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# TEACHING VARIABLES AND STUDENTS PERFORMANCE ON THE CONCEPT OF SAPONIFICATION

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**ABSTRACT:** *The study investigated the project method and the effective teaching of saponification (Soap Making) using local materials. Out of 1,902 population, 65 sample in their intact class was used for the quasi-experimental study. The instrument for data collection was Chemistry Achievement Test (CAT) based on the senior secondary (III) curriculum. Three research questions and two hypotheses were formulated at 0.05 level of significance. The instrument Chemistry Achievement Test (CAT) which contained 25 items was validated and found reliable at coefficient of 0.89 using Kuder Richardson 21 ($KR_{21}$) method. The validated instrument was used to collect data after teaching using the lesson package. The data collected were analyzed using ANCOVA. Findings of the study revealed a mean difference in students' performance using project method; which when compared was not statistically significant. Also, both the treatment and the controlled variables have no influence on gender performance. The study recommends that Chemistry should be taught using available local resource materials and student-centered teaching methods.*

**KEYWORDS**: Saponification, Project Method and Teacher Variables

## INTRODUCTION

The world today is technologically advancing in science and technology. One of such curriculum consideration in this advancement is Chemistry, playing vital role especially in this 21st century. The National Policy on Education (FRN 2004) stated that science should be taught at all levels of education in Nigeria, so as to equip the citizens with the necessary requirement to live effectively in this age of science and technology. Education therefore, aims at developing in the learners the ability to explore the environment through creativity and inquiry. The teacher is a major factor in the wave of teaching and learning processes. Therefore, the ability of the teacher in selecting appropriate teaching method(s) that will enhance students' understanding of the concept is very essential. The use of conventional method(s) alone which does not bring about retention of what is taught should be de-emphasized while activity-based instructional method(s) with appropriate utilization of the available local materials should be the focus. "The new Chemistry curriculum for Nigerian Secondary Education system focuses on practical activities with emphasis on locally available materials. The implication of this, is that, chemistry teachers need to re-examine their classroom method(s) of teaching with the view to adopting or in-deed devising school-based practical activities in which specific resources are effectively utilized to the benefits of the students" (Eya, 2011).

According to Aladejana and Egbedokun (2007), the quality of the classroom and the materials the teacher can bring into the classroom to aid and enhance learning are very important. They further stated that activity-based learning develops learner's interest in science and possibly enhance performance. Dresden and Lee (2007) also affirmed that when students are adequately engaged in the learning process, performances become higher as students find the classroom



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or learning environment more enjoyable and enriching. It therefore, becomes imperative that new ways of presenting chemical concepts be developed, such that theoretical or text book knowledge are complemented with practical demonstrations and applications. Project method is such an activity-based teaching method that allows students explore and experience their environment through their sense and in a way direct their own learning. The emphasis is on experiential learning (learning by doing) rather than rote and memorization. According to Ajeyalemi (2011), project method allows students to get a real sense of science; learn cooperatively, create, build and construct ideas. Research has also shown that project-based learning is particularly effective for historically low achieving students (Jeena, 2008). According to him, students taught in a project based environment achieve higher scores in a standardized test. This is in line with studies of Carlson and Sullivan (1999) which revealed that the use of project method did not only increase students' interest, but also resulted in students achieving high grade point average (GPA) scores. Project method is such a viable alternative that provides hands-on-activities and enables students to utilize itself available local materials around them. With this approach, the learners' intellect is challenged so that they connect what they are learning to what they are already familiar with. This arouses the interest of the learners and provides enjoyable motivational activities that stimulates and in turn enhances understanding and performance.

However, students' performance in science especially Chemistry has been so poor that the number offering Chemistry at the West African School Certificate Examination(WACE) in Nigeria has been decreasing yearly (WAEC Report 1999) in Konji and Okonji (2009). Also WAEC and NECO chief examiners report of May /June 2003, 2004 and 2005 according to Ifeakor in Nzewi (2006), indicates poor performance of students in Chemistry since the past years. Similarly, according to Muyiwa and Onukwube in National Mirrow Online (2011), the poor performance rate in the West African Examination Council (WAEC) and National Examination Council (NECO) examination from 2009 till 2012 has not been encouraging. This phenomenon of poor external result among Nigerian students especially those in secondary school has become a source of worry to successive governments, parents and major stake holders in the education sector. Could this ugly posture or poor performance be attributed to routine education where the use of conventional or traditional teaching method(s) is emphasized instead of learning by doing? The Registrar and Chief Executive Officer of NECO, promise Okpala in his report blamed the Mass failure in the quality of teaching and learning in schools according to him, there is little the examination bodies could do to salvage the already bad situation (National./Mirrowonline.net 2012). Therefore, this study seeks to ascertain the effectiveness of project method in teaching chemistry concept such as saponification using available local materials.

**Statement to the Problem**

The poor performance of Chemistry Students in Secondary Schools in Nigeria has become a source of concern. In 2009, less than 50% of students passed the West African School Certificate Examination with Credit in five subjects including English and Mathematics. The same poor performance ratios were equally recorded by the students in the subsequent years of 2010 and 2011. Similarly, the May / June 2012 West African Certificate Examination result has shown that less than 40% of 1,699, 878 candidates who sat for this examination scaled through the result adjudged to be about eight (8%) percent improvement on the last years result. According to the outgoing Head of the Nigerian National Office (HNO), Uyi Uwadiae, who announced the result 649,156 candidates representing 38.81% obtained credit in five subjects



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and above including English and Mathematics. This means that over one million failed the examination said to be the best results in the past three years. Therefore, the identification of how important it is for teachers to teach using appropriate method(s) and learning materials is one of the solutions to this ugly phenomenon of poor performance.

**Purpose of the Study**

The purpose of the study is to examine the effectiveness of the use of project method in teaching the concept of saponification using local resource materials. Specifically, this study aims at:

i. Determining the extent to which project method can enhance the understanding of the saponification concept in Chemistry.

ii. Examine the effect of using standard chemical materials and the local materials on students performance when taught the concept of saponification in chemistry.

iii. Compare the performance of male and female students when taught the concept of saponification using the project method.

**Research Questions**

The following research questions directed the study:

i. To what extent can project method enhance the understanding of the concept of saponification in chemistry?

ii. How does students' performance differ when taught the concept of saponification using standard chemical materials as compared to local materials?

iii. To what extent can the male and female students' performance differ when taught the concept of saponification using project method?

**Hypotheses**

The following hypotheses were postulated:

i. There is no significant difference between the performance of students taught the concept of saponification using standard chemical materials and those taught using local materials.

ii. There is no significant difference between the performance of male and female students taught the concept of saponification using project method.

**Scope of the Study**

The focus of this study was on teaching the concept of saponification (Soap Making). The students used the local materials found around the environment to produce soap. These materials include: ash extract from unripe plantain peel, palm husk and palm kernel oil.

**Significance of the Study**

The importance of science and technology in our society today cannot be overemphasized. Science teachers are working assiduously to attain the goal of effective science teaching,



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particularly chemistry. This study therefore, has both academic, social and policy significance. The academic significance is that it will stimulate and arouse the interest of students to understand chemistry concept better. Teachers will also appreciate the effectiveness of project method in the teaching chemistry concept using available local materials.

The social significance entails that members of the public reading this work will become away of the benefits of using local materials in teaching and learning.

The policy significance is that the recommendations of this study will help curriculum planners on education to see the need to give project method and the use of local materials the right place in chemistry curriculum and incorporate it as an effective method of teaching chemistry concept(s).

## METHODOLOGY

This was a quasi-experimental study made up of two groups which involved the use of pretest and post-test. The population comprised of the senior secondary (III) Chemistry students from ten (10) government approved schools in Port Harcourt Local Government Area of Rivers State Nigeria. A total population of one thousand nine hundred and two (1,902) students made up of eight hundred and eighty three (883) males and one thousand and nineteen (1,019) females was targeted. Two schools made up of sixty five (65) senior secondary (III) Chemistry students were selected, comprising of twenty three (23) females and forty two (42) males. The two schools were purposively selected, reflecting mixed sample (i.e. boys and girls) chemistry students in their intact classes.

The research instrument was a Chemistry Achievement Test (CAT) which contained twenty five (25) items based on the senior secondary (III) Chemistry Curriculum. The content covered the chemistry of saponification (soap making). The items in the Chemistry Achievement Test (CAT) was vetted by experts in Chemistry education to determine its suitability in terms of the concept involved. The reliability coefficient was determined using Kuder Richardson 21 ($KR-_{21}$) and was found to be 0.89. This was adjudged 89% reliable for the study.

### Data Presentation and Analysis

The two schools were taught the concept of saponification using project method but with different instructional materials. Group 1 (Control group) was taught with standard chemical materials while group 2 (experimental) was taught using local materials. The data collected after teaching with the lesson package prepared was analyzed using Mean ($\bar{X}$), standard Deviation (SD) and Analysis of Covariance (ANCOVA). The results are shown in the tables below.



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## RESULT

**Table 1: Mean ($\bar{X}$) and Standard Deviation of pretest and Post-test scores of students, classified by treatment**

| Method | Treatment | N | Pre-Test | | Post –Test | | Mean gain | % gain |
|---|---|---|---|---|---|---|---|---|
| | | | Mean $\bar{x}$ | SD | Mean $\bar{x}$ | SD | | |
| Project | Standard chemical materials (Control) | 35 | 15.17 | 2.51 | 19.62 | 2.86 | 4.45 | 29.33% |
| | Local materials (Experimental) | 30 | 14.73 | 3.17 | 19.23 | 2.94 | 4.50 | 30.55% |

Table 1 shows that the use of project method has a mean difference in the performance of students. It also revealed that the materials used has no significant influence on students' understanding of the concept of saponification. This can be deduced from the mean scores of Group 1 (standard chemical materials) with 4.45 (29.33%) and Group 2 (local materials) with 4.50 (30.55%).

**Hypothesis 1**

**Table 2: Analysis of Covariance (ANCOVA) of Post-Test scores: classified by treatment using Pre-test as covariates.**

| Source of variation | Type III sum of Squares | DF | Mean Square | F | Sig. |
|---|---|---|---|---|---|
| Corrected Model | 288.6429[9] | 2 | 144.321 | 36.831 | .000 |
| Intercept | 145.935 | 1 | 145.935 | 37.243 | .000 |
| Pre-test | 284.323 | 1 | 284.323 | 72.561 | .000 |
| Treatment | .418 | 1 | .418 | .107 | .745 |
| Error | 234.104 | 60 | 3.918 | | |
| Total | 24499.000 | 63 | | | |
| Corrected Total | 523.746 | 62 | | | |

**R Square = 551 (adjusted R squared = .536)**

Table 2 shows that there was no significant difference between the performance of students taught the concept of saponification using standard chemical materials and those taught using local materials ($F_{1, 60} = .107$, $P > .05$). Hence, the null hypothesis ($H_{01}$) was accepted.

**Table 3: Mean ($\bar{X}$) and Standard Deviation of Pre-test and Post-test scores of Students, classified by treatment and gender.**

| Treatment | Gender | N | Pre-test | | Pre-test | | Mean Gain | & gain |
|---|---|---|---|---|---|---|---|---|
| | | | $\bar{X}$ | SD | $\bar{X}$ | SD | | |
| Standard chemical (control Group) | Male | 24 | 14.87 | 2.61 | 19.00 | 2.87 | | |
| Local Materials (Experimental Group) | Male | 18 | 14.66 | 3.41 | 19.05 | 2.94 | 4.27 | 28.71% |
| | **Total** | **42** | **14.76** | **2.87** | **19.02** | **2.91** | **4.27** | **28.71%** |



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| | | | | | | |
|---|---|---|---|---|---|---|
| Standard chemical (control Group) | Female | 11 | 15.80 2.27 | 21.00 2.30 | | |
| Local Materials (Experimental Group) | Female | 12 | 14.83 3.35 | 19. 50 3.06 | 4.90 | 31.98% |
| | **Total** | **23** | **15.32 2.81** | **20.25 2.65** | **4.90** | **31.98%** |

Table 2 revealed that the mean scores of the male students is 19.02 while that of the female students is 20..25 with a mean gain of 4.27 (28.71%) for males and 4.90 (31.98%) for females. This shows that materials used do not affect male and female students' understanding of the concept of saponification differently.

**Table 4: Analysis of Covariance (ANCOVA) of Post-Test scores: classified by treatment using Pre-test as covariates.**

| **Source of variation** | **Type III sum of Squares** | **DF** | **Mean Square** | **F** | **Sig.** |
|---|---|---|---|---|---|
| Corrected Model | 296.201[9] | 2 | 148.100 | 39.052 | .000 |
| Intercept | 125.204 | 1 | 152.204 | 40.134 | .000 |
| Pre-test | 277.969 | 1 | 277.968 | 73.295 | .000 |
| Treatment | 7.977 | 1 | 7.977 | 2.103 | .152 |
| Error | 227.546 | 60 | 3.792 | | |
| Total | 24499.000 | 63 | | | |
| Corrected Total | 523.746 | 62 | | | |

**R Square = 556 (adjusted R squared = .551)**

Table 4 shows that there was no significant difference between the performance of male and female students taught the concept of saponification using standard chemical materials and those taught using local materials ($F_{1,60} = 2.103$, $P > .05$). Hence, the null hypothesis ($H_{02}$) was accepted.

## DISCUSSION

The over reliance on the imported and customized resource materials for science teaching took root from the colonial packaging. This has contributed to Africa, or indeed Nigeria under development in science. The working materials over the years had centered on stereotype laboratory reagents, which a times are in short supply. The researchers felt worried, believing the fact that the Nigeria environment is rich with abundant natural resources capable of playing alternative role to standardized materials. Consequent upon which the study was undertaken. The method applied was quite scientific in process. The result obtained revealed no significant difference in the performance of students when the two methods were used. There was no gender (male/female) differences in the performance even when the treated (project method) was packaged. The findings agree with work done by Fennema (2000), Pomerentz (2002), Raimi (2002), in Salami (2009) and Ejimaji (2010), who in their various works revealed no significant difference exist in the academic performance of students taught using local resource materials, and not even with male and female students.


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## CONCLUSION

The study has shown that students understand and perform better when taught with activity oriented teaching method such as project method. It also shows that the use of local materials in the teaching of chemistry concept such as saponification is effective when compared with the use of chemical standard materials in the laboratory. Similarly, the instructional materials used did not influence the male and female performance significantly.

## RECOMMENDATIONS

Chemistry should be taught using student-centered and activity oriented teaching methods. The use of local materials should be adopted as a viable alternative to the conventional laboratory chemicals.

Principals and heads of science in schools should motivate and encourage science teachers with the necessary resources and assistance for effective teaching.

Policy makers and curriculum planners on education should incorporate and enforce the use of locally sourced materials in teaching.

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