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Kitchen Resources Classroom Interaction and Academic Performance and Retention of SS2 Chemistry Students in Thermochemistry

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ABSTRACT
This study examined kitchen resources, classroom interaction pattern, academic performance and retention of SS2 Chemistry students in Thermochemistry. Fermentation of samples of five different juices, heating capacities of five samples of wood, induced thermal decomposition of five samples of shellfish shells powder and dissolution of five samples of glucose were used for the study. The sample comprised 240 students 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) and classroom interaction schedule (Cis) was used for data collection. Kuder Richardson formula 20 reliability co_efficient was 0.89 for CAT. The inter rater reliability was 0.89 while the intra rater reliability was 87%.Teaching with kitchen resources produced productive classroom interaction pattern which enhanced the performance and retention of students. It was recommended that teachers should adopt kitchen resources in the teaching of chemistry.
Key word: kitchen resources**,** classroom interaction pattern **.**

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). Science is an intellectual activity carried out by humans that is designed to discover information about the natural world in which humans live, and to discover the ways in which this information can be organized into meaningful patterns (science 2011). A primary aim of science is to collect facts (data). An ultimate purpose of science is to discern the order that exists between and among the various facts (Gottlieb, 2011).

According to Ausubel's (1958) theory of advanced organizer,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 teachers use resources form the environment (e.g kitchen) as learners can visualize the materials they already know as advance organizer in teaching and learning process.

In Edgar (1969) audio visual model of teaching theory ,the cone of learning shows that learners only remember 10% of what they read, 20% of what they hear, 30% of what they see 50% of what they hear and see, 70% of what they say and 90% of what they say and do. The concept of classroom interaction and teaching has a lot to do with classroom learning (Kalu, 1997). Teachers establish the pattern of general conduct during a lesson, while on their part students establish certain types of behaviour to coincide with this pattern. Consequently, the students participate to a varying the students participate to a varying degree in different classes and react differently to different teachers. This combined instructional pattern and student participation lead to a specific classroom environment characterized by specific interaction patterns. .

Academic achievement of students in science subjects generally and in Chemistry in particular had witnessed a deplorable trend in the past decades. 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 (Ihuarulam, 2008; Ifeakor, 2006; Udo, 2006; Okafor, 2000) The present exercise is an endeavour to empirically find out if the assertions about the use of kitchen resource are true in Senior Secondary Chemistry students in Calabar education zone.

LITERATURE REVIEW

Literature review on relevant literature was carried out. The environment (e.g. kitchen) is the largest laboratory and learning system ever imagined (Eshiet, 1996). According to Eshiet (1996), the laboratory is a workhouse for scientific practices such as teaching, learning, learning practical skills, the search for new ideas and the designing/testing of prototypes in engineering technology. Hayward (1992) sees the kitchen as a place stocked with quality approved materials and probably the safest chemical laboratory in the world.

Kitchen Chemistry was set up by Johnson, (2005) to create innovative science resources that make the teaching of science easier for teachers and more fun for the pupils. Kitchen resources promote collaborative learning, team building, and enterprise in education and can challenge even the most able pupils as well as offering support for the weaker pupils. Helmenstine, (2008) suggested kitchen resources that can be used for experiments and projects to explore science where one cannot find or afford chemical. Kitchen Chemistry presents the science behind cooking though concise description users can discover how the kitchen is like a Chemistry laboratory and cooking an experiment. Students can learn about common chemical compounds in the kitchen, including sugar, starches, fats and protein. Understanding of Chemistry can create new, great food recipe (kitchen chemistry product,(2011). Learning is not a spectator sport. Students do not learn much just by sitting in class listening to the teacher, memorizing repackaged assignments, and spitting out answers. They must make what they learn part of themselves .Rogers (1969) argues that "much significant learning, is acquired by doing" and that learning is facilitated when the student is a responsible participant. Vygotsky states that learning takes place in a social context and that interaction is with others (Palinscar, 2005). Active learning offers a paradigm for students learning that differs from the traditional lecture method based, model (Johnson, Roger and Karl, 2006) Difference in provision learning and amount of learning is obvious from (Edgar, 1969) cone of learning.

RESEARCH METHOD

A quasi experimental factorial research design was used for this study. The sample was 240 students. Experimental and control groups 120 students each. The experimental groups were taught using kitchen resources and their classroom interaction pattern was coded. The control groups were taught using normal science without kitchen resources and their classroom interaction pattern was also. Two instruments were used. Chemistry Achievement Test (Cat) and Classroom Interaction Schedule (Cis). . CAT was a 60 item five response option objective test. This served as the pretest, post test and retention test . Every correct answer in each instrument attracted 1 mark and wrong answer zero mark. The maximum marks for all the 60 items in each instrument was 60 marks. Classroom observation/Interaction Schedule (CIS) (Odinka, 2011) was used for data on classroom interaction. It comprised a series of seven categories: A, B, C, D, E, F and G. When coding of categories ABC were divided by coding of DE FG and number 1 and above was obtained, the classroom interaction was productive. When less than I was obtained the classroom interaction pattern was non productive.

In each class period of 40 minutes, 15 minutes (900 seconds) was used as observation period. In the first 13th minute of the class observation period 5 time units were observed comprising 5 minutes (300 seconds). No observation was done for the first minute; rather observation was done after every 2 minutes. The first minutes was used to get the class started. In the 2nd 13th minute of the class observation period, 5 time units were observed randomly, comprising 5 minutes (300 seconds) . In the 3rd 13th minutes of the class observation period, 5 time units were observed randomly comprising 5 minute; (300 seconds).A stopwatch was used. Total time for observation in a single classroom comprised 15 minutes (900seconds). The very prominent event with the longest duration was coded, after every 3 seconds.

RESULTS AND DISCUSSION

After classroom interaction pattern was established data analysis on students' performance and retention was carried out hypothesis by hypothesis using analysis of covariance. Hypothesis one: There is no significant influence of classroom interaction pattern on students' academic achievement. The F value for classroom interaction pattern, 1047.381, was greater than the critical F value of 3.84 at .05 significance level and (1.237) degrees of freedom. Students in classrooms with productive interaction patterns had greater mean academic achievement (x = 47.667, S=9.187) than their counterparts in classrooms with non-productive interaction patterns(x=16.833, S=6.395).Null hypothesis was rejected.

Table 1: Mean standard deviation and summary of one-way analysis of ANCOVA for classroom interaction pattern and students' academic achievement.

Classroom interaction pattern			N	$\bar{X}$	S
Productive			120	47.667	9.187
Non-productive			120	16.833	6.395
Sources of variation	Sum of squares	df	Mean squares	F	Sig. level
Intercept	29235.333	1	29235.333	548.788	.000
Pretest	2283.748	1	2283.748	42.869*	.000
Classroom interaction pattern	55796.641	1	55796.64	1047.381*	.000
Error	12625.586	237	53.273		
Total	70705.975	239			

*p<.05 df = (1,237) critical F=3.84

Hypothesis two: There is no significant difference in the retention level of SS2 chemistry students when taught Themochemistry with and without kitchen resources.Table two showed calculated F of 1468.581, greater than the critical F value of 3.84 at .05 significance level and (1,237) degrees of freedom. Implying that classroom interaction pattern significantly influences students' retention.

Table 2: Mean, standard deviations and summary of one-way ANCOVA of classroom interaction pattern and students' retention in Thermochemistry

Classroom interaction pattern			N	$\bar{X}$	S
Productive			120	47.417	9.280
Non-productive			120	12.067	4.967
Sources of variation	Sum of squares	Df	Mean squares	F	Sig. level
Intercept	27339.571	1	27339.571	543.675*	.000
Pretest	1266.716	1	1266.716	25.190*	.000
Classroom interaction pattern	73849.899	1	73849.899	1468.581*	.000
Error	11917.918	237	50.287		
Total	87034.533	239			

*p<.05 df=(1,237) critical F=3.84

The classroom interaction pattern significantly affected students' academic achievement according to the study because prior to the class students were told to gather the resources for the class. As such students had a lot of questions running through their minds what kitchen resources would be doing in a Chemistry class. These made the class very interactive as they asked the teacher questions, interacted with the resources and performed simple experiments. This would have lead to their high academic achievement.

This finding is in line with the work of Das (2011) that students working in group will develop teamwork skill and promote idea exchange between students from diverse backgrounds (productive interaction pattern) will facilitate academic achievement in Chemistry. The finding of Okafor (1993) found a positive relationship between classroom interaction behaviour and students level of achievement. Emah (1998) and Ogunkola (1999) also observed a positive relationship between classroom interaction pattern and academic achievement of students in science, when taught using resources from the environment (kitchen).

CONCLUSION AND RECOMMENDATIONS

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 Chemistry will require real objects and activities/experiment that can convert topics that seem imaginary to concrete for students' understanding. It allowed students to interact better in their lesson. Students in the control groups forgot what they learnt and retained less than students in the experimental group. This is so as kitchen resources used in teaching experimental groups were materials they encounter every day of one's lives.

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. Students should be given the opportunity to perform all tasks whether simple, complex, specific or general in any science instruction and at home. This will make it possible for them to construct their own knowledge, as well as test and evaluate their vital knowledge for conceptual change.

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