 'students’ acquisition of basic process skills in chemistry.

**2.3.2 Studies on basic science process skills. Acquisition**

Chakelu(2009) investigated the effects of biology practical activities on students’ process skills acquisition in Abuja municipal Area council.

The design of the study was quasi-experimental, specifically the present, post-test, non-equivalent control group design. Three research question and three hypotheses guided the study. The treatment consisted of teaching a selected biology concept “Animal nutrition” to the experimental group using practical activities method while the control group was taught the same concept using the lecture method. The science process skill acquisition Test (SPAT) designed by the researcher, was the instrument used for data collection. The results repealed that practical activities method was more effective in fostering students’ acquisition of science process skills than the lecture method. The interaction effect between teaching method and gender of the subject was not significant. The study cited above is similar to the present study in terms of designs. Instrumentation for data collection and science process skills in practical activities. The present study will identify the effect of the practical activities on students acquisition of the basic process skills by student in chemistry to fill the shot falls of the precious study.

Okinuga, Oji and Yande (2013) conducted a study to assess science process skills acquisition of Basic science students in junior secondary school 3. The design for this study was descriptive survey.

Three research question and one null hypothesis guided the study and eight domains of science process skills were examined. Purposive, stratified and random sampling techniques were used to select a sample of two-hundred and forty students. Basic science process skills Test (BSPST) and challenges of skills Acquisition Questionnaire (CSAQ) was the self0validated instrument used to collect information from the Basic science students and their teachers.

Mean and standard deviation were used for data analysis. Results of their study showed that students have a low acquisition of science process skills. However, calcification is the most acquired skill and the only proficient skill in the domain of science process skills measuring/using number relations is the least acquired of all the science process skills. The study also revealed that students are not successful at acquiring basic science process skills such as observation, interpreting, inferring, communicating, predicting and experimenting. The study is related to the present day in terms of method of data analysis. Though both are related, they differ in purpose, scope and some skills like predicting, inferring and interpreting will not be incorporated in the present work. The present work will use as well validated instrument to identify the effect of practical activities on basic observation, measurement and communication skills.

The above literatures reviewed have relationship with the present work in terms of (basic) science process skills acquisition. Though the above work related to this present study, they failed to find out the effect of practical activities on students acquisition of basic science process skills in chemistry.

**2.3.3 Studies on basic observational skills**.

 Charles AgyeiAmoah Emmanuel. E and Eric Appiah (2018 may) conduct a study on Assessing the observation skills of biology students in selected senior high school in the Eastern region of Ghana. The design for this study was descriptive survey. Two research question and no null hypothesis guide the study. The purpose of the study was to determine whether senior high school from 3 biology students has the skills of observation. The study adopted “Basic skills Assessment” approach or method. One public government science school offering biology was selected randomly and one private science school offering biology was also selected purposively for this study. A task was developed for assessing the observation skills of biology students at SHS3. The research questions were answered using the Mann-Whithey U- test. The result indicated that students (both males and females) were performing at similar levels in the skill of observation. A look at the mean ranks indicates that even though the males scored higher than the females, the difference was not statistically signification. The study is related to the present day in terms of observational skills but differs in purpose, geographical location, instrument for data collection, subject area. The present work will fill the gaps by identifying the effect of practical activities on. Students’ acquisition of basic science process skills in chemistry.

 Veronique (2007) conducted a study on student’s basic process skills and attitude toward science: inputs to an enhanced students’ cognitive performance. The research design was a descriptive condition design. The purpose of the study was to find out the correlation of mastery of Basic process skills and attitude towards science to students performance that may serve as basis in developing an intervention program in science. The study found that: In correlation between mastery in Basic process skills and performance in science observing and predicting skills show significant relation with remembering dimension; observing, inferring and predicting skills have significant relationship with understanding dimension, only classifying skill has no significant relationship to apply dimension: communicating and predicting skills are significantly related to analyzing dimension and all basic process skills are significantly related to creating. The above study is related to the present study in terms of some basic process skills like observing and communicating but differs in research designs, purpose of study, and attitude towards science. The present study will identify the effect of the practical activities on students’ acquisitions of Basic science process skills in chemistry.

**2.3.4 Studies on Basic Communication Skills**

 S.C-komba (2015) conducted a study on the perceived importance of communication skills course among university students. The case of two universities in Tanzania. The article was based on study which was conducted to examine the perceived importance of communication skills course among Tanzanian university students. The study adopted a case study design. The method of data collection was questionnaire and interview and analyzed using thematic intent analysis it was found that the communication skills course wars perceived by the majority of the respondents as an important course for the acquisition of communication skills needed in academic setting. The article is related to the present interims of communication skills and method of data collection but differ in other basic process skills like observation and measuring design of study, location and subject. The present work will fill in the gap by identifying the effacer of practical activities on students’ acquisition of basic process skills in chemistry.

 ZeidanJayosi (2014) studies science process skills and altitudes towards science among Palestinian secondary school students. The study was carried to investigate the relationship between the Palestinian secondary school students knowledge level of science process skills and their attitudes towards science. The research design was experimental method of data collection was questionnaire The result showed that there were significant difference in science process skills due to gender favoring females; and due to residence favoring villages students. However, there was no significant difference in attitudes towards science due to the variable. The study is related to the present work in terms of science process skills, research design and method of data collection but differs in some variables like gender, location. The current student will fill the gap by identifying at teats 3 basic process skills and identifying their effects on students’ practical activities.

 Komba, S.C &Kafanabo. E. J (2012) conducted a study on investigation of the predictive validity of communication skills examination on university students’ offer all academic performance in Tanzania. The object of the study was to determine the extent to which the communication skills examination predicts the overall performance expressed in terms of university CGPA. The sample technique used was the random sampling method. The result of the study should that the university communication skills examination positively predicted the overall students’ performance expressed in terms of GPA’S,More over the communication skills examination scores predicted the university GPA’s better than the students university pointer. However, the study is related to this current study in terms of communication skills but differ in some variables like gender, location, subject students’ performance. The present work will cover the gap. By identifying the effect of practical activities on students’ acquisition of basic communicable skills.

**2.3.5 Studies on basic experimental skill:**

Eva Trnova and Josef Trna(2015) conducted a study on science experimental skills under development. The paper presents significant developmental aspects of the students' science experimental skills in science education. Science experimental skills are briefly described and classified. Authors put the accent on the structure of regulation phases within acquiring of science experimental skills. Experimental skills go through quite rapid development within students' school attendance from the primary up to secondary school. The aim of research is level measuring of acquiring these skills during students' experimental skills development. Students in primary school are not able to reach all developmental stages. All developmental stages of acquiring science experimental skills are achieved by students at first on upper secondary school. Results are presented as exemplified by concrete science experimental skill: observation and measuring of temperature. The presentation is supplemented by original science experiments. The article is related to the present work in terms of experimental skills. But differs in method of data analysis, subject, and design of study. The present work will bridge the gap by identifying the effect of practical activities on students’ acquisition of basic science process skills.

Ediyanto,Iva N. Atika and Masashi Hayashid (2017) The purpose of science education is that students can individually master the science process skill and engage in inquiry. The basic science process skills consist of observing, communicating, classifying, measuring, inferring and predicting. Meanwhile, integrated science process skills are controlling variables, defining operationally, formulating hypotheses, interpreting data, experimenting and formulating models. Science for All indicates that science should be accessible by all learners including deaf and hard of hearing students. Low learning achievement of deaf and hard of hearing students do not come from a low intellectual ability, but due to the intelligence that did not get a chance to develop optimally. Purpose of this study is to explain that deaf and hard of hearing students can master the science process skills. A total of 6 journals on the topic of science process skills and deaf and hard of hearing students were reviewed. These pieces of literature were collected via Hiroshima University Library, and then analyzed and interpreted in accordance with the objectives of the study. Based on this literature review, deaf and hard of hearing students can understand about basic science process skills and develop more positive attitudes towards science. If teachers can apply the right learning model and are supported with good facilities, it is possible that deaf and hard of hearing students will be able to learn about the integrated science process skills. The article is related to the present interms of basic science process skills but differs in subject, method of data analysis, design of study, and special students. The present work will fill the gap by identifying the effects of practical activities on students’ acquisition of basic science process skills in chemistry.

**2.4 Summary of Literature Reviewed.**

 The study on theories related to the study such as Gagne, Brunner and piaget theories. They believed that learning takes place when we are able to strive as the gestalt. The three theories advocated for activity based learning. The conceptive frame work also reviewed important concept like science and practical activities, basic science process skills acquisition, students’ acquisition, concept of separation techniques.

 Empirical students portrayed previewed studies similar to basic science process skills acquisition by male and female students in rural and urban areas. Therefore this study will establish the effect of practical activities on students’ acquisition of basic science process skills.

 **CHAPTER THREE**

This chapter described the methods adopted in the investigation of the problem of the study. It was organized under the following sub-headings, research design, and area of study, population of the study, sample and sampling techniques, instrumentation, validation of the instruments, swing, research procedure and method of data analysis.

3.1 Research Design

The study adopted a pre-test post test experimental design. Experimental designs are primary approach to investigate casual relationship and to study the relationship between one variable and another. The research used this design to compare two groups; the group taught with non-practical activities. The design enables the research to collect original data from the respondents themselves and estimate their level of basic science process skill in filtration separation techniques in chemistry.

8.2 Area of Study.

The research was carried out in Uyo Local Government Area of Akwa Ibom State. This area lies on the North East of Akwa Ibom State bounded by Itu and Ibiono Local Government Area by the North, North West by Ikot Ekpene Local Government Area and west by Abak Local Government Area and in the East by Uran Local Government Area. It lies at latitude 5’03’4.57” North and Longitude 7’56’0:60” East on the globe with a land mass of 255.9 sqkm and a total population of 427873 national census, 2006. The people are generally Ibibio with unique tradition. They are reputed for resourcefulness and highly mobilized for economic development and political integration within the state and the Nigerian Federation.

3.3 Population of the Study

 The study population is made up of all the senior secondary one SS1chemisry students in Uyo local government Area. The choice of senior secondary school 1 students was because they have had prior knowledge on the chosen concept of study and so were expected to have acquired the skills necessary for practical activities in chemistry they were exposed to.

3.4 Sampling and Sampling Technique

 Purposive sampling technique was used to select a sampling size of 100 senior secondary one chemistry students for the study. The choice of the purposive sampling for this study was to select schools in Uyo Local Government Area that satisfied the following conductions: School with standard laboratory, school with standard chemistry teachers, schools that are ready to allow their students to participate and school with the required number of chemistry students. Two schools were selected out of the 15 public school in Uyo Local Government Area constituting of 50 students each.

3.5 Instrumentation

The researcher designed a science process skill Acquisition practical Test (SPSAPT) to measure the degree the students have acquired for each skill. The instrument was developed by the research. The SPSAPT instrument was made up of a set of practical instruments to guide the respondents carry out the laboratory activity. The SPSAPT made provision for a rating scale titled science process skill Acquisition Rating scale (SPSARS) which includes the skills under research, observing, measuring and communicating.

3.6 Validation of Instrument.

To establish the validity of the instrument, it was given to three expends for face and concept validation. The experts were from Department of science Education in University of Uyo, Akwa Ibom State. The validates were requested to scrutinize the relevance of the items of the instrument to the study, whether the questions under each skill properly represent the skill in question, clarity of the instrument to the study and whether the students are observable and ratable. Based on the observations of these experts, the items of the instrument were mollified and were used for data collection.

3.7 Reliability of the Instrument

The trial testing of the instrument was carried out on a representative sample of 20 students by a chemistry teacher that the research trained on the rating items. These students were selected from two schools in uyo Local Government Area. Test-re test reliability technique was used on the scores of the students to determine the internal consistency reliability coefficient for overall quantitative analysis items obtain a coefficient of 0.842. The SPSAT was said to be reliable.

3.8 Scoring

It was scored according to the sum total of all the points picked by each student for each variable according to the point of the science process skill Acquisition Rating scale (SPSARS)

3.9 Research Procedure

A letter was gotten from department of science education, university of Uyo, Akwa Ibom State by the research to be given to the principal of the schools to be used for the research process. The research was assisted by two chemistry teachers which were trained on how to rate the students on the variable skill of observing, measuring and communicating and objective of the research was dearly state. This was to ensure the acquisition of the state skills. Therefore the instruments issued out were collected for calculations and analysis.

3.10 Method of Data Analysis

Mean and standard deviation were used to answer the research questions. All hypotheses were tested at 0.05 level of significance and analyzed using t-test.

**CHAPTER FOUR**

This chapter deals with the techniques of data analysis relating to the four hypotheses and the interpretation of results presented in tabular

**4.1 Result**

**4.1.1 Test of Hypothesis 1**

There is no significance difference in the mean score of those taught with practical activities and non-practical activities**.**

**Table 1: t-test analysis of students taught with practical activities and non-practical activities.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Group |  N |   |  SD | dF | t-cal | t-crit | DecisionP<0.05 |
| Pre-test(non-practical activities) | **50** | **14.06** | 14.06 |  |  |  |  |
|  |  |  |  | 98 | 2.43 | 1.66 | significant |
| Posttest(practical activities) | 50 | 8.42 | 8.5 |  |  |  |  |

Table 1 show that the calculated t-value is 2.43 while the critical t-value of T with 98 degrees of freedom at 0.05 level of significance is 1.66. Thus, the calculated t-value of 2.43 is greater than t-critical value of 1.66. Consequently, the null hypothesis of there is no significance difference in the mean scores of students taught with practical activities and non-practical activities is rejected. Hence there is a significant difference in the mean scores of students taught with practical activities and non-practical activities.

**4.1.2 Test of Hypothesis 2**

There is no significance difference in the mean observation process skills of students taught separation techniques as a practical activity and those without observation skills.

 **Table 2: t-test analysis of post scores of observation process skills of students taught separation techniques as a practical activity and those without observation skills.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Observation skill | N |  | SD | dF | t-cal | t-crit | Decision p<0.05 |
| Experimental group(observation) | 50 |  13.72 |  13.73 |  |  |  |  |
|  |  |  |  |  98 |  2.40 |  1.66 |  significant |
| Control group(non observation) |  50 |  8.26 |  8.44 |  |  |  |  |

Table 2 shows that the calculated t-value is 2.40 while the critical value of T with 98 degrees of freedom at 0.05 level of significant is 1.66. Thus, the calculated t-value of 2.40 is greater than the t-critical value of 1.66. Hence the null hypothesis of there is no significance difference in the mean observation process skills of students taught separation techniques as a practical activity and those without observation skills is rejected. Consequently, there is significant difference in the mean observation process skills of students taught separation techniques and those without observation skills.

**4.1.3 Test of Hypothesis 3**

There is no significance difference in the mean communication process skills of students taught separation techniques as a practical activity and those without observation skills.

**Table 3: t-test analysis of post scores of communication process skills of students taught separation techniques as a practical activity and those without communication skills.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Communication skill |  N |   | SD |  dF |  t-cal | t-crit | Decision p<0.05 |
| Experimental group(communication)  |  50 | 14.12 | 14.10 |  |  |  |  |
|  |  |  |  | 98 | 2.92 |  1.66 | Significant |
| Control group(non-communication) |  50 | 7.64 | 7.76 |  |  |  |  |

 The calculated t-value of 2.92 was greater than t-critical value of 1.66 for degrees of freedom of 98 at 0.05 level of significance. Hence, the null hypothesis is rejected which implies that there is significant difference in the communication process skills of students taught separation techniques as a practical activity and those without communication skills**.**

 **4.1.4 Test of Hypothesis 4**

There is no significant difference in the mean communication process skills of students taught separation techniques as a practical activity and those without communication skills.

**Table 4: t-test analysis of post scores of experiment process skills of students taught separation techniques as a practical activity and those without experiment skills.**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Experiment skill** | **N** | **** |  **SD** | **dF** |  **t-cal** |  **t-crit** | **Decision p<0.05** |
| **Experimental group(experiment)** |  **50** |  **13.68** | **13.65** |  |  |  |  |
|  |  |  |  |  **98** | **2.76** | **1.66** | **Significant** |
| **Control group(non-experiment)** |  **50** | **7.58** |  **7.65** |  |  |  |  |

Table 4 shows that the calculated t-value is 2.76 while the critical value of T with 98 degrees of freedom at 0.05 level of significant is 1.66. Thus, the calculated t-value of 2.76 is greater than the t-critical value of 1.66. Hence the null hypothesis of there is no significance difference in the mean experiment process skills of students taught separation techniques as a practical activity and those without experiment skills is rejected. Consequently, there is significant difference in the mean experiment process skills of students taught separation techniques and those without experiment skills.

**4.2 Discussion of Results**

The results of the findings are discussed based on the four hypothesis stated for this study.

 From table1, it is observed that there is significant difference in the mean scores of students taught with practical activities and non-practical activities. The results show that students taught separation techniques using practical activities scores higher than students’ taught without practical activities. Therefore, the effects of practical activities is that it aids students understands chemistry, encourages creativity in students, offers students the opportunities of getting hands-on experience in the safe handling of chemicals and laboratory apparatus.

 Table2 shows that there is a significant difference in the mean observation process skills of students taught separation techniques and those without observation skill. This implies that students who were taught separation techniques with observation skills perform better than those that didn’t use observation skills.

Table 3 shows that there is significant difference in the mean communication process skills of student taught separation techniques and those without communication skills. This implies that practical activity aids the students understand communication skills and in turn they perform better than those without.

Table 4 also shows that there is significance difference in the mean experiment process skills of student taught separation techniques using practical activities and those taught without experiment skill. The result shows that student though taught with practical activities acquires the experiment skills than student that were not taught with practical activities.

**4.3 summary of Findings**

The following contributes to the major findings of the study

1. There is significant difference in the mean scores of students taught with practical activities and non-practical activities.

2. from the findings, students taught with practical activities acquires the basic observation skill than those without observation skill as shown by their overall mean score.

3. Senior secondary school students has easy acquisition of the basic communication process skills in separation techniques as a practical activity than students without practical activities.

4. Students taught using practical activities has easier acquisition and understanding of basic experiment process skills than student taught with non practical activities.

**** session and a sample size of 100 students. Four research questions and Four null hypotheses guided the study. the instrument for data collection was science process skills acquisition practical test (**SPSAPT)** with a rating scale titled science process skill acquisition rating scale (SPSARS) adopted by the researcher. The instruments were face and content validated by experts in department of science Education University of Uyo, Akwa Ibom State. This was to ensure that the instruments had high validity and usability.

 In line with finding of the study, recommendations were proffered and suggestions for further study were equally made.

**5.2 Conclusion**

Based on the findings of the study on practical activities and students acquisition of basic science process skills in separation techniques in chemistry in Uyo Local Government Area, the following conclusion were made:

1. The effect of senior secondary school student’s acquisition of basic science process skills is low. Therefore, teachers are expected to teach the student with practical activities as this will enhance acquisition of basic science process skills especially in separation techniques.

2. Senior secondary school students taught with practical activities demonstrated high and easy acquisition of basic observation science process skills. Therefore teachers should teach chemistry with practical activities. All students should be taught under the same condition for even acquisition of basic science process skills.

3. Senior secondary school students taught with practical activities demonstrated high level of acquisition of basic communication science process skills in separation techniques than students with non-practical activities. Therefore, the teachers should help the student mater the basic communication skills and also laboratories should be equips with modern laboratory apparatus to enhance students’ performance in chemistry through acquisition of appropriate basic science process skills. Chemistry concepts such as separation techniques should be taught with practical activities so that students will do science instead of learning science among others.

4. Students with basic experiment skills understood practical activities especially in separation techniques than those without the basic experiment skill. Teacher should ensure that the student masters the basic science process skills especially the experimental skills, and this can be achieved through practical activity in separation techniques and in chemistry as a whole

**5.3 Educational implication of the study**

The results of the study have educational implications on the students, teachers, curriculum planner and developers, examination bodies and the researchers.

 Active participation of students in class aid retention and makes the lesson more meaningful. This is achieved when students apply their five senses and other skills in learning instead of learning through abstraction. Students should try their best possible to involve themselves in practical activities in chemistry using improvised materials where possible. This will motivate the student to work hard and acquire skills thereby bridging any form of influence of gender and location on acquisition of skills.

 The findings of this study have implications on the teachers who should adopt practical method of teaching which is the students centered method. Activity-based method enhances understanding of chemistry concept such separation techniques and increase learners ability to acquire basic science process skills.

 The finding of this study will help curriculum planner and policy makers in planning and decision making process which must come from needs of a students as well as society in general. Therefore, the curriculum planner’s needs to review the present chemistry curriculum to emphasized more the use of practical activities in teaching chemistry for proper acquisition of skills. This is because curriculum serves as guide book to every skillful teacher.

 This study implores the educational researchers to develop proper instrument for assessment of all type of educational domains in all science subjects. The researchers must take up studies on the identification of all science process skills in chemistry practical, the result of this will give you a new direction to carry out the research in tertiary institution.

 The result of this study will generally help examination bodies like WAEC, NECO, and NAPTEB in assessing senior secondary school student in practical chemistry skills through the use of direct observation of the skills from chemistry student during examination instead of the traditional method of assessing students through paper and pencil currently in use in practical examination. The examination bodies can adopt the instruments and organized workshop for science teachers on the importance of it.

**5.4 Recommendations**

Based on the findings of the study, the following recommendations are made:

1. Chemistry teachers should present science process skills in clearer terms, starting from simple to complex to enable students to acquire them and they should direct more attention to female student for improvement on their science process skills acquisition to enhance their performance in chemistry.

2. Laboratories should be equipped with modern facilities to enhance students’ performance in chemistry through acquisition of appropriate science process skills.

3. The number of periods per week for science lesson should be increased to create room for elaborate laboratory activities with students. This will help eradicate student’s low acquisition of process skills.

4. Government/Ministry of education and professional organization like STAN should organize workshops, seminars and conferences for chemistry teachers to update them on science process skills acquisition. The need for training of chemistry teachers on science process skills is recommended in order to make their teaching more practical oriented.

5. More qualified science teachers should be employed and evenly posted since they are in a better position to use the practical activities in promoting students of acquisition of skills in practical chemistry in every school.

**5.5 Suggestions for further studies**

1. A replication of this work embracing a wider geographical area and a larger sample size is essential to ensure a greater reliability generalization.

2. Only three science process skills were tested out of the fifteen identifies by the American Association for the Advancement of science, AAAS. Therefore, there is need for further studies to cater for the remaining twelve sciences process skill areas.

3. Replication of the study could be undertaken in other subject areas like Physics, Biology and integrated science.

4. This study was centered on only public secondary schools. The inclusions of private schools will give room for comparisons that would further validate the findings in future studies for greater generalization.

5. The same study could be conducted in the institution of higher learning using similar instruments.

**REFERENCES**

Abonyi, U. M (2013). *Effects of practical activities on students understanding of chemistry concept*; unpublished master Degree Thesis. Nnamd; Azikiwe University, Akwa.

Adam, H. (2009). What are science process skills? Retrieved o January, 27.200, from http:www. Wisegeck. Com /what are science process skills. Htm.

Adesoji, F A &ogini, A.M (2012) students’ aptitude indices as predictors of learning outcomes in chemistry. *British journal of Arts and social science,* 8 (11), 174-184.

Adeyemo, S.A (2009). Understanding and acquisition of entrepreneurial skills. A pedagogical orientation for classroom teacher in science education. Tournal Turkish science Education, 6(3), 56-64 American publisher.

Ajaja, O. P (2010). Processes of science skills acquisition. Competencies required of teacher for imparting them*. Journal of quality Education*. 6(4), 6-12

Akin bobola, A. O &Afolabi, F.O (2010*). Analysis of science process skills in West African.*

American Association for the Advancement of science, (2007). Science –*A process Approach* Washington D.C.

Ango, M. L (2011*). Needed science process skills as foundation for effective technology education for national development?* In P. O. Awotunde (ED), issues in technology education for national development. Jos: National Association of Teacher of technology, 1:92-104.

Bosede, A. F (2010). Influence of sex and location on relationship between students. Problems and academic performance. *The Journal of social science* 5(4) 340-345.

Charters, A.A, Eshun, E.&Appiah, E (2018). Assessing the observation skills of biology students in selected senior High school in the Eastern Region of Ghana.

Chukelu, C. U. (2009). *Effect of biology practical activities on students process skills acquisition in Abuja municipal Area council.* Unpublished M. Ed. Thesis. University of Nigeria, Nsukka.

Eva Trnova and Josef Trna(2015) eva In: IOSTE 2006. Europe Needs More Scientists. The Role of Eastern and Central European Science Educators (pp. 77-84). Tartu: University of Tartu, 2006. ISBN 978-9949-11-567-9., At Tartu, Estonia

First International Conference on Science, Mathematics, and Education, (ICoMSE 2017) Copyright © 2018, the Authors. Published by Atlantis Press. This is an open access article under the CC BY-NC license (http://creativecommons.org/licenses/by-nc/4.0/). A

Gagne, R.M (1965). *The psychology basic of science. A. process approach* SAPA Washing ton, D.C. AAS miscellaneous publications. 65-68.

Ibe, E. (2004*). Effects of guided inquiry, demonstration and conventional method of teaching science on acquisition of science peocess skills among senior secondary school students* (Unpublished M.Ed). Department of science Education, university of Nigeria, Nsukka.

Ibe, E. (2013*). Effects of constructivist instructional model on scientific literacy levels and interest of upper basic science students*. Unpublished ph. D. Thesis. Department of science education, university of Nigeria, Nsukka.

Jerome Bruner (1966).

Komba S. C. (2015). The perceived importance of communication skills course among university students: the case of two universities in Tanzania. *African Journal of Teacher Education* vol 4, No2 partII (Fall 2014/ spring 2015)

Komba S. C &Katanabo. E .J. (2012). Investigation of the predictive validity of communication skills examination on university students’ overall academic performance in Tanzania*. International Journal of Education* , 4(4):247-266.

Mendor, A.K. (2002*). Effects of constructivist model on acquisition of science process skill among junior secondary students* (unpublished M.Ed.). department of science Education, University of Nigeria, Nsukka.

Muhammad, B.A (2014). An evaluation of efficacy of conceptual instructional method of teaching practical chemistry. A case study of secondary school in Zaria Education zone of Kaduna State, Nigeria. *African Journal of Education and Technology* 4(1), 112-118.

Okeke, A.C (2008). Women in non-traditional occupations. Schools can make the difference in building and carrier Development for Women by women studies unit of the institution of Education, University of Nigeria Nsukka.

Okinuga, R.O, Ojo, O.T &Yawande, R.O (2013). Assessment of acquisition of science process skills of basic science students in universal Basic Education programmed. *Journal of science Teachers Association of Nigeria* 43(2) 16-19.

Opateye, J.A. (2012). Developing and assessing science and technology process skills in Nigerian universal Basic Education Environment. *Journal of Education and society Research*, 2, 34-42.

Omajuwa, J. (2011). *Senior secondary school students’ difficulties in science process skills acquisition* (unpublished M.Ed. dissertation). Delta state university Abraka.

Owoeye, J.S &Yara, P.O. (2011). School location and academic achievement of secondary school in Ekiti state, Nigeria*. Asian social science* (ASS) 7(5), 170-173.

Ozgelen, S. (2012). Scientists’ science process skills within a cognitive domain frame work. *Eurasia Journal of mathematics, science & Technology Education,* 8, 283-292.

Senilay, K (2011). Improving the science process skills: Ability of science student teachers using I diagram. *Eurasia Journal of physics & chemistry Education*, 3, 26-38

Piaget, J (1960). *The origins of intelligence in children*. New York: international universities press, publisher

Ugwuanyi, A.A (2011*). An investigation into the extent of use of practical activities in teaching chemistry*. Unpublished first Degree project. University of Nigeria, Nsukka.

Veronique M,M (2017). Basic process skills and attitude toward science inputs to an enhanced students’ cognitive performance

Yusuf, M.O &Afolabi, A.O (2010). Effect of computer Assisted instruction (AI) on secondary school students’ performance in Biology. *The Turkish online Journal of Educational Technology*, 9(1),-62-69.

Zeidan, H. A &Jayosi, R.M (2014): science process skills and attitudes science among Palestinian secondary school student.

Dol. https. II doi. Orgl 10.5430/wje. V5, lp 13.

A Literature Study of Science Process Skill toward Deaf and Hard of Hearing Students

 Appendix A

 Department of Science Education,

 University of Uyo,

 Uyo.

 23rd September, 2019.

Dear respondents,

 I, Ekanem, Nsimene Cosmas of department of science education with the registration number 15/ed/se/1316, seeks for compliance to fill up this rating scale4 for research purpose under the topic “effects of practical activities on students acquisition of basic science process skills in separation techniques in chemistry”

 I promise your details remain undisclosed as far as this research work is concerned. It will be used for this purpose after ward discarded.

 Thank you for your compliance and support.

 Yours sincerely,

 Ekanem, Nsimene Cosmas

APPENDIX B

SCIENCE PROCESS SKILL ACQUISITION PRACTICAL TEST (SPSAPT)

INSTRUCTION: answer all questions

1. Which of the following separation techniques is dependent on difference in volatility?
a) Distillation
b) Crystallization
c) Magnetic separation
d) Fractional crystallization

 2. Crystallization exploits difference in which factors?
a) Specific heat
b) Boiling point
c) Melting point
d) Bubble point

3. What is the size of equipment determined by?
a) Rate of mass transfer from one phase to another
b) Rate of heat transfer from one phase to another
c) The number of reactions taking place
d) The amount of byproduct formed

4.Which of the following is not an important property that governs the extent of separation?
a) Polarizability
b) Vapor pressure
c) Temperature
d) Radius of gyration

5. How is Oil and Hexane separated?
a) Distillation
b) Separating funnel
c) Crystallization
d) Electrophoresis

6.How a mixture of iron and copper fillings is be separated?
a) Magnetic separation
b) Crystallization
c) Evaporation
d) Distillation

7. What is added when it is difficult to condense vapors leaving the distillation column at top?
a) Adsorbent
b) Absorbent
c) Agitator
d) ESA

8. How is sulphur separated from its impurities?
a) Desublimation
b) Sublimation
c) Crystallization
d) Drying

 9.sieving is a technique used to separate mixtures containing solid particles of
A. small sizes
B. large sizes
C. different sizes
D. the same size

10. Chromatography is used to separate components of mixtures which differ in their rates of?

* **A.** diffusion
* **B.** migration
* **C.** reaction
* **D.** sedimentaion

11.

|  |
| --- |
| Which of the following separation processes uses boiling to separate mixtures? |
| A |   Filtration |
| B |   Sublimation |
| C |   Centrifuge |
| D |   Crystallization |
| E | fractional  Distillation |
| 12. In the filtration process, what is the substance that passes through the filter called? |
|  | a)  Sublimate |
|  |   b)Mixture |
|  |   c)Filtrate |
|  |   d)Centrifuge |
|  |   e)Residue |
| 13. In the filtration process, what is the substance that is removed by the filter called? |
| a) |   Sublimate |
| b) |   Mixture |
| c) |   Filtrate |
| d) |   Centrifuge |
| e) |   Residue |
| 14) Boiling salt water to remove the salt from the water is an example of what type of separation process? |
| https://www.ducksters.com/questions/nr/rbd.gif |   Filtration |
| https://www.ducksters.com/questions/nr/rbd.gif |   Sublimation |
| https://www.ducksters.com/questions/nr/rbd.gif |   Centrifuge |
| https://www.ducksters.com/questions/nr/rbd.gif |   Crystallization |
| https://www.ducksters.com/questions/nr/rbd.gif |   Distillation |
|  |  |

15. When a solution is heated water evaporates and solute

1. evaporates too
2. left as residue
3. disappear
4. condens

16. Soluble solid is separated from water by process of

1. heating
2. evaporation
3. condensation
4. reaction

17. Which of the following methods are to be applied to separate Oxygen rich components and Nitrogen rich components?
a) Crystallization
b) Zone melting
c) Magnetic separation
d) Distillation

18. **Which of these mixture types would have visible particles that could settle to the bottom of the mixture?**

a.suspension

b.solution

c.colloid

d.sassafrass

19. a mixture of sand and water can be separated by?

a. filtration

b.crystalization

c.seving

d. evaporation

20. in hand picking, mixtures are separated based on:

a. colour, size and shape

b. different boiling points

c. different boiling points

d. solubility

APPENDIX C

SCIENCE PROCESS SKILS ACQUISITION RATING SCALE (SPSARS)

 SECTION A

Background information of students:………………………………………

Name of school:………………………………………………………..

 SECTION B

 For raters

The scale ranges from the lowest point of 1 to the highest point of 5

Key to scale

Poor……………………….1

Fair…………………………2

Good……………………………..3

Very good………………………4

|  |  |  |
| --- | --- | --- |
| S/N | PRACTICAL ACTIVITIES |  SCALE  |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| A | Observational skills | 4 | 3 | 2 | 1 |
| 1 | Identification of laboratory apparatuses and solutions |  |  |  |  |
| 2 | Ability to identify an appropriate separation technique to separate a mixture |  |  |  |  |
| 3 | Ability to identify the substrate from the filtrate |  |  |  |  |
| 4 | Ability of how to fix the filter paper on the funnel |  |  |  |  |
| 5 | Identifying the effect of using the wrong apparatus for separating a particular mixture |  |  |  |  |
| B | Communication skills |  |  |  |  |
| 1 | Describing brief observations made |  |  |  |  |
| 2 | Using the correct technical terms in reporting results of the experiment e.g dissolved /soluble instead of melt |  |  |  |  |
| 3 | Recording the results step by step |  |  |  |  |
| 4 | Using the correct chemical symbol, formula and ion in recording the separation carried out |  |  |  |  |
| C | Experimenting skills |  |  |  |  |
| 1 |  Positioning of the funnel in the mouth of the burette |  |  |  |  |
| 2 | Ability to fold the filter paper in to the funnel |  |  |  |  |
| 3 | ability to allow the sediments settle before filtering |  |  |  |  |
| 4 | Ability to carefully rinsed all the apparatus |  |  |  |  |

Answers to the chemistry achievement test

1 a

1. c
2. a
3. c
4. b
5. a
6. b
7. b
8. c
9. a
10. e
11. c
12. e
13. d
14. d
15. b
16. d
17. a
18. a
19. a

APPENDIX D

TABLE OF DATA ANALYSIS FOR HYPOTHESIS ONE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | PRACTICAL ACTIVITIES | NON-PRACTICAL ACTIVITES |  |  |
| S/N | X1 | X2 | $$x^{2}$$1 | X2$^{}2$ |
| 1 | 13 | 8 | 169 | 64 |
| 2 | 12 | 9 | 144 | 81 |
| 3 | 16 | 7 | 256 | 49 |
| 4 | 17 | 9 | 269 | 81 |
| 5 | 16 | 5 | 256 | 25 |
| 6 | 13 | 10 | 169 | 100 |
| 7 | 12 | 7 | 144 | 49 |
| 8 | 14 | 8 | 196 | 64 |
| 9 | 11 | 9 | 121 | 81 |
| 1 | 13 | 10 | 169 | 100 |
| 11 | 15 | 9 | 225 | 81 |
| 12 | 18 | 8 | 324 | 64 |
| 13 | 16 | 12 | 256 | 144 |
| 14 | 12 | 8 | 144 | 64 |
| 15 | 16 | 6 | 256 | 36 |
| 16 | 17 | 5 | 289 | 25 |
| 17 | 13 | 7 | 169 | 49 |
| 18 | 16 | 5 | 256 | 25 |
| 19 | 17 | 9 | 289 | 81 |
| 20 | 15 | 9 | 225 | 81 |
| 21 | 11 | 5 | 121 | 25 |
| 22 | 12 | 12 | 144 | 144 |
| 23 | 18 | 9 | 324 | 81 |
| 24 | 13 | 10 | 169 | 100 |
| 25 | 17 | 10 | 289 | 100 |
| 26 | 13 | 11 | 169 | 121 |
| 27 | 16 | 10 | 256 | 100 |
| 28 | 12 | 10 | 144 | 100 |
| 29 | 14 | 9 | 196 | 81 |
| 30 | 14 | 8 | 196 | 64 |
| 31 | 10 | 6 | 100 | 36 |
| 32 | 11 | 5 | 121 | 25 |
| 33 | 14 | 6 | 196 | 36 |
| 34 | 12 | 10 | 144 | 100 |
| 35 | 14 | 12 | 196 | 144 |
| 36 | 15 | 17 | 225 | 289 |
| 37 | 13 | 8 | 169 | 64 |
| 38 | 12 | 9 | 144 | 81 |
| 39 | 15 | 10 | 225 | 100 |
| 40 | 15 | 11 | 225 | 121 |
| 41 | 13 | 5 | 169 | 25 |
| 42 | 13 | 10 | 169 | 100 |
| 43 | 16 | 9 | 256 | 81 |
| 44 | 12 | 7 | 144 | 49 |
| 45 | 16 | 9 | 256 | 81 |
| 46 | 11 | 7 | 121 | 49 |
| 47 | 13 | 9 | 169 | 81 |
| 48 | 16 | 9 | 256 | 81 |
| 49 | 15 | 7 | 225 | 49 |
| 50 | 14 | 7 | 196 | 49 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | F | FX | CF | X2 | FX2 |
| 18 | 2 | 36 | 2 | 324 | 648 |
| 17 | 4 | 68 | 6 | 289 | 1156 |
| 16 | 9 | 144 | 15 | 256 | 2304 |
| 15 | 6 | 90 | 21 | 225 | 1350 |
| 14 | 6 | 84 | 27 | 196 | 1176 |
| 13 | 10 | 130 | 37 | 169 | 1690 |
| 12 | 8 | 96 | 45 | 144 | 1152 |
| 11 | 5 | 55 | 50 | 121 | 605 |
|  |  | 703 | 50 |  | 10,081 |

x =∑fx/∑f = 703/50 =14.06

X =14.06

% score of those taught with practical activities = 14.07/20\*100

= 1406/20 = 70.3%

Standard deviation of those taught with practical activities

s.d =

σ$∑fx2-\frac{\left(x\right)2}{N}=σ10081-(14.06)2/50$

S.D = $√$10081-197.68/50 =$\sqrt{9883.32}/50$

$$√197.66$$

S.D = 14.06

Those taught without practical activities

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | F | CF | FX | X2 | FX2 |
| 12 | 3 | 3 | 36 | 144 | 432 |
| 11 | 3 | 6 | 33 | 121 | 363 |
| 10 | 9 | 15 | 90 | 100 | 900 |
| 9 | 13 | 28 | 117 | 81 | 1053 |
| 8 | 6 | 34 | 48 | 64 | 384 |
| 7 | 7 | 41 | 49 | 49 | 343 |
| 6 | 4 | 44 | 18 | 36 | 108 |
| 5 | 6 | 50 | 30 | 25 | 150 |
|  | 50 |  | 421 |  | 3733 |

X=∑FX/∑F = 421/50 =8.42

X = 8.42

% SCORE OF THOSE TAUGHT WITTHOUT PRACTICAL ACTIVITIES = 8.42/20\*100

=842/20 = 42.1%

Standard deviation of those taught without practical activities

S.D =$\sqrt{∑fx2}-\left(x\right)2/N$ =

$$\sqrt{3733}-(8.42)2/50$$

=$\sqrt{3733}-70.89/50$

S.D = $\sqrt{3662.11}/50$

= $√73.24$

=8.5

Tcal for HO1: X1-X2/√$\sqrt{\left(N1-1\right)S21}+\left(N2-1\right)S22⦋\frac{1}{N1}+1/N2⦌$

/N1+N2-2

Tcal = 14.06-8.42/√ (50-1)197.68+ (50-1)70.89⦋1/50+1/50⦌

/(50+50)-2

Tcal = 5.64/$\sqrt{9686.32}+3473.61⦋0.04⦌$/ 100-2

= 5.64/$\sqrt{526.40}/98$

= 5.64/2.318

= 2.43

**APPENDIX E**

TABLE OF ANALYSIS FOR HYPOTHESIS TWO

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | BASIC OBSERVATIONAL SKILLS | NON OBSERVATIONAL SKILLS |  |  |
| S/N | X1 | X2 | X12 | X22 |
| 1 | 11 | 9 | 121 | 81 |
| 2 | 13 | 6 | 169 | 36 |
| 3 | 12 | 8 | 144 | 64 |
| 4 | 11 | 8 | 121 | 64 |
| 5 | 15 | 8 | 225 | 64 |
| 6 | 16 | 9 | 256 | 81 |
| 7 | 14 | 12 | 196 | 144 |
| 8 | 15 | 9 | 225 | 81 |
| 9 | 16 | 5 | 256 | 25 |
| 10 | 12 | 6 | 144 | 36 |
| 11 | 15 | 7 | 225 | 49 |
| 12 | 13 | 9 | 169 | 81 |
| 13 | 18 | 5 | 324 | 25 |
| 14 | 16 | 10 | 256 | 100 |
| 15 | 14 | 12 | 196 | 144 |
| 16 | 15 | 9 | 225 | 81 |
| 17 | 12 | 5 | 144 | 25 |
| 18 | 17 | 5 | 289 | 25 |
| 19 | 11 | 7 | 121 | 49 |
| 20 | 15 | 9 | 225 | 81 |
| 21 | 16 | 6 | 256 | 36 |
| 22 | 12 | 9 | 144 | 81 |
| 23 | 13 | 7 | 169 | 49 |
| 24 | 12 | 8 | 144 | 64 |
| 25 | 11 | 12 | 121 | 144 |
| 26 | 14 | 6 | 196 | 36 |
| 27 | 13 | 6 | 169 | 36 |
| 28 | 16 | 7 | 256 | 49 |
| 29 | 11 | 11 | 121 | 121 |
| 30 | 13 | 11 | 169 | 121 |
| 31 | 14 | 10 | 196 | 100 |
| 32 | 14 | 12 | 196 | 144 |
| 33 | 13 | 7 | 169 | 49 |
| 34 | 17 | 10 | 289 | 100 |
| 35 | 12 | 6 | 144 | 36 |
| 36 | 11 | 7 | 121 | 49 |
| 37 | 16 | 9 | 256 | 81 |
| 38 | 15 | 11 | 225 | 121 |
| 39 | 12 | 12 | 144 | 144 |
| 40 | 12 | 7 | 144 | 49 |
| 41 | 11 | 8 | 121 | 64 |
| 42 | 18 | 11 | 324 | 121 |
| 43 | 13 | 8 | 169 | 64 |
| 44 | 17 | 9 | 289 | 81 |
| 45 | 15 | 8 | 225 | 64 |
| 46 | 13 | 10 | 169 | 100 |
| 47 | 11 | 5 | 121 | 25 |
| 48 | 13 | 7 | 169 | 49 |
| 49 | 16 | 9 | 256 | 81 |
| 50 | 11 | 6 | 121 | 36 |

Those taught with basic observational skill

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | F | CF | FX | X2 | FX2 |
| 18 | 2 | 2 | 36 | 324 | 648 |
| 17 | 3 | 5 | 51 | 289 | 867 |
| 16 | 7 | 12 | 112 | 256 | 1794 |
| 15 | 7 | 19 | 105 | 225 | 1575 |
| 14 | 5 | 24 | 70 | 196 | 980 |
| 13 | 9 | 33 | 117 | 169 | 1521 |
| 12 | 8 | 41 | 96 | 144 | 1152 |
| 11 | 9 | 50 | 99 | 121 | 1089 |
|  |  | 50 | 686 |  | 9624 |

x =∑fx/∑f = 686/50 =13.72

X =13.72

% score of those taught with basic observation skill= 13.72/20\*100

= 1372/20 = 68.6%

Standard deviation of those taught with basic observation skill

s.d =

σ$∑fx2-\frac{\left(x\right)2}{N}=√9624-(13.72)2/50$

S.D = $\sqrt{9624}-188.23$/50 =$√9435.77/50$

$$√188.71$$

S.D = 13.73

Those taught without basic observation skill

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | F | CF | FX | X2 | FX2 |
| 12 | 5 | 5 | 60 | 144 | 720 |
| 11 | 9 | 9 | 44 | 121 | 484 |
| 10 | 4 | 13 | 40 | 100 | 400 |
| 9 | 10 | 23 | 90 | 81 | 810 |
| 8 | 7 | 30 | 56 | 64 | 448 |
| 7 | 8 | 38 | 56 | 49 | 392 |
| 6 | 7 | 45 | 42 | 36 | 252 |
| 5 | 5 | 50 | 25 | 25 | 125 |
|  | 50 |  | 413 |  | 3631 |

X=∑FX/∑F = 413/50 =8.26

X = 8.26

% SCORE OF THOSE TAUGHT WITTHOUT basic observation skill = 8.26/20\*100

=826/20 = 41.3%

Standard deviation of those taught without basic observation skill

S.D =$\sqrt{∑fx2}-\left(x\right)2/N$ =

$$\sqrt{3631}-(8.26)2/50$$

=$\sqrt{3631}-68.22/50$

S.D = $\sqrt{3562.78}/50$

= $√71.25$

=8.44

Tcal for HO2: X1-X2/√$\sqrt{\left(N1-1\right)S21}+\left(N2-1\right)S22⦋\frac{1}{N1}+1/N2⦌$

/N1+N2-2

Tcal = 13.72-8.23/√ (50-1)188.51+ (50-1)71.23⦋1/50+1/50⦌

/(50+50)-2

Tcal = 5.46/$\sqrt{9236.99}+3490.27⦋0.04⦌$/ 100-2

= 5.46$√509.09/98$

= 5.46/2.27

= 2.40

APPENDIX E

TABLE OF ANALYSIS FOR HYPOTHESIS THREE

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| S/N | BASIC COMMUNICATION SKILL | NON COMMUNICATION SKILL | X1 | X2 |
| S/N | X1 |  X2 |  X12 |  X22 |
| 1 | 15 | 6 | 225 | 36 |
| 2 | 16 | 7 | 256 | 49 |
| 3 | 14 | 11 | 196 | 121 |
| 4 | 13 | 8 | 169 | 64 |
| 5 | 16 | 5 | 256 | 25 |
| 6 | 11 | 9 | 121 | 81 |
| 7 | 14 | 9 | 196 | 81 |
| 8 | 16 | 8 | 256 | 64 |
| 9 | 18 | 7 | 324 | 49 |
| 10 | 13 | 5 | 169 | 25 |
| 11 | 11 | 6 | 121 | 36 |
| 12 | 12 | 9 | 144 | 81 |
| 13 | 17 | 9 | 289 | 81 |
| 14 | 17 | 7 | 289 | 49 |
| 15 | 11 | 8 | 121 | 64 |
| 16 | 12 | 6 | 144 | 36 |
| 17 | 13 | 8 | 169 | 64 |
| 18 | 12 | 7 | 144 | 49 |
| 19 | 13 | 6 | 169 | 36 |
| 20 | 11 | 5 | 121 | 25 |
| 21 | 15 | 8 | 225 | 64 |
| 22 | 11 | 10 | 121 | 100 |
| 23 | 12 | 9 | 121 | 81 |
| 24 | 15 | 5 | 225 | 25 |
| 25 | 12 | 7 | 144 | 49 |
| 26 | 13 | 8 | 169 | 64 |
| 27 | 15 | 9 | 225 | 81 |
| 28 | 12 | 7 | 144 | 49 |
| 29 | 15 | 6 | 225 | 36 |
| 30 | 13 | 10 | 169 | 100 |
| 31 | 18 | 5 | 324 | 25 |
| 32 | 15 | 8 | 225 | 64 |
| 33 | 14 | 9 | 196 | 81 |
| 34 | 15 | 11 | 225 | 121 |
| 35 | 11 | 7 | 121 | 49 |
| 36 | 12 | 8 | 144 | 64 |
| 37 | 11 | 7 | 121 | 49 |
| 38 | 16 | 11 | 256 | 121 |
| 39 | 11 | 10 | 121 | 100 |
| 40 | 16 | 8 | 256 | 64 |
| 41 | 15 | 6 | 225 | 36 |
| 42 | 16 | 11 | 256 | 121 |
| 43 | 12 | 7 | 144 | 49 |
| 44 | 11 | 6 | 121 | 36 |
| 45 | 12 | 5 | 144 | 25 |
| 46 | 14 | 9 | 196 | 81 |
| 47 | 15 | 9 | 225 | 81 |
| 48 | 12 | 6 | 144 | 36 |
| 49 | 15 | 9 | 225 | 81 |
| 50 | 15 | 5 | 225 | 25 |

Those taught with basic communication skill

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | F | CF | FX | X2 | FX2 |
| 18 | 3 | 3 | 54 | 324 | 972 |
| 17 | 2 | 5 | 34 | 289 | 578 |
| 16 | 6 | 11 | 96 | 256 | 1536 |
| 15 | 11 | 22 | 165 | 225 | 2475 |
| 14 | 9 | 31 | 126 | 196 | 1764 |
| 13 | 7 | 38 | 91 | 169 | 1183 |
| 12 | 8 | 46 | 96 | 144 | 1152 |
| 11 | 4 | 50 | 44 | 121 | 484 |
|  |  | 50 | 706 |  |  10,144 |

x =∑fx/∑f = 706/50 =14.12

X =14.12

% score of those taught with basic communication skill = 14.12/20\*100

= 1412/20 = 70.6%

Standard deviation of those taught with basic communication skill

s.d =

$$∑fx2-\frac{\left(x\right)2}{N}=√10144-(14.12)2/50$$

S.D = $\sqrt{10144}-199.37$/50 =$√9944.61/50$

$$√198.89$$

S.D = 14.10

Those taught without basic communication skill

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | F | CF | FX | X2 | FX2 |
| 11 | 4 | 4 | 44 | 121 | 484 |
| 10 | 3 | 7 | 30 | 100 | 300 |
| 9 | 10 | 17 | 90 | 81 | 810 |
| 8 | 9 | 26 | 72 | 64 | 576 |
| 7 | 9 | 35 | 63 | 49 | 441 |
| 6 | 8 | 43 | 48 | 36 | 288 |
| 5 | 7 | 50 | 35 | 25 | 175 |
|  | 50 |  | 382 |  | 3074 |

X=∑FX/∑F = 382/50 =7.64

X = 7.64

% SCORE OF THOSE TAUGHT WITTHOUT basic communication skill = 7.64/20\*100

=764/20 = 38.2%

Standard deviation of those taught without basic communication skill

S.D =$\sqrt{∑fx2}-\left(x\right)2/N$ =

$$\sqrt{3074}-(7.64)2/50$$

=$\sqrt{3074}-58.36/50$

S.D = $\sqrt{3015.64}/50$

= $√60.31$

=7.76

Tcal for HO3: X1-X2/√$\sqrt{\left(N1-1\right)S21}+\left(N2-1\right)S22⦋\frac{1}{N1}+1/N2⦌$

/N1+N2-2

Tcal = 14.120-7.64/√ (50-1)14.102+ (50-1)7.762⦋1/50+1/50⦌

/(50+50)-2

Tcal = 6.48/$\sqrt{9741.69}+2950.29⦋0.04⦌$/ 100-2

= 6.48$√507.67/98$

= 6.48/2.27

= 2.92

APPENDIX F

TABLE OF ANALYSIS FOR HYPOTHESIS FOUR

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | BASIC EXPERIMENTAL SKILL | NON- EXPERIMENTAL SKILL |  |  |
| S/N | X1 | X2 | X12 | X22 |
| 1 | 13 | 7 | 169 | 49 |
| 2 | 12 | 5 | 144 | 25 |
| 3 | 16 | 8 | 256 | 64 |
| 4 | 12 | 5 | 144 | 25 |
| 5 | 11 | 8 | 121 | 64 |
| 6 | 17 | 5 | 289 | 25 |
| 7 | 15 | 8 | 225 | 64 |
| 8 | 13 | 5 | 169 | 25 |
| 9 | 17 | 6 | 289 | 36 |
| 10 | 12 | 7 | 144 | 49 |
| 11 | 15 | 9 | 225 | 81 |
| 12 | 16 | 6 | 256 | 36 |
| 13 | 13 | 8 | 169 | 64 |
| 14 | 11 | 9 | 121 | 81 |
| 15 | 15 | 9 | 225 | 81 |
| 16 | 15 | 8 | 225 | 64 |
| 17 | 14 | 7 | 196 | 49 |
| 18 | 13 | 8 | 169 | 64 |
| 19 | 16 | 9 | 256 | 81 |
| 20 | 12 | 7 | 144 | 49 |
| 21 | 16 | 9 | 256 | 81 |
| 22 | 17 | 8 | 289 | 64 |
| 23 | 11 | 9 | 121 | 81 |
| 24 | 12 | 6 | 144 | 36 |
| 25 | 15 | 9 | 225 | 81 |
| 26 | 13 | 7 | 169 | 49 |
| 27 | 14 | 10 | 196 | 100 |
| 28 | 15 | 8 | 225 | 64 |
| 29 | 13 | 7 | 169 | 49 |
| 30 | 12 | 5 | 144 | 25 |
| 31 | 12 | 8 | 144 | 64 |
| 32 |  14 | 8 | 196 | 64 |
| 33 | 12 | 9 | 144 | 81 |
| 34 | 15 | 9 | 225 | 81 |
| 35 | 12 | 9 | 144 | 81 |
| 36 | 13 | 10 | 169 | 100 |
| 37 | 18 | 9 | 324 | 81 |
| 38 | 13 | 10 | 169 | 100 |
| 39 | 12 | 10 | 144 | 100 |
| 40 | 14 | 8 | 196 | 64 |
| 41 | 14 | 6 | 196 | 36 |
| 42 | 11 | 5 | 121 | 25 |
| 43 | 13 | 10 | 169 | 100 |
| 44 | 14 | 5 | 196 | 25 |
| 45 | 15 | 6 | 225 | 36 |
| 46 | 12 | 7 | 144 | 49 |
| 47 | 13 | 9 | 169 | 81 |
| 48 | 14 |  8 | 196 | 64 |
| 49 | 13 | 7 | 169 | 49 |
| 50 | 15 | 7 | 225 | 49 |

Those taught with basic experiment skill

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | F | CF | FX | X2 | FX2 |
| 18 | 1 | 1 | 18 | 324 | 324 |
| 17 | 3 | 4 | 51 | 289 | 867 |
| 16 | 4 | 8 | 64 | 256 | 1024 |
| 15 | 8 | 16 | 120 | 225 | 1800 |
| 14 | 8 | 24 | 112 | 196 | 1568 |
| 13 | 11 | 35 | 143 | 169 | 1859 |
| 12 | 11 | 46 | 132 | 144 | 1584 |
| 11 | 4 | 50 | 44 | 121 | 484 |
|  | 50 |  | 684 |  | 9510 |

x =∑fx/∑f = 684/50 =13.68

X =13.68

% score of those taught with basic experiment skill = 13.68/20\*100

= 1368/20 = 68.4%

Standard deviation of those taught with basic experiment skill

s.d =

σ$∑fx2-\frac{\left(x\right)2}{N}=√9624-(13.68)2/50$

S.D = $\sqrt{9510}-187.14$/50 =$√9322.86/50$

$$√186.45$$

S.D = 13.65

Those taught without basic experimenting skill

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| X | F | CF | FX | X2 | FX2 |
| 10 | 5 | 5 | 50 | 100 | 500 |
| 9 | 11 | 16 | 99 | 81 | 891 |
| 8 | 12 | 28 | 96 | 64 | 768 |
| 7 | 9 | 37 | 63 | 49 | 441 |
| 6 | 6 | 43 | 36 | 36 | 216 |
| 5 | 7 | 50 | 35 | 25 | 175 |
|  | 50 |  | 379 |  | 2991 |

X=∑FX/∑F = 379/50 =7.58

X = 7.58

% SCORE OF THOSE TAUGHT WITTHOUT PRACTICAL ACTIVITIES = 7.58/20\*100

=758/20 = 41.3%

Standard deviation of those taught without practical activities

S.D =$\sqrt{∑fx2}-\left(x\right)2/N$ =

$$\sqrt{2991}-(7.58)2/50$$

=$\sqrt{2991}-57.45/50$

S.D = $\sqrt{2933.55}/50$

= $√58.67$

=7.65

Tcal for HO4: X1-X2/√$\sqrt{\left(N1-1\right)S21}+\left(N2-1\right)S22⦋\frac{1}{N1}+1/N2⦌$

/N1+N2-2

Tcal = 13.68-7.58/√ (50-1)13.652+ (50-1)7.652⦋1/50+1/50⦌

/(50+50)-2

Tcal = 6.1$\sqrt{9129.80}+2867.60⦋0.04⦌$/ 100-2

= 6.1$√479.89/98$

= 6.1/2.21

= 2.76

A**PPENDIX G**

NOTE OF LESSON FOR EXPERIMENTAL GROUP ON THE CONCEPT OF SEPARATION TECHNIQUES

SUBJECT: CHEMISTRY

CLASS: SSI

TOPIC: SEPARATION TECHNIQUES

CLASS SIZE: 50 STUDENTS

SEX: MIXED

DURATION: 80 MINUTES (DOUBLE PERIOD)

DATE: 30TH SEPTEMBER, 2019

BEHAVIOURAL OBJECTIVES: during and at the end of the lesson, students should be able to:

1. Define separation technique
2. List at least 5 types of separation techniques
3. Explain the following separation techniques
4. Filtration
5. Sieving.
6. Use of separating funnel.

**PREVIOUS KNOWLEDGE:** student have learnt about mixtures.

**INSTRUCTIONAL MATERIALS**: conical flask, filter paper, volumetric flask, sand, chalk, water.

**REFERENCE MATERIAL:** essential chemistry for senior secondary schools by I.A. ODESINA

New school chemistry for senior secondary schools by Osei Yaw Ababio(5th edition)

**INSTRUCTIONAL STRATEGY:** Activity-based

|  |  |  |  |
| --- | --- | --- | --- |
| **STEPS** | **TEACHERS ACTIVITIES** | **LEARNERS ACTIVITIES** | **LEARNINGPOINT** |
| **INTRODUCTION:**  | the teacher introduces the lesson by mixing sand and beans together and ask the students to select the beans from the stone | The students selects the beans from the stone. |  To make the students have idea of separation |
| **STEP1: MEANING OF SEPARATION TECHNIQUES** | The teacher defines separation technique to the students | The student listen to the teacher and respond |  |
| **STEP11: TYPES OF SEPARATION TECHNIQUES.** | The teacher enumerate explain and carry practical activities on the following types of separation techniques1. Filtration
2. Sieving
3. Decantation
4. Evaporation
5. Fractional distillation
6. Crystallization
7. Hand picking
8. Use of separating funnel and
9. Magnetic separation
 |  The student listens to the teacher and ask questions where necessary. | To make the students the types of separation techniques and the factors to consider when choosing a method to use |
| **STEP111: PRACTICAL ACTIVITIES INVOLVED IN SEPARATION TECHNIQUES** | The teacher put the student into small groups and carry out some practical activities to demonstrate the following separation techniques1. Filtration
2. Sieving
3. Decantation
4. Evaporation
5. Fractional distillation
6. Crystallization
7. Hand picking
8. Use of separating funnel and
9. Magnetic separation
 | The student repeat the practical activity after the teacher in the small groups | To help the students understand how separation is being carried out using different methods and also to acquire the basic science process skills of observation, communication and experimentation |
| **EVALUATION** |  The teacher evaluates the lesson by asking the following questions: i. explain the concept of separation technique.ii. list 5 types of separation techniquesiii. explain how to carry out sieving, use of separating funnel and filtration separation techniques. | The students listen to the teacher and answer the questions | To check if the students understood the lesson |

.**SUMMARY: the** teacher summarize the lesson pointing out the salient points .

**APPENDIX H**

NOTE OF LESSON FOR CONTROL GROUP ON THE CONCEPT OF SEPARATION TECHNIQUES

SUBJECT: CHEMISTRY

CLASS: SSI

TOPIC: SEPARATION TECHNIQUES

CLASS SIZE: 50 STUDENTS

SEX: MIXED

DURATION: 80 MINUTES (DOUBLE PERIOD)

DATE: 30TH SEPTEMBER, 2019

BEHAVIOURAL OBJECTIVES: during and at the end of the lesson, students should be able to:

1. Define separation technique
2. List at least 5 types of separation techniques
3. Explain the following separation techniques
4. Filtration
5. Sieving.
6. Use of separating funnel.

**PREVIOUS KNOWLEDGE:** student have learnt about mixtures.

**INSTRUCTIONAL MATERIALS**: a chart showing filtration and use of funnel separation technique

**REFERENCE MATERIALS:** essential chemistry for senior secondary schools by I.A. ODESINA

New school chemistry for senior secondary schools by Osei Yaw Ababio(5th edition)

**INSTRUCTIONAL STRATEGY:** lecture method

**PRESENTATION**

|  |  |  |  |
| --- | --- | --- | --- |
| **STEPS** | **TEACHERS ACTIVITIES** | **LEARNERS ACTIVITIES** | **LEARNINGPOINT** |
| **INTRODUCTION:**  | the teacher introduces the lesson asking the students what the understand by separation technique. | The students listen to the teacher. |  To make the students have idea of separation |
| **STEP1: MEANING OF SEPARATION TECHNIQUES** | The teacher defines separation technique to the students | The student listen to the teacher and respond |  |
| **STEP11: TYPES OF SEPARATION TECHNIQUES.** | The teacher enumerate and explain some of it the following types of separation techniques1. Filtration
2. Sieving
3. Decantation
4. Evaporation
5. Fractional distillation
6. Crystallization
7. Hand picking
8. Use of separating funnel and
9. Magnetic separation
 |  The student listens to the teacher and ask questions where necessary. | To make the students the types of separation techniques and the factors to consider when choosing a method to use |
| **STEP111: TYPES OF SEPARATION TECHNIQUES CONTINUATION** | The teacher the following separation techniques1. Fractional distillation
2. Crystallization
3. Hand picking
4. Use of separating funnel and
5. Magnetic separation
 | The students respond to the teacher | To help the students understand the concept of separation techniques. |
| **EVALUATION** |  The teacher evaluates the lesson by asking the following questions: i. explain the concept of separation technique.ii. list 5 types of separation techniquesiii. Explain sieving, use of separating funnel and filtration separation techniques. | The students listen to the teacher and answer the questions | To check if the students understood the lesson |

.**SUMMARY: the** teacher summarize the lesson pointing out the salient points.