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COMMUNITY RESOURCES AND STUDENT'S CREATIVE ABILITY IN CHEMISTRY

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Abstract

The study focused on determining student's creative ability among chemistry students taught titrimetric analysis with plant dyes as indicator. The study took two approaches – laboratory investigation and classroom application of the laboratory finding. A quasi experimental design was adopted with two research questions and two hypotheses. A sample size of 100 students drawn from two intact classes (50 control and 50 experimental) were used. One instrument, Creative Ability Test (CAT) was used to collect data and analyzed using mean, standard deviation and t-test. The findings of the study revealed that plant dye indicator enhanced students' creative ability than the methyl orange indicator. It was also found that female students perform equally well as their male counterpart. Recommendations were made which include using of appropriate community resources to enhance teaching and learning of chemistry in our secondary schools.

Introduction

Science education is the hub and engine of scientific and technological development. The educational reform agenda such as Science for All and integration of trade and entrepreneurship education in the new senior secondary education is part of the effort to restructure and stimulate rapid industrial growth and improve students' scientific thinking for self-reliance. Udofia (2005), found learning resources useful for learners to acquire basic scientific knowledge and skills. The National Policy on Education (NPE 2004) stipulated among other objectives the diversification of curriculum to cater for differences in talents and opportunities open to students after secondary school; equipping the students to live effectively in our modern age of science and technology.

Abysmal performance of chemistry students has been linked to many factors such as teachers' teaching method, learning materials and learning styles (Ifamuyiwa 2006). Eze (2002); reported that students achievement in senior secondary school (SSS) chemistry have been dwindling over the years. Other natural factors such as gender, cognitive and reasoning ability, creative ability and sense organs also play their parts (Anwanyang, 2004).

According to Dikko (2009) environmental conditions that can promote creativity are lacking in Nigerian schools and maintain that teachers ought not be slaves to schemes of work and clock rule class activities but should be liberal and resourceful.

. Also, Nwagbo (1997) reported that science teaching in Nigeria does not encourage the achievement of scientific goal, because it does not foster creativity and scientific thinking. There are variety of materials/resources which the science teachers can use to concretize abstract concepts and ideas, make learning more interesting, real and lively (Mkpa 2001). Science, especially chemistry should be taught in an exploratory and creative way with ample opportunity to think critically, reflectively and experiment with variety of materials within and outside the school environment.

Okebukola (2008) revealed that girls are not given enough opportunities as boys to participate and manipulate materials in a science class and these factors hinder the performance of the girl child. Collaborating the statement, Okeke (2001) also reported that the society expect male students to perform well in science. In developing and enriching experiences of learners towards acquiring scientific skills, environment and locally available resources should be used in the hands-on-minds-on activities (Opara 2002 and Udofia 2005).

Hence, this study focuses on the effect of plant dye as indicator for teaching titrimetric analysis and its effect on students' creative ability in chemistry.

Utilization of environmental resources in chemistry

Ifeakor (2006) reported that teachers' teaching method and use of appropriate teaching materials are very important in teaching/learning chemistry. Mkpa (2001) also asserted that community resources are indispensable factors in the attainment of educational goals and maintains that community resources are resources/chemicals existing in the communities and are effective means of communicating information to students. These include material resources such as improvised chemicals, instrument; physical resources like industry, plantations; institutional resources like science centres and human resources such as medical personnel and guidance counselors.

Ochonogor (2000), Udofia and Udo (2006) used improvised indicators from hibiscus and ginger in acid-base titration and base from plantain husk and observed that plant resources enhance students performance in titrimetric analysis.

Various chemicals can be obtained locally for teaching and learning different chemistry concepts as shown below:

Resources	Teaching Topic	Uses
1. Wood ash/Plantain Husk/Cassava bark	Alkali	Soap making/base for titration.
2. Coloured leaves/flowers/stems	Indicator	Chromatography/ indicator for acid base titration
3. Ripe plantain/banana/palm wine	Alcohol	Production of Alcohol
4. Scent leaves	Esters	For perfume and flavours
5. Fruits e.g. orange, lemon, pineapple	Organic acid	Food flavours and fruit juice
6. Palm oil	Fat and oil	Paint, cosmetic and soap making
7. Resins/wax from palm tree. e.g. raffia palm	Vanish	Polishing of wood/ gum

Community resources and students' creative ability

The primary goal of education is to create men who are capable of doing things not simply repeating what other generations have done but men who are creative, inventive and discoverers (Gbamanja 1991). Community resources are instructional materials/resources within or outside the school which can make teaching/learning delightful and meaningful.

Creativity is the ability to discover new solution to problem or to produces new ideas different from that of the general population (Dikko, 2009). According to Gbamanja (1991), it is difficult to grade creativity hence there is paucity of research reports on the effect of creativity on student academic achievement. However, Gbamnja (1991) maintains that assessment of creativity should be focused on how well the students follow directives to execute a task, curious, flexible, resourceful, drive, enjoyment in solving problems and high spirit of inquiry

Dikko (2009) stressed that creativity is enhanced when children are exposed to cue rich environment (community resources) with opportunity to touch, use tools and transform objects. The use of plant dye as indicator (resource) for teaching/learning titrimetric analysis with a focus on the effect on students' creative ability is in line with the chemistry curriculum which emphasizes the development of student problem solving, creativity, scientific attitude and interest. Hence creativity here is based on the ability to carry out the extraction of the plant dye (indicator) following appropriate steps and without the teachers demonstration.

Purpose of study

The study aimed at determining the effect of plant dyes on students' creative ability in chemistry. The specific objectives were;

1. Determine the effect of ginger dye (indicator) on students creative ability in chemistry.
2. Determine the difference in creative ability of male and female students taught titrimetric analysis using ginger dye as indicator

Research questions

Two research questions were raised to guide the study:

1. To what extent do plant dye (indicator) affect students; creative ability in chemistry?
2. Do male and female students differ in their creative ability when taught titrimetric analysis using plant dye?

Research hypotheses

1. There is no significant difference in students creative ability taught titrimetric analysis using plant dye and those taught without.
2. Male and female students do not differ significantly in their creative ability when taught titrimetric analysis using plant dye.

Research design
The study was a quasi-experimental research using a non-randomized control group.

Population/sample
The population consisted of about 1,835 Senior Secondary II chemistry students in 9 government owned co-educational secondary schools in Uyo L.G.A. of Akwa Ibom State. A sample of 100 chemistry students drawn by simple balloting from two intact classes in the target population. The experimental group consisted of 50 students (23 males and 27 females) and the control group consisted of 50 students (24 males and 26 females).

Instrumentation
The instrument used in the study was the Creative Ability Test (CAT) on titrimetric analysis. This was a 10-item 4 option objective test. It was used to classify the subjects into high, average and low creative ability groups, 1-4 points was considered low, 5-6 point – average and 7-10 points was high.

Validation/Reliability of Instrument
The instrument (CAT) was face validated by lecturers from Department of Science Education, University of Uyo before it was trial tested on twenty SS2 chemistry students in school not selected for the study. The difficulty and discrimination indices of CAT were 0.26 and 0.70, 20%-70% respectively. The reliability co-efficient determined using Kuder Richardson formula-21 (KR-21) was 0.73.

Research procedure
The instrument was first administered to the students as pretest by the chemistry teachers of the chosen schools who served as research assistants. The experimental and control groups were divided into 6 subgroups each. The students in control group were taught titrimetric analysis using conventional chemicals (0.1M NaoH as base and methyl orange as indicator). The experimental group used (0.1M NaoH) as base and indicator from ginger (zyngiber officinale). The exercise lasted for two weeks. After the exercise, a reshuffle version of CAT was re-administered as post-test.

Data analysis
The data were analyzed using mean, standard deviation and t-test.

Results
Table 1: Mean and Standard Deviation of students pretest and posttest scores on creative ability taught with and without plant resources.

Variable	N	Pretest Mean	SD	Posttest Mean	SD	Mean Gain
Experimental						
High	19	7.7	2.3	16.6	3.2	8.9
Average	21	6.3	1.4	14.6	3.0	8.3
Low	10	5.9	2.4	13.5	3.3	8.5
Total	50					
Control						
High	15	5.8	1.7	14.1	2.4	8.3
Average	20	6.6	1.9	14.6	2.6	8.0
Low	15	8.1	1.6	16.0	3.7	7.9
Total	50					

N = Sample size, X=Mean; SD = Standard Deviation

Result
A comparison of the mean scores of students in both pretest and posttest in Table 1 above showed that the mean gain in each of the groupings was as follows for experimental/control: high creative ability 8.9/8.3; average creative ability group8.3/8.0; low creative ability group 8.5/7.9. The result reveals that there is significant difference in students creative ability taught titrimetric analysis. Hence the null hypothesis was rejected.

Table 2: t-test analysis of male and female students' creative ability.

Group	N	X	SD.	df	t. cal	t, cri
Experimental (Male)	23	39.8	14.37	48	1.52	3.98
Experimental (Female)	27	31.5	12.53			

Result

The result in Table 2 shows that the calculated t-value of 1.52 is less than the critical t –value of 3.98 at degree of freedom 48 at 0.05 level of significance.

This shows that there is no significant difference in the creative ability of male and female students taught titrimetric analysis using plant dye as indicator. Hence, the null hypothesis was retained.

Discussion

Table 1 shows that students' creativity was enhanced using chemicals from local resources. This can be attributed to students involvement in the collection, extraction and preparation of indicator from local resource than those (control) who used the commercial indicator. This finding agrees with Udofia and Udo (2006) with regards to the use of plant dye as resource from learners environment to enhance creativity and make learning more interesting and concrete.

The result in Table 2 indicates that male and female students do not differ in their creative ability when taught titrimetric analysis using plant dye as indicator.

This finding disagree with Okeke(2001) who asserted that the society expects male students to perform academically better than female students. As stated by Okebukola(2008) that the girl child performance is hindered by low participation and manipulation of materials in the science class. The active involvement of the female students in the laboratory preparation of the plant dye(indicator) may have caused them to equally perform well as their male counterparts.

Conclusion

Based on the findings, community resource is an effective resource from which chemicals/dye can be obtained for teaching and learning titrimetric analysis. This will go along way provide materials for effective hands-on-minds on activities that will enhance creativity in chemistry and science in general. The female students' creative ability can be enhanced through active participation and manipulation of materials in the science class. A radical shift both in teaching and learning with emphasis on the use of learners environment would promote creative ability and scientific skill development for the attainment of educational goals.

Recommendations

1. Chemistry teachers should be more resourceful by utilizing community resources for meaningful teaching and learning of chemistry.
2. Students should be more involved in activity oriented teaching/learning process to enhance creativity, interest and scientific skills in sciences.
3. Government should organize capacity building workshops for science teachers that will train and retrain them on appropriate scientific skills.

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