

# TEACHING CHEMISTRY THROUGH IDENTIFICATION OF SCIENCE PROCESS SKILL INVOLVED IN THE PRODUCTION OF PERFUME USING PINEAPPLE RIND

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## Abstract

*The study was carried out to determine the science process skills involved in the production of perfume using pineapple rind. The study was an experimental design which employed a sample of 8 one hundred (100) SS2 chemistry students randomly drawn from four co-education schools in Onitsha Education Zone. Two research questions and one hypothesis guided the study. Process skills observation guide was used to collect the data. The instrument was validated. Mean and standard deviation were used for data analysis and z test was used to test the hypothesis at the significance level of 0.05. From the findings, it was observed that almost all the science process skills listed were involved in the production of perfume using pineapple rind. Gender was not a significant factor in the level of acquisition of the science process skills by students during the production. The findings also showed that perfume as an improvised resource material enhances and increases the students' science process skills and this makes the understanding of chemistry concepts more concrete rather than abstract. Recommendations were however made.*

**Keywords:** Chemistry, Science process skills, Production, perfume, Pineapple rind,

## **Introduction**

The word science comes from a Latin word “scientia” meaning “knowledge” and in broadest sense is a systematic knowledge-base or prescriptive practice being capable of resulting in prediction. It is the knowledge attained through experimentation especially as obtained and tested through scientific method concerned with the physical world. Science is the origin of subjective observations on which early man based empirical rules for the practical utilization of knowledge (Chikobi, 2016). Chikobi maintained that science is a means of providing explanations for certain events, occurrences and phenomena in nature using acceptable laws, theories, principles and concepts.

Science is an accumulated and systematized learning of knowledge of natural phenomena. The origin of science has been traced to the crude and often subjective observations on which early man based empirical rules for the practical utilization of knowledge (Uzogulu, 2018). The progress of science is marked out not only by an accumulation of scientific knowledge but by the emergence of the scientific method and of the scientific attitude (Okebukola, 2015). Science has proved itself indispensable in the improvement, development and civilization of mankind, as well as in the skilled manpower where it is the bedrock of productive activity.

Science is dynamic in nature and new methods and strategies are continually being evolved to facilitate its teaching, hence, teachers need to improve their knowledge by attending training programmes. These updates will enable them live up to expectation by exhibiting mastery of subject matter as well as distinguish themselves as experts in pedagogy. Njelita (2017) added that science enriches the young with facts, principles and skills as tool for building the natural world. Okeke (2019) observed that science is a dynamic human activity concerned with understanding and helps man to know more about the universe. Without the application of science it would have been impossible for man to explore the other planets of the universe. Also, the awareness of the existence of other planets would not have been realized. Science can be studied in collaboration with education in institutions of higher learning as science education. Science education exposes students to the development in science skills. This will enable them face challenges, make decisions, develop survival strategies and learn to live effectively within the global community (Federal Ministry of Education, 2017). As a discipline, science education is considered as the most valuable tool for human development that is why it was included in the curriculum so as to meet up certain goals of the nation’s development.

One of the most fundamental subjects of natural science is chemistry. Chemistry involves experimentation and the learner is required to observe, record, calculate and make intelligent references (Nnoli, 2021). Chemistry deals with the composition, properties and uses of matter. She maintained that chemistry is the catalyst for sustainable national development. Chemistry is also a subject that is very essential for human survival. It is an aspect that deals with nature of matter and how matter can be transformed into useful products. It is the technology we enjoy today.

Science process skills are commonly used to describe a set of broadly transferable abilities that are reflective of what scientists do. Science educators have argued that teaching students science facts is not as important as developing their science process skills so that they can learn this knowledge on their own (Nkwoma, 2018). Science process skills involve display of expertise in ordered actions designed to enhance science, which is attained through practice. Science process skills expose the learners to operate like scientists and these process skills when acquired could be applied in non-scientific situations (Njelita, 2017). The significance of science process skills highlighted above could be meaningful when the students exhibit competence in them particularly at the informative stage in science learning in schools. These skills when acquired will be carried over to higher education and will as well be utilized in solving everyday problems. Low acquisition of science process skills by the students has also been mentioned as the major factors militating against achievement in chemistry. Science achievement particularly chemistry cannot be realized without the acquisition of science process skills. Teachers also need to be patient especially with students that have difficulties in acquiring process skills. When we teach students to use process skills, we are also teaching them skills in every area of their lives. Science process skills are integrated together when scientists design and carryout experiments.

Active engagement with science will likely make students to become more interested and have more positive attitude towards science. It is in realization of this, that the Federal Government of Nigeria emphatically incorporated student's acquisition of the process skills as an objective of the National Policy on Education (NPE, 2017).

Gender refers to the social attributes and opportunities associated with being male or female and relationship among women and men, boys and girls as well as the relationship among women and among men. Gender equality is an issue that affects the lives and future of women as much as it does men. Chemistry teachers are therefore expected to expose learners to activities that will aid them in the acquisition of science process skills, such as the identification of the science process skills involved in the production of perfume using pineapple rind.

Pineapple (*Ananas comosus*) is in the family of Bromeliaceae and from the specie of sorosis (A2dey, 2018). It is a multiple or composite fruit which develops from a number of flowers juxtaposed together. Historians believed that pineapple originated in Brazil in South America. Thailand, Philippines, Brazil and China are the main pineapple producers in the world supplying 50% of the total output. The Spanish introduced it to the Philippine and Hawaii in the early 19<sup>th</sup> century, the first Commercial of its plantation was in 1886 in Zimbabwe and Guam. According to Chair (2019), many people said that the fruit was first introduced in Hawaii when a Spanish ship brought it in 1500. The fruit was cultivated successfully in Europe and pineapple pits began in 1720. But nowadays, together with India, Nigeria, Indonesia, Mexico, Costa Rica and Kenya form the remaining 50% of pineapple producers. The rind of pineapple is the tough outer skin on tasty tropical fruit. You can recognize the rind as the parts of pineapple that you do not usually eat.

Perfume is a mixture of fragrant essential oils or aroma compounds, fixative and solvents, used to give the human body, animal, food, objects and living spaces a pleasant scent (Chair, 2019). Perfumery or the art of making perfume began in ancient Mesopotamia and Egypt and was further refined by the Romans and Persians. According to Chair, perfumes have been known to exist in some of the earliest human civilizations either through ancient text or from archeological digs. Modern perfumery began in the late 19<sup>th</sup> century with the commercial synthesis of aroma compounds such as vanillin or coumanin, which allowed for the composition of perfumes with smells previously unattainable solely from natural aromatic alone (Beychok, (2017). Production is the process of making or growing something in large amounts, hence, the researcher intends to find out the science process skills in the production of perfume (vanillin) using pineapple rind.

### **Statement of the Problem**

Nigeria is a country endowed with huge natural resources to produce finished products for her basic needs, but fact still remains that the skills needed for such productions is not inculcated to the young school leavers. This is partly due to the emphasis on theory teaching and little attention to practical theory which could have equipped the students with the necessary process skills that would help them engage in production of goods and also serve as a means of employment to them after school. Chemistry is taught by the combination of teaching-learning using discussion or simple demonstration methods, which have not helped in improving student's achievement in chemistry. Activity-based teaching should be encouraged in teaching chemistry in order to help students acquire more process skills. Hence, this study determines to investigate the process skills involved among chemistry students through the production of perfume from pineapple rind.

### **Purpose of the study**

The purpose of this study was to examine the teaching of chemistry through identification of science process skill involved in the production of perfume using pineapple rind. Specifically, the study identified;

1. the science process skills involved in the production of perfume from pineapple rind.
2. the influence of gender on acquisition of science process skills.

### **Research Questions**

The following research questions were formulated to guide the study:

3. What are the science process skills involved in the production of perfume from pineapple rind?
4. To what extent do gender influence acquisition of science process skills during the production of perfume using pineapple rind?

### **Hypothesis**

The null hypothesis was tested at 0.05 level of significance.

1. There is no significant difference between male and female students in the acquisition of science process skills during the production of perfume using pineapple rind.

## Methods

The research design adopted for this study was pure experimental. The study was carried out in senior secondary school in Onitsha North Local Government Area of Anambra State. The population of this study comprised the entire Senior Secondary School three (SS2) chemistry students in the 32 (Thirty two) public secondary schools in Onitsha Education Zone of Anambra State. The sample for the study comprised 100 (One hundred) SS2 chemistry students. To obtain this sample, all the government owned secondary schools in Onitsha Education Zone were first stratified into boys, girls and co-educational schools. Four schools were selected by stratified random sampling from the 14 co-educational schools in the zone. Two schools were selected from Onitsha north Local Government Area with seven (7) co-educational schools; one school was selected from Onitsha South Local Government Area with two (2) co-educational schools and one school was selected from Ogbaru Local Government Area with five (5) co-education schools. The instrument used for data collection was process skills observation Guide (POG) which was subjected to face validity. The POG was developed based on experiences of an expert in educational psychology and three experienced chemistry teachers including the researcher. The guide was to identify the process skills that are involved in the production of perfume using pineapple rind. The instrument consists of 15 items rated on 4 point scale. Process skills with mean value of 2.50 and above indicated mostly involved, while those with mean value below 2.50 were regarded as not involved.

Method of extraction of perfume from pineapple fruit was maceration/solvent extraction method and the solvent used was ethanol. Simple apparatus used includes grater, knives, pot, kerosene stove. The air dried fresh rind (peels) of pineapple fruit was placed on a chemical balance to determine the mass. The rind was crushed and grinded into particles by means of grinding machine. The materials were soaked with 10ml of ethanol. The soaked crushed rind was allowed to stand for 2days to allow the solid particles to be extracted by the solvent. The concentrate or the filtrate was collected by decantation and sieving separation techniques. The resultant solution was boiled for 2-3 hours to evaporate the ethanol, leaving the liquid fragrant. The alkalinity or acidity of the liquid fragrant (perfume) was tested using litmus paper.

The data were collected and analyzed using mean and standard deviation. Z-test was used to test the null hypothesis at the significance level of 0.05. The process skill that has a mean value of 2.50 and above indicates positive response while the process skills that has mean value of 2.49 and below indicates negative response. The criteria mean is 2.50.

## Results

**Research Question One:** What are the science Process skills involved in the production of pineapple rind?

**Table 1: Mean rating scores and Standard Deviation of chemistry students on science process skills involved in the production of perfume using pineapple rind.**

S/N	Process Skills	Means	Standard Deviation
1.	Observing	2.85	1.15
2.	Classifying	2.20	1.03
3.	Communicating	1.80	0.98
4.	Measuring	2.85	1.19
5.	Counting and using numbers	3.20	0.82
6.	Inferring	2.70	1.14
7.	Predicting	2.55	1.24
8.	Experimenting	2.95	1.02
9.	Questioning	2.80	1.35
10.	Manipulating	2.70	1.61
11.	Formulating hypothesis	2.30	1.23
12.	Controlling variable	2.65	1.24
13.	Formulating models	2.75	1.09
14.	Interpreting data	2.72	1.03
15.	Making operational definitions	2.58	0.94
<b>Total:</b>		<b>39.60</b>	<b>17.06</b>

Table 1 shows the mean scores and standard deviation of process skills achieved in the production of perfume using pineapple rind. The mean scores revealed that 12 process skills out of 15 were acquired. Only classifying, communicating and formulating hypothesis were not acquired. It also shows that the acquisition of science process skills increased in the production of perfume.

**Research Question Two:** To what extent do gender influence acquisition of science process skills during the production of perfume using pineapple rind.

**Table 2: Mean scores on gender influence on acquisition of science process skills during the production of perfume using pineapple rind.****Table 2: Mean ratings scores of male and female students on the acquisition of science process skills.**

Gender	Number of students	Means	SD
Males	40	2.58	0.67
Females	60	2.68	0.87

Table 2 shows that the mean scores of females are higher than those of males in observing, communicating, measuring, counting and using numbers, inferring, experimenting, formulating, hypothesis, controlling variables, interpreting data and making operational definitions. The males obtained higher mean scores than the females in classifying, predicting, questioning, manipulating, and formulating models. Males exhibited low acquisition in measuring, counting and using numbers, inferring and experimenting. Females exhibited low acquisition in classifying, questioning and manipulating, predicting, formulating models.

### Hypothesis:

There is no significant difference between male and female students in the acquisition of science process skills during the production of perfume using pineapple rind.

**Table 3: Z-test of the mean ratings of male and female students on the acquisition of science process skills**

Gender	Number of students	Means	SD diff	Z - cal	Z - crit
Males	40	2.58	0.67	98	0.13
Females	60	2.68	0.87	1.960	

From table 3, the calculated z-value is 0.13 and z-critical value is 1.960. Since the Z-calculated is less than the critical z value. The null hypothesis is therefore accepted. Hence, there is no significant difference between male and female students in the acquisition of science process skills during the production of perfume using pineapple rind.

### Discussion

In the discussion of the identification of the science process skills involve in the production of perfume using pineapple rind, it was observed that 12 process skills out of 15 was identified to be acquired by students. The mean scores of female are higher than those of male in observing, communicating, measuring, counting and using numbers, inferring, experimenting, formulating hypothesis, controlling variables, of interpretation data and making operational definitions. Both exhibited low acquisition in inferring and experimenting. There is no significant difference between male and female students in the acquisition of science process skills during the production of perfume using pineapple rind. It was also observed that the production of perfume enhances and increases the students' science process skills and this makes the understanding of chemistry concepts more concrete rather than abstract.

## Recommendations

1. The findings of this study revealed that students exhibited low acquisition in classifying, communicating and formulating hypothesis. Teachers are therefore, expected to emphasize the inculcation of these process skills in students by the use of appropriate methods and teaching aids in their teaching.
2. Chemistry teachers should attend workshops, seminars and conferences to acquaint themselves with modern methods of teaching especially those that are learner-centered and ways of inculcating science process skills.
3. The curriculum planners will help to determine the extent to which the stated objectives in chemistry are achieved. This will guide the teacher in helping students to identify the process skills exhibited in a particular production and those not exhibited.
4. The stated objectives by curriculum planners will also enable teachers to prepare resources, materials and equipment for inculcation of these science process skills for better performance of students. It will also provide them with empirical evidence which is necessary for important decisions in science curriculum.
5. The teacher should ensure that students have more interest in learning that involves their full participation; hand-on and minds on.
6. The government being aware of lack of teaching aids and equipment for science teaching in our schools should try to provide schools with these materials and equipments like science laboratories for effective teaching of science which will enhance the acquisition of these process skills.
7. The curriculum theory and curriculum should not start from students as learners but from students' entitlement or access to knowledge. This will guarantee youths future and create peaceful and prosperous society.

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