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Kitchen Resources, Reasonning Ability Levels and Academic Performance and Retention of SS2 Chemistry Students in Calabar, Nigeria

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Abstract - This study examined kitchen resource, reasoning ability level, academic performance and retention of SS2 Chemistry students in Thermo-chemistry. Thermochemical activities in the kitchen such as, fermentation of samples of five different juices (mango, orange, pineapple, grape and paw-paw), heating capacities of five samples of wood (mango, orange, guava, almond and rubber), induced thermal decomposition of five samples of shellfish shells powder (mangrove snail shell, fresh water periwinkle shell, freshwater snail shell, clam shell and mangrove periwinkle shell) and dissolution of five samples of glucose (2g, 4g 6g, 8g and 10g) were used for the study. The sample comprised 240 drawn from four secondary schools in Calabar Education Zone of Cross River State of Nigeria. Quasi experimental factorial research design was used for this study. Chemistry Achievement Test (Cat), Chemistry Retention Test (Cat), and Reasoning Ability Test (Rat) were used for data collection. Analysis of covariance (ANCOVA) was used in the analysis of data. From the findings, the use of kitchen resources enhanced the performance and retention level of high and low reasoning ability level of students exposed to kitchen resources during the teaching of Thermochemistry. It was recommended that teachers should be encouraged to adopt kitchen resources in science teaching.

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KITCHEN RESOURCES, REASONNING ABILITY LEVELS AND ACADEMIC PERFORMANCE AND RETENTION OF SS2 CHEMISTRY STUDENTS IN CALABAR, NIGERIA

Strictly as per the compliance and regulations of :

Kitchen Resources, Reasonning Ability Levels and Academic Performance and Retention of SS2 Chemistry Students in Calabar, Nigeria

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Abstract - This study examined kitchen resource, reasoning ability level, academic performance and retention of SS2 Chemistry students in Thermo-chemistry. Thermochemical activities in the kitchen such as, fermentation of samples of five different juices (mango, orange, pineapple, grape and paw-paw), heating capacities of five samples of wood (mango, orange, guava, almond and rubber), induced thermal decomposition of five samples of shellfish shells powder (mangrove snail shell, fresh water periwinkle shell, freshwater snail shell, clam shell and mangrove periwinkle shell) and dissolution of five samples of glucose (2g, 4g 6g, 8g and 10g) were used for the study. The sample comprised 240 drawn from four secondary schools in Calabar Education Zone of Cross River State of Nigeria. Quasi experimental factorial research design was used for this study. Chemistry Achievement Test (Cat), Chemistry Retention Test (Cat), and Reasoning Ability Test (Rat) were used for data collection. Analysis of covariance (ANCOVA) was used in the analysis of data. From the findings, the use of kitchen resources enhanced the performance and retention level of high and low reasoning ability level of students exposed to kitchen resources during the teaching of Thermochemistry. It was recommended that teachers should be encouraged to adopt kitchen resources in science teaching.

I. Background to the Study

Humans live in a world of science and throughout their entire lives they encounter issues and problems that have their foundation in science. Science is the bedrock of scientific and technological careers and development (Uche & Umoren, 1998). An ultimate purpose of science is to discern the order that exists between and among the various facts (Gottlieb, 2011). Science can also be said to be the concerted human efforts to understand, or to understand better, the history of the natural world and how this world works, with observable physical evidence as the basis of that understanding. It is done through observation of natural phenomena and/or through experimentation that tries to stimulate natural process under controlled conditions (Science, 2011).

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Chemistry occupies an enviable position in the senior Science national curriculum. Chemistry as a subject of study combines with other natural science subjects of Physics, and Biology to qualify students for admission into tertiary institutions to read such courses as Medicine/Surgery, Pharmacy, Engineering, Science Education, Science, Agriculture etcetera (JAMB,-2010/2011UME/D).

Science education at all levels of education in Nigeria is in a deplorable state from the primary, secondary and to the tertiary institutions. There is a problem of dearth in science resources and this contributes to students' poor academic performance in Chemistry at the secondary school level (Nkanu, 2009, 2008;Opera, 2008; Oriade, 2008; Udo, 2006; Uche & Umoren; 1998).

Science being an activity has been designed such that it be taught through a series of activities in schools (Afemikhe, 1992). The National Policy on Education (2004) has demanded a complete integration of both theory and practical in Science teaching at school. Studies carried out by Ivowi (1999) in Biology, Chemistry and Physics; reveal that teachers do not completely comply with the provisions for teaching these subjects. The most commonly cited reason is the lack of Science equipments in schools. Although efforts appear to be made in building science laboratories and supplying science equipments, these have not matched demands of schools in any satisfactory manner (Oriade, 2008).

Since the problem above is enormous and the absence of these facilities appears to adversely affect the teaching and learning of science, some measures need to be taken. It was based on this that this study attempts to look inward at the resources in the kitchen and how they can be used to teach Thermochemistry. The modern kitchen is stocked with quality materials, and is probably the safest chemical laboratory in the world (Hayward 1992). Many activities and materials

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abound in the kitchen. The early days of a learner's development are centered round the home, and the kitchen. The kitchen is a unit of the home and special consideration of the home as a resource in teaching science can be seen in the light of the modern kitchen being regarded as a workshop of various practices, which expose the learner to in experiences, in the various aspects of the subject of Chemistry (Eshiet, 1996).

Reasoning encompasses all thinking activities that involve making or testing inferences. This includes inductive reasoning and deductive reasoning. Reasoning is also closely related to problem solving and creativity. The ability to reason has a fundamental impact on one's ability to learn from new information and experiences because reasoning skills determine how people comprehend, evaluate, and accept claims and arguments.

It has been discovered that people generally perform better with relations that can be visualized leading to a spatial representation theory for reasoning and eventually, a semantic theory (Johnson–Laird 2006). The work of Guilford & Sternberg (2011) suggests that there are many different kinds of reasoning abilities and that reasoning skills are task specific. It is on the basis of this premise that the study designed reasoning ability questions in order to place students into different ability group and to find out how reasoning ability affects students academic performance and retention in Thermochemistry.

Ausubel in his book "Educational Psychology: A Cognitive View" (1968) said that if I had to reduce all educational psychology in just one principle, I would say that, the most important single factor influencing learning is what the learner already knows, ascertain this and teach him.

Concepts are meaningful only when the learner can visualize them and subsume them within a cognitive-structure. This means that the learners already understand more generic concepts that incorporate or include the concept one is trying to teach. This can be achieved when a Chemistry teacher uses resources form the environment (e.g kitchen) as learners can visualize the materials they already know as advance organizer in teaching and learning process.

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II. Research Methodology

A quasi experimental factorial research design was used for this study. The design is a modification of the pretest posttest retention test control group design with one treatment variable and one moderator variable. The 2x2 factorial designs were used. The study was carried out in Calabar Educational Zone also known as Southern Education/Zone of Cross River State.

The population for this study comprised all the Senior Secondary (SS2) Chemistry Students in public secondary schools in Calabar Educational Zone of Cross River State. For the purpose of this study, two instruments were used. They were: Chemistry Achievement Test (Cat) and Reasoning Ability Test (Rat).

The Chemistry achievement test (Cat) was an instrument developed by the researcher for data collection. Cat was a 60 item five response option objective test. Reasoning ability test (RAT) was an instrument used to monitor the reasoning mode of students.

This instrument provided both the correct response option and matching reason in order to identify students who merely guessed answers since they will not be able to choose the correct reason. Rat consisted of 24 – items, 12 questions that were followed with 12 reasons why such an option was chosen

a) Sampling Technique

A multi-stage, involving the use of stratified random sampling and purposive sampling was used for the study. The sample was made up of (240) Senior Secondary School Chemistry students from four schools in four Local Government Areas in Calabar Education Zone, made up the sample for the study. A break- down of this figure showed 120 students each in the experimental and control groups respectively.

b) Data Collection and Analysis

Two hypotheses were used for this study:

Hypothesis there is no significant difference between the academic performance of students with different reasoning ability levels when taught with and without kitchen resources. Analysis of Covariance using pretest as covariate was used for data analysis.

Hypothesis two: There is no significant difference in the retention of students of different reasoning ability levels when taught with and without kitchen resources analysis of covariance was also used for analysis.

i. *Test for hypothesis one*

Table 1

Mean standard deviation and summary of 2x2 analysis of covariance of effect of treatment and reasoning ability level on SS 2 Chemistry students' performance in Thermochemistry

Treatment	Reasoning ability	Mean	Std. Deviation	N
Experimental	High	47.61	9.74	64
	Low	47.73	8.60	56
	Total	47.67	9.19	120
Control	High	18.84	6.37	45
	Low	15.63	6.14	75
	Total	16.83	4.40	120
Total	High	35.73	16.56	109
	Low	29.35	17.52	131
	Total	32.25	17.35	240

Source of variation	Sum of squares	Df	Mean squares	F	Sig level	Partial Eta square
Corrected Model	59504.631	4	14876.158	280.877	.000*	.827
Intercept	29020.555	1	29020.555	547.937	.000*	.700
PRE	2171.305	1	2171.305	40.996	.000*	.149
TRT	52814.424	1	52814.424	997.190	.000*	.809
Reasoning Ability	122.051	1	122.051	2.304	.130	.010
Treatment x Reasoning ability	62.484	1	62.484	1.180	.279	.005
Error	12446.369	235	52.963			
Total	321566.000	240				
Corrected total	71951.000	239				

R squared = .827 (adjusted R squared = .824) F-critical = 3.86 *p>.05.

A glance at the descriptive statistics, in Table 1 indicates that there is a slight difference in the mean between high ability groups; and low ability 47.61 and 47.73 respectively. Examination of Table 1 further shows that the high reasoning ability students in the experimental group, had an almost equivalent mean (x=47.61). Thermochemistry posttest scores to low reasoning ability level students with a mean of x = 47.73. On the other hand, the high reasoning ability level students in the control groups had a higher mean (x=18.84) Thermochemistry past test scores than their low reasoning ability level counterparts (x =15.63).

However, the results also showed that students who were taught with kitchen resources had higher post test achievement scores in Thermochemistry (x=47.67) were compared with the control groups, (taught without kitchen resources) x = 32.25. The result of the 2x2 analysis of variance presented in Table 15, showed that, treatment main effect was significant (F=997.190; P<.05); reasoning ability was not significant (F=2.304, P>.05). The interaction of treatment with reasoning ability was not significant (F=1.180; p>.05). The null hypothesis was rejected for treatment.

Further observation of Table 1 shows that 80.9% (.809) variance was accounted for by treatment, 1% (.010) by reasoning ability and 0.5% (.005) by interaction between treatment and reasoning ability.

ii. *Test for hypothesis two*

Table 2

Means, standard deviations and summary of 2x2 analysis of ANCOVA of effect of treatment and reasoning ability level on SS 2 Chemistry students' retention in Thermochemistry

Treatment	Reasoning Ability	Mean	Std. deviation	N
Experimental	High	47.44	9.74	64
	Low	47.39	8.79	56
	Total	47.42	9.28	120
control	High	13.84	4.84	45
	Low	11.00	4.76	75
	Total	12.07	4.97	120
Total	High	33.57	18.47	109

	Low	26.56	19.29	131		
	Total	29.74	19.21	240		
Source of variation	Sum of squares	Df	Mean squares	F	Sig level	Partial Eta square
Corrected Model	76398.990	4	19099.748	381.573	.000*	.867
Intercept	27105.461	1	27105.461	541.510	.000*	.697
Pretest	1194.025	1	1194.025	23.854	.000*	.092
Treatment	70183.914	1	70183.914	1402.128	.000*	.856
Reasoning ability	109.260	1	109.260	2.183	.141	.009
Treatment x Reasoning Ability	50.171	1	50.171	1.002	.318	.004
Error	11762.993	235	50.055			
Total	300458.000	240				
Corrected total	88161.983	239				

R squared = .867 (Adjusted R squared =.864) F-critical = 3.86 * P>.05.

Generally the mean retention scores of the high reasoning ability level group (x=33.57) was higher than the low reasoning ability level group (x=26.56) in both experimental and control. The result of the 2x2 Analysis of Variance in respect to retention presented in Table 16, showed that, treatment effect was significant (F1402.128.,P<.05); reasoning ability was not significant (F=2.183;P>.05). The interaction effect between reasoning ability level and treatment was not significant (F=1.002; P>.05).

The Table also indicates that treatment accounted for 85.6% (.856) variance, reasoning ability was 0.9% (.009) and interaction effect was 0.4% (.004). With respect to reasoning ability the null hypothesis was retained. Thus, the contribution of reasoning ability is minimal taken individually (0.9%) and in combination with treatment (0.4%).

c) Discussion of Findings

The first hypothesis sought to find out if there was significant influence of reasoning ability on SS2 Chemistry students' academic performance in Thermo-chemistry when taught when taught with and without kitchen resources. The finding of this study revealed as shown in Table 1 earlier that there was no significant difference in the interaction of treatment and reasoning ability level on students' performance in Thermo-chemistry. The critical F-value of 3.86 was higher than the calculated F-value of 1.180. The explanation of this result is that reasoning ability level of students does not affect their performance level when taught with and without kitchen resources. This therefore means that both low and high reasoning ability level students can benefit when taught using kitchen resources.

This finding in respect to treatment main effect and the interaction of treatment and reasoning ability is consistent with the findings of Nkanu (2009) who reported no significant difference in the performance of high and low reasoning ability levels students exposed to the same learning situation. In a similar vein, Adeboye (2008) reported no significant difference in achievement gains between subjects in each reasoning ability level who used different methods. Ejilo (2002) found that both high and low reasoning ability level students could do well in science if exposed to similar learning conditions.

The result of the second hypothesis in Table 2, showed that, the two way interaction between reasoning ability level and treatment when retention level of students were considered showed that, the critical F value of 3.86 was higher than the table F-value of 1.002.. It therefore means that reasoning ability level of students does not interact with treatment as far as retention level of Chemistry students is concerned. The finding therefore shows that both high and low ability level students can retain Thermochemical concepts when taught using kitchen resources. Kitchen resources are good for all categories of reasoning ability level students when retention level is sought. This finding in respect to treatment main effect and the interaction of treatment and reasoning ability is consistent with the findings of Ya-Wen and Hsia (2009) study of the influence of reasoning ability on the performance/retention of students in secondary schools.

III. Conclusion

The study showed the importance and significant role played by instructional materials (Kitchen resources) on students' achievement, especially in Chemistry. They have positive influence in achievement in Chemistry. This explains why a subject like Chemistry will require real objects and activities/experiment that can convert topics that seem imaginary to concrete for students' understanding. It made students to use their intellectual ability during the learning and teaching process. It encouraged creativity, bringing learning homewards and often improved and enhanced students' achievement.

IV. Recommendations

1) There is the need for the development of positive attitudes by teachers towards the use of kitchen resources for their students. This will encourage the development of their proficiency.

2) Teachers should bring their teaching to the level of the students' aptitude by using familiar instructional resources (kitchen) and make classroom interactions more interesting so as to arouse the interest of the students and academic excellence.

References Références Referencias

1. Adeboye, A. (2008). *Effective Utilization of Materials Resources on Science Students Academic Achievement.* Unpublished Doctorate Dissertation, University of Jos, Nigeria.
2. Adeboye, A. (2008). *Effective Utilization of Materials Resources on Science Students Academic Achievement.* Unpublished Doctorate Dissertation, University of Jos, Nigeria.
3. Afemikhe, M. (2000). Gender and Students' Achievement in Physics. *Journal of Research in Science Teaching, 19* (2), 53.
4. Ejilo, C. O. (2002). Effect of groupings in teaching and learning of science. unpublished M.Sc (Ed) thesis, University of Uyo.
5. Eshiet, I. T. (1996). *Improvisation in Science Teaching-Philosophy and Practice*. Abak Belpot (Nig.).
6. Gottlieb, S. (2011). Why do Science (unclassified material downloaded from www.gly.uga.-edu/ railsback/1122science
7. Guilford, J. P & Sternberg, R. J. (2011). Reasoning *www.dean.usma,edu/..eason.html*
8. Hayward, D. (1992). Do it your self Chemistry for Elementary Schools. *International Newsletter on Chemical Education*. IUPAC (UK), 37 (99) 1 – 3.
9. Ivowi, U. M. O. (1999). Perspective on Education and Science Teaching. Abuja. Foremost Educational Services Limited.
10. Johnson-laird, P. N. (2006). *How we Reason* Oxford: Oxford University Press.
11. Nkanu, M. (2009) *Relationship between Educational Resources and students academic performance in Akwa Ibom State*. Unpublished Doctoral Dissertation, Faculty of education, University of Uyo, Nigeria.
12. Opera, M. F. (2008). Utilization of laboratory facilities and students' academic performance. published M.Ed thesis of Anambra State University Uli, Ananbra State.
13. Oriade, T. I. (2008). An empirical study of the Utilization of instructional materials and Laboratory resources in Biology. *Curriculum Implementation.* A paper presented at the 4th Annual Conference of STAN, Bayelsa State.
14. Science (2011). What is Science Part III. Downloaded from (*www.gly.edu/railsback/1-122science 2htm* (2011). What is Science? Downloaded from (*www.gly.uga.edu/-railsback/ 1122science3-html).*
15. Uche, S. C. & Umoren, G. U. (1998). *Integrated Science Teaching: Perspective and Approaches*. Aba: AAU Vitalis Book Compa.
16. Udo, E. U. (2006). Availability, Selection and utilization of instructional resources for teaching primary science in Uyo. Jornal *of Sciences Teacher's Association of Nigeria.*
17. University Matriculation and PCE Examination (2010/2011) Ikeja: Longman.
18. Ya-wen, L. & Hsia– Ching, S. (2009). Enhancing eight grade students' scientific reasoning through web-based learning program. *Education Technology & Society* www.ifets.info/journal.