



Science Teachers
Association of Nigeria

STEM EDUCATION AND CREATIVITY



**55th Annual Conference
2014**

Zephirus C. O. Ojoku
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Zephrinus Chidubem Njoku
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PAPER 29

COCOYAM: AN IMPROVISED RESOURCE FOR ENHANCING CREATIVITY IN TEACHING AND LEARNING OF CHEMISTRY AND AGRICULTURAL SCIENCE

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Abstract

This paper determined the use of varieties of Cocoyam as improvised materials in teaching the concept of acidity in Chemistry and Agricultural Science in Secondary Schools in Akwa Ibom State. The effect of heat on the pH level of different varieties of Cocoyam was also determined. Improvisation and creativity in Chemistry and Agricultural Science teaching, using Cocoyam and their applications were discussed. The study also articulated the objectives, the procedures for application of the improvised resource (Cocoyam) and the reaction of heat on the pH levels of the Cocoyam as well as the implications of improvisation of the resource to teaching and learning of Chemistry and Agricultural Science.

Introduction

Reforms in education at all levels are predicated on meeting the challenges of an ever changing society. Notable among them are reforms in curriculum content and methods of science instructions at the secondary school level. The major purpose of STME curriculum is to promote cognitive achievement, acquisition of process skills and development of appropriate scientific attitudes, (Oloruntegbe and Omoifo, 2000). The National Educational Research and Development Council (2000) recommended a focus on investigation and inquiry in the science classroom at all educational levels. Science Education, therefore, should provide critical, creative, innovative, appropriate skills and knowledge for self-reliance of the citizens.

Science, according to Njoku (2007) is the rational and systematic study of the environment through observation and experimentation with a view to understanding the environment and manipulating the resources of nature for human development. This implies that teaching must be proactive, creative, exploratory and student centered to achieve the objectives of STME at the secondary school level. It is pertinent to note that scientific and technological development depends on individuals who are creative and productive, and can apply their knowledge to solve problems. Effective teaching and learning of science subjects at the secondary school level is a precursor to making the individual creative and productive.

Evidently, SMTE especially Chemistry, Agricultural Science and other Science based subjects provide opportunities for students to develop creativity, acquire knowledge, skills and attitudes needed to become creative, productive and responsible members of the society.

To be creative is to be original, prolific and imaginative. Creativity explains ingenuity, resourcefulness and inventive. Creativity therefore is an indispensable higher order science process skill which engages both mental and physical prowess of the individual toward solving problem. Creativity as defined by Dikko (2005) is the ability to discover new solutions to problems or produce new ideas different from general beliefs. Similarly, Udofia (2005) defined creativity as the productive effort or endeavour, unique to an individual. Every child has a creative potential but the level varies from one individual to another. Creativity can be motivated and developed in learners through the use of appropriate instructional approach and resources in instructional delivery in science subjects. Creativity improves students self-esteem, achievement and exploration of ideas (Abiola, 2008). The lack of creative ability is dangerous to the development of the society.

One of the greatest impediments to scientific and technological development in Nigeria, according to Ekpo (2007) is lack of creativity and maintains that patience and careful observations of the surrounding environment could bring new findings and advancement in knowledge. Reports by Nwosu (2000) and Adedayo (2011), indicate that majority of science teachers are not creative enough to improvise teaching resources majorly due to non-resourcefulness. In developing and enriching experiences of learners towards acquiring scientific skills and enhancing creativity, the locally available resources within the environment should be used in the hands-on activities, (Udofia, 2005).

Improvisation and Creativity in Science Teaching

Science teaching requires standard equipment, chemicals and concrete resources for meaningful teaching and learning. However, the poor funding of education coupled with increased students' population makes it difficult to acquire adequately the resources for practical demonstrations. The use of local materials in science teaching and learning hinges on the concept of improvisation. Ekong (2003) defined improvisation as the creation, development, derivation, selection and building up of relevant and needed materials from the resources of the environment for demonstrative instructions. Udo and Eshiet (2007) stressed that science teaching should be done with the use of teaching materials drawn from the students' immediate environment. Ezeife (1993), Eshiet (1996), and Inyang (1997) all agreed that improvisation promotes innovation, creativity, resourcefulness and reduce cost. Eshiet (1996) saw improvisation as the sourcing, selecting and employment of relevant materials in the absence or shortage of standard ones for meaningful realization of educational goals. In science classes, creative individuals could be identified by their manifestation of curiosity, resourcefulness, desire to discover, preference for difficult task, enjoyment of solving problems, flexible thinking and spirit of inquiry (Gbamanja, 1991). Gbamanja also maintained that assessment of creativity should be focused on how well the students follow directives in executing tasks.

Researchers on the use of improvised materials for instructions such as Okpara (2002), Udofia (2005), Udo and Eshiet (2007) had differently used improvised materials from learners environment to enhance learning processes in Chemistry. Udofia (2007) found out that students' involvement in collecting, extracting, preparing and using improvised indicators in titrimetric analysis in Chemistry significantly enhanced creativity among secondary schools students. Anderson (2004) was of the opinion that practical experience in any science subject such as Agricultural Science, Chemistry and so on, is crucial for real understanding of the

principles and application of knowledge gained for cognitive growth and technological advancement.

A report by Nnaoli (2004) indicated that there is little or no use of locally available resources like cocoyam, cassava, yam, bitter leaf, guinea corn and palm oil in teaching and learning science processes in schools. This stereotype approach to teaching and learning science, particularly Chemistry and Agricultural Science have little environmental significance and results in poor creative ability development among students.

Cocoyam: Types and their Applications as Improvised Resource

Cocoyam is an underground stem tuber which belongs to the family of *Araceae* and comprise of over 1,800 species. Cocoyam is grown in the humid tropics and coastal swamps in the South-West and South-South geopolitical zones of Nigeria with almost double maxima of rainfall. Cocoyam is extensively grown for commercial purposes and as compound crops, as edible corms and leaves. Generally, cocoyam, especially the *Xanthosoma* and *Colocasia* have growing cycles of nine to eleven months during which it produces a large stem called corm surrounded by smaller edible cormels. Ekanem and Osuji (2006) asserted that cocoyam is grown throughout the humid tropics for its edible corms, cormels and leaves as well as for other traditional applications. According to Etukudo (2003), the cormels of *Xanthosomasogittifolium* (Afiakpong), *Xanthosomamaffaffa* (Ndanaikpong), *Xanthosomaantiquorium* (Asimeka), *Colocasiaesculenta* (Nimbo) are edible and can be eaten boiled, pureed, fried or roasted. The tender leaves are eaten as vegetables while the older leaves can be used for wrapping. (Note: the nomenclature in parenthesis are the vernacular names)

In Akwalbom State in particular, cocoyam such as *XanthosomaSogittifolium* (Afiakpong) has a traditional and social application, where it is used for making special diet called 'EkpangNkukwo' during traditional marriage ceremonies (Etukudo, 2003). Udemeobong (2004) submitted that trioxonitrate (v) acid (HNO_3), a strong mineral acid can be obtained from *Xanthosomaantiquorium* (Asimeka, (yellow) cocoyam). *Caladium bicolor* (IkpongEkpo) commonly called 'elephant ear' has colourful foliage and are grown as ornamental plant. The leaves have varying color mixtures of pink, white or red. *Caladium bicolor* is not commonly used as food because of its severe itching effect. However, Burkill (1995) in Etukudo (2003) reported that *Caladium bicolor* is eaten in the Carribean with much washing and prolong cooking.

Cocoyam produces gummy milk sap when peeled. The milk sap contains oxalate crystals responsible for the itching effect of most of the cocoyam species. Iwuoha and Kalu (1995) and Njoku and Ohia (2007) in their separate studies submitted that oxalate content in cocoyam is highly reduced by boiling and roasting. It becomes imperative therefore that this study sought to establish the application of cocoyam as improvised resource for teaching of a concept of acidity, particularly in Chemistry as applies to Agricultural Science.

Objectives of this study

The study sought to determine:

1. the use of improvised cocoyam as materials in teaching the concept of acidity in science.
2. the effect of heat on different cocoyam species

Procedure of the study

Five varieties of matured corms of different species of cocoyam namely-

- (a) *Xanthosomasogittifolium* (Afiakpong), (b) *Xanthosomamaffaffa* (Ndanaikpong),
- (c) *Xanthosomaantiquorium* (Asimeka), (d) *Colocasiaesculenta* (Nimbo) and

(e) *Caladium bicolor* (Ikpongekpo) were obtained, washed to remove the soil remnant before peeling.

Table 1: Showing Cocoyam species used with Botanical and Vernacular names

Sample Cocoyam	Botanical Name	Vernacular & Common description	pH value	
			unboiled	Boiled
A	<i>Xanthosomasogittifolium</i>	'Afiakpong' White yam	6.24	5.91
B	<i>Xanthosomamaffaffa</i>	'Ndanalkpong' Red cocoyam	6.71	6.21
C	<i>Xanthosomaantiquorium</i>	'Asimeka' yellow yoked	6.22	6.18
D	<i>Colocasiaesculenta</i>	'Nimbo' White grained	6.48	6.33
E	<i>Caladium bicolor</i>	'Ikpongekpo'	6.3	5.81

The peeled cocoyam were grated into different containers and labeled. Five 250cm³ beakers labeled A- E, based on the variety used. 50g each of the different species of grated cocoyam was accurately weighed and put into each beaker. 50cm³ of water was added to each beaker, stirred and allowed to settle for 20 minutes. The mixture was filtered and 30cm³ of the filtrate measured into boiling tube. The pH of the solution was taken using a pH meter. The solution was boiled for 10 minutes, cooled and the pH of the solution taken and result recorded. The exercise was repeated with the rest of the filtrates. Due to itching effect of the cocoyam, it was advisable to wear hand gloves (polythene bag) which protected the hands during grating process. The results of the pH values of the different cocoyam species are shown in Table2.

Findings and Discussions

The result in Table 2 reveals that *Caladium bicolor* (Ikpongekpo) and *Xanthosomaantiquorium*(Asimeka) are more acidic when compared to *Xanthosomamaffaffa* (Ndanaikpong), *Xanthosomasogittifolium* (Afiakpong) and *Colocasiaesculenta* (Nimbo). This supports the fact that *Caladium bicolor* and *Xanthosomaantiquorium* itching are more severe when compared to other species of cocoyam. This falls in line with reason advanced by Udemeobong (2004) who asserted that HNO₃ could be extracted from yellow cocoyam (*Xanthosomaantiquorium*).

The itching effect is caused by oxalate crystals (H₂C₂O₄), a poisonous, colourless acid which occurs naturally in some plants and can be used in dyeing, cleaning and bleaching. The table also shows that the pH level of cocoyam can be reduced by heating which subsequently reduces the itching effect. This is in support of the findings of Iwuoha and Kalu (1995) submission that oxalate content is highly reduced on boiling.

Table 2:pH values obtained from 30cm³ of cocoyam extract obtained by soaking 50g grated cocoyam species in 50cm³ of H₂O and boiling for 10 minutes

Cocoyam Species	<i>Xanthosoma Sogittifolium</i>	<i>Xanthosoma maffaffa</i>	<i>Xanthosoma antiquorium</i>	<i>Colocasia Esculenta</i>	<i>Caladium bicolor</i>

pH values when unboiled	6.24	6.71	6.22	6.48	6.53
pH values when boiled	5.91	6.21	6.13	6.33	5.81

The implication of improvisation of cocoyam resource for the teaching and learning of Chemistry and Agricultural Science is to the extent encouraging teaching and learning from known to the unknown. It would enhance creativity in the teachers while executing their instructional responsibilities of identification and selection of suitable instructional resources for effectiveness. It would encourage creative participation in instructional planning and execution by the students and teachers. The ensuring of reflective and creative thinking among the students would have been achieved.

Conclusion

Improvisation by the Chemistry and Agricultural Science for effective instructions and facilitated students learning becomes imperative. This study has established the practicability of utilizing varieties of cocoyam for teaching and learning of acidity in Chemistry and Agricultural Science. Chemistry and Agricultural Science teachers should therefore integrate the principles and practice of improvisation from local resources into their teaching and students learning processes. This will ensure the realization of articulated objectives in the Chemistry and Agricultural Science curriculum in the school system.

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