Vol. 15(1), pp. 19-26, January, 2020
DOI: 10.5897/ERR2019.3810
Article Number: B4E1C7162538
ISSN: 1990-3839

http://www.academicjournals.org/ERR

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Educational Research and Reviews

Full Length Research Paper

Enhancing students' academic performance in Chemistry by using kitchen resources in Ikom, Calabar

Cecilia Obi Nja[1]*, Bernedette Cornelius-Ukpepi[1,2], Emmanuel Asuquo Edoho[1] and Hope Amba Neji[1]

[1]Department of Science Education, Faculty of Education, University of Calabar, Calabar, Cross River State, Nigeria.
[2]Department of Curriculum and Teaching, Faculty of Education, University of Calabar, Cross River State, Nigeria.

Received 20 August, 2019; Accepted 25 November, 2019

This paper seeks to investigate how students' performance in Chemistry can be enhanced by using kitchen resources in Calabar. The kitchen resources used included a piece of white paper, a swab, lemon juice and candle. These were used to show that paper cellulose was oxidized by flame due to the catalysis of lemon juice acid. Other materials used were empty bottles of water, a balloon, a teaspoon, a glass, vinegar and sodium bicarbonate to inflate balloons without blowing. Volcano being made with a large glass, water, liquid dye, oil, effervescent tablet and a lantern was to demonstrate immiscibility, and carbon dioxide was formed because of effervescent tablet dissolution. The sample comprised 50 students drawn from two secondary schools in Ikom Education Zone of Cross River State. Two instruments were used to collect data: Chemistry Interest Questionnaire (CIQ) and Chemistry Achievement Test (Cat). Cronbach was used to establish reliability for CIQ and was found to be 078. Richardson formula 21 was used to establish reliability for Cat, 0.83. The research used a mixed design (quasi experimental and survey design). Data obtained were analyzed using independent t-test and Pearson product moment correlation coefficient. The results gave a significant t test of 4.96 and positive r =0.90 at 0.05 alpha level. The null hypothesis was not accepted which stated that there is no significant relationship between students' interest when taught with and without kitchen resources. The second null hypothesis with regard to Chemistry interest and academic achievement was also not accepted. Teachers are encouraged to use kitchen resources in the teaching of Chemistry to foster interest which will lead to high academic performance.

Key words: Kitchen resources, academic achievement, interest students, teachers.

INTRODUCTION

Science and technology advances are evident in every facet of our society. This can be seen even in the local as well as modern society. It can be found in the health care delivery system where humans no longer rely on herb for treatment of diseases and man has come to terms with the fact that diseases are not caused by witches and wizard but by factors in the environments. This includes the presence of bacteria, virus and fungi in the environment. In the financial sector, even from the comfort of one's home with banks application, financial transactions can be carried out without visiting the bank. The society has become cashless. In the business

*Corresponding author. E-mail: njacecilia@gmail.com.

sector, buying and selling are also done from the comfort of one's home. This is possible as all transactions are done online and door to door delivery is provided. In communication, science and technology has turned the world to a global village where distance is no longer a barrier to communication. With the invention of skypes, one can see his/her love one online without getting to travel. However, it is unrealistic to think citizens have fully harnessed the knowledge and products of science and technology since scientific belief and knowledge as numerous studies have been shown. Science is not given the prominent position that it requires in the society in terms of culture despite a key factor in the economic advancement of countries.

Students' academic performance is the extent to which students achieve their short or long-term educational goals. This is commonly measured through external or internal examination as well as continuous assessment in form of tests, assignments, projects, debates, practical as well as term papers. Two forms of evaluations are used to assess students' academic performance: formative and summative evaluations. Continuous assessment is a form of formative evaluation of students' academic performance that provides early indications of the performance of students. The essence is to provide remedial opportunities for those who did not perform well in the test. Continuous assessment also provides students with information that can be used to improve their academic achievement (Wikipedia, 2019).

It is no longer news to hear that student's academic achievement in Nigerian schools in both external examination and internal examination has been very poor. This situation if it remains unabated will further under develop the nation. Consequently, there is this burning desire to bring science closer to the society, and in so doing, a lot of creativities may be introduced into science education environment (Osbome et al., 2003). The concept of children's motivation and interest in science and scientific knowledge is paramount to bring about students that are involved in careers that have science basis to enable them to successfully impact knowledge acquired in the society "Nuffield Foundation" (Dsborne and Dillon, 2008).

The root of this ugly trend in poor academic achievement in science in general and Chemistry in particular in science is not connected to how science subjects are taught (Rocard et al., 2007). Hence, there is a requirement for a pragmatic change in the way science is taught. Science deals with knowledge of the universe and therefore should not be taught using lecture method; it should be taught with concrete things taken from the environments. Topics that have links with Chemistry concepts are found in every environment we find ourselves. Pinto (2003) commented on the benefits of science learning using activities that learners get involved with in their day to day life as a stimulator of students' motivation (Jiménez-Liso et al., 2013; Castro and Garcia, 2010). Parvin (2008) used a pool of 4,000 children in UK aged 9 to 14, who found that youngsters find the subject less inspiring and relevant to their lives as they move from primary to secondary school. The research discovered that there are several reasons for a fall in popularity in science including 'a curriculum that is often perceived by students as being too theoretical and not relevant', 'a poor understanding of the options offered by science based career in both students and some teachers and a shortage of specialist science teachers in secondary schools.

Students' record that shows the number of students who register in science classes in Nigerian secondary schools revealed that students' enrollment has been dropping on yearly basis (Akanbi, 2003; Bamidele, 2004). This scenario calls for urgent mitigating action to curb this problem if Nigeria must be at par with the world. Many of the problems that face Nigeria as a developing nation that ranges from food insecurity to poor medical health delivery can be solved to an extent with the knowledge of science and technology. This is so as new improved species of plants as developed by technology can take care of food insecurity. There is also the use of tractors, herbicides, fertilizes, to increase food supply with advances in science and technology. This cannot be achieved in Nigeria when the old method of students sitting down and passively learning science in schools is still in place (Omoesewo, 2009; Bhowmik et al., 2013).

A study done by Aina and Adedo (2013) showed that the causes of low enrolment in science included: Lack of trained science personnel in post primary schools. Schools also lacked instructional resources for teaching as well as textbooks written in a language that is not easily comprehended by students. The researcher also observed that Chemistry is difficult to assimilate and that solving of problems that require calculation was also an issue.

Teaching that will motivate students and build in them interest to learn should be one that makes sense to them. It should be delivered with instructional materials that explain the concepts to students in a simple and step by step presentation. When students cannot link what they are being taught with practical experiences, it brings about low interest in that subject which is manifested in their poor academic performance. When students' interest is captured, learning becomes very easy (Aina and Adedo, 2013; Hermitt 2007). Benjamin (2014) conducted a study on "The Impact of Performance Assessment on Students' Interest and Academic Performance in Science". The result obtained revealed a significant effect on the use of performance assessment as teaching strategy in the science classroom. This leads to increased students' interest in class and improved academic achievement of students.

Essien et al. (2015)'s study on the effect of interest on academic achievement in Social Studies revealed a strong positive relationship between interest and

academic achievement. The data analyzed showed that the r value of 0.15 calculated was greater than the critical value of 0.06 at 0.06 significance level.

A survey employing a Likert-based questionnaire consisting of 60 items was carried out, and documentary analysis was conducted on the students' final exam grades. The results show that interest and motivation had significant influence on students' learning outcomes, as shown by their final exam grades in the subject (Risa and Pupung, 2019).

Kusurkar et al. (2012) studied the effect of motivation on academic performance using a structural equation modeling analysis. The findings revealed a positive effect of interest on the academic performance of students.

A research was conducted on "Students' Motivation towards Science Learning and Students' Science Achievement. It was seen that, the female students were significantly more motivated than male students in learning science. The result of the study indicated that students' motivation towards science learning has a significant correlation with students' science achievement ($r = 0.354^*$, $r^2 = 0.125$, $p = 0.000$) (Chan and Norlizah, 2017). In a similar vein, Sukor et al. (2017) observed a positive significant relationship score between motivations and academic performance of students.

A Master thesis on factors influencing poor performance in science subjects at Ingwavuma circuit reported that, motivation (interest) affected students' academic performance in science (Ngema, 2016). Ezike (2018) studied the correlation between students' interest and their academic performance in Chemistry. He found a significant positive relationship between the students' interest and academic performance in Chemistry. The result implied that as interest increases academic performance also increases.

Kpolovie et al. (2014)'s study on "Academic Achievement Prediction: Role of Interest in Learning and Attitude towards School" shows there is a significant correlation and multiple prediction of students' academic achievement with the predictor variables.

From the reviewed literature, interest in science/chemistry is very important for academic achievement. Some researchers have conducted researches and have found some of the methods to increase students' interest. Nhorvien et al. (2016) researched on "correlation between science learning motivation and students' academic performances"; they discovered that students who responded to the questionnaire that was administered had high motivation (interest) in science and that led to their high achievement in Science. This interest is extrinsic implying that the learning environment provided it.

Herzog et al. (2016) investigated how students in Science classes can be motivated to choose a career in science. The results of the research showed that action-based learning and relevance to their career choice can stimulate their interest in Science. In that regard, Cox (2019), while writing on the topic "How to Motivate Students to Love Science" believes that if there is a connection between Science to Students' Everyday Life, they will be interested in science. This can be done by showing the science behind their daily activities for it will stimulate their interest.

Johnson (2005) is known as the father of kitchen Chemistry. It was borne out of his desire to make the teaching of Chemistry simple, to make students easily it and to make teaching of Chemistry easy for teachers. In using kitchen Chemistry, It was observed that that kitchen resources brought about collaborative learning and it was able to bring about increase in academic achievement of both low and high academic achievers. The entire universe is a laboratory that can be used to teach Chemistry. Using kitchen resources that learners are familiar with like cooking wares, storage and the Chemistry behind them make learning to be fun and not a difficult task to achieve (Home Experiments, 2011). This study aims to find out if the use of kitchen resources has any impact on students' interest in Chemistry and its effects on their academic performance in Chemistry.

THEORETICAL FRAMEWORK

Ausubel's theory of meaning learning and advance organizer

Ausubel (1968) said that if he had to reduce all educational psychology in just one principle, he would say that, the most important single factor influencing learning is what the learner already knows, ascertain this and teach them accordingly. Essentially, the theory has two components. First, there is the elaboration of what he called "advance organizer" that serves the purpose of increasing the clarity and stability of learning materials.

The second is a formulation of a procedure for the attainment of meaningful learning. Advance organizer, as defined by Ausubel, consists of those introductory materials that are presented in advance of an actual learning at higher level of abstraction and generality. The second component of Ausubel's postulation is the theory of meaningful verbal learning. The central key that explains the theory of meaningful verbal learning is subsumption, a process that describes the relevant knowledge already extant in the learner's cognitive structure and the new elements of information or concepts to be learned.

The implications of Ausubel's theory to the study are as follows: 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 from the environment (e.g. kitchen) as learners can view the

materials they already know as advance organizer in teaching and learning process.

During teaching, instructional resources should be presented such that the concept to be taught proceeds from the most generic (those in students kitchen) concepts to the most specific ones. Before trying to define activation energy for instance, first teach with materials that deal with more generic concepts for example, enthalpy of reaction which subsumes activation energy.

Learners can learn a concept only when they are "ready" for it (Learner readiness). It is from this theory that the principle of previous knowledge, which forms the background for learning, became very common. The implication here is that when resources from the kitchen that are familiar to the learner are used in the teaching/learning process, students' readiness can be enhanced.

Gagne's cognitive theory

Gagne and Briggs (1977) maintains that new learning occurs through the combining of previously acquired and learned entities as well as upon their potentials for transfer. As a result of that, the rate of cognitive development does not depend on innate factors of maturational readiness only, but also on the mastery of simpler pre-requisite resources or materials around us. Gagne proposed five different kinds of learning and proceeded further to delineate how instructions may be used to facilitate the acquisition of each.

The implication of Gagne's theory of instruction to the study is that: Teachers must always state their learning objectives in clear behavioural term. This helps the Chemistry teacher to be focused and it also guides him to know the right resources in the kitchen to use in his teaching/learning process. When this is done, it may bring about meaningful learning outcome.

Learning units or tasks must be duly analyzed to identify their relevant components. For example, in the teaching of enthalpy, its component should include exothermic and endothermic reaction, activation energy, catalyst energy profile diagram, etc. When the relevant components are identified and arranged in a hierarchical form and relevant kitchen resources selected, that may bring about high academic performance of students.

The arrangement of relevant component should be in a manner that would ensure easy comprehension, effective and meaningful learning. This arrangement when backed-up with resources that are drafted from the learner's environment (kitchen) may increase their academic performance.

Gagne's theory of instruction can be of tremendous importance to the teacher teaching Chemistry. Materials to be presented to learner's need to be broken down into relevant components and teaching is to be in a hierarchical order. Theories of instruction and learning reviewed provide the necessary frame work on which part of this study which has to do with academic performance of SS2 Chemistry students is supported.

Understanding a Brain-Base approach to learning and teaching (Emotions critical to patterning)

Positive emotions such as love, excitement, enthusiasm and joy enhance the ability to process information and create "safe" environment (Sylwester, 1996). Stress and constant fear, at any age, can circumvent the brain's normal circuits. And yet, emotions are critical to learning. Emotion can improve memory. Teachers need to establish an environment that is free from intimidation and rejection, high in acceptable challenge and where the learner experiences active participation and relaxed alertness (Dwyer, 2002). Deutsch (2003) says, "How learners feel is very important to their learning process. If the learner is enthusiastic and does not feel stress, learning will take place". If the conditions are negative and the learner does not feel relaxed and safe in the learning environment, feeling threatened will shut down the learning process and as Goleman claims, "hijack" the rest of the brain (Viadero, 1996).

The result of students' responses showed that 1/3 of students believe students' emotions are very important in learning. Student A wrote, "I will introduce the topic, crack jokes to make the class lively and not boring to them and teach in the language they understand". Student B wrote, "I will always make students happy." Student C wrote, "I will teach with happiness and jokes to make the class interesting".

From the fore gone, students' emotion is very important in learning. When students are emotionally stable, the brain process will not shut down and interest is enhanced and as such learning takes place.

Understanding a Brain-Base approach to learning and teaching (Learning enhanced by challenges and inhibited by threat)

A little bit of challenge makes learners to learn better. We remember having to go through the process more easily if the process is not so simple that it can be learned unconsciously. However, too much of a challenge or threat stops us from learning well. If a student feels anxious or threatened, she will be so busy processing and dealing with anxiety/threat and as such not much energy can be put toward processing the desired information. This means students must be comfortable and stimulated to learn (Bromley, 2017). Nunley (2019) says the environment inside the classroom must be more desirable than the environment outside the classroom. If students feel like being in the classroom is

punishment, then any behavior they can exhibit to get out of the environment is being reinforced when you force them to leave. Classrooms should be welcoming and be a place where students feel valued and encouraged, not belittled and degraded.

The students' responses to questionnaire agree with the above principle. Student X wrote, "I will teach it to the understanding of the students and find their areas of difficulties." Student Y wrote, "I will first be friendly to students." Student 2 wrote, "I will challenge my students with questions."

The principles of brain-based learning and students' responses analysis showed that teachers should be very careful with students' emotions if they are serious about learning. Teachers should not mock, belittle or abuse a student to make the student feel inferior as that will hinder learning. Teachers should also endeavour to use materials around the learning environment as resources for teaching. Teachers should as much as possible reduce rote memory method of knowledge. Teachers should strive to take students out for field trip in case the materials cannot be brought to the classroom. Teachers should try as much as possible to minimize threat in the classroom as that hinders the functioning process of the brain.

Statement of the problem

Academic achievement of students in science subjects generally and in Chemistry in particular had witnessed a deplorable trend in the past decades. Observations from 2005 to 2014 have consistently revealed poor achievement in Chemistry in senior secondary school certificate examination organized by West African Examination Council. A lot of research work has been carried out on students' poor academic performance.

Empirical works reviewed indicated that in appropriate teaching methods, lack of instructional materials/resources as reasons for poor academic performance of students in sciences. Improvisation had been used to improve students' performance in physics. There are mainly opinions on the benefits of kitchen resources and if any few empirical works on the use of kitchen resources in the teaching of Chemistry. 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.

Against this background therefore, the problem of this study was to investigate what is the academic performance of Chemistry students when taught with kitchen resources? What will be its effect on students' interest.

Purpose of the study

The purpose of the study is to determine if the use of kitchen resources in teaching has any significant effect on Chemistry students' interest in chemistry and its effect on the academic performance of Chemistry students. How the use of kitchen resources in teaching affects chemistry students' interest in chemistry? How will students' interest in Chemistry affect their academic performance?

Research questions

The following questions guided the study:

(1) How does teaching with and without kitchen resources affect Chemistry students' interest in the subject?
(2) How does students' interest in Chemistry affect Chemistry students' academic performance?

Statement of hypotheses

These postulated hypotheses were utilized in this study.

(1) There is no significant difference between the interest level of SS2 Chemistry students taught Chemistry using kitchen resources and those taught without kitchen resources.
(2) Interest of students does not significantly relate to Chemistry students' academic achievement

MATERIALS AND METHODS

A mixed method design was used for the study. This is a quasi-experimental research design for teaching with kitchen resources and expo facto design for the investigation of interest of the students. The research population was 200 students. This study was conducted using 50 students as the sample size. The sample size was selected using simple random sampling technique from a table of random numbers. Secondary 11 students were distributed in two classrooms. These two groups were named experimental and control. In both groups, students were grouped in fives. The experimental group was taught using kitchen resources while the control was taught using the conventional method. All resources and experiments carried out were developed by the researcher.

Details of the experiments carried out by the experimental group are shown in Appendix 1. Two instruments were developed by the researchers for this study: The Chemistry Interest Questiommaire (CIQ) and Chemistry achievement test (Cat). The CIQ had 10 items that used 4 Likert questionnaire scale. It was validated by expects in test and measurement department of the research area. CIQ was subjected to Cronbach Alpha reliability coefficient to ascertain the reliability of the instrument. The result of Cronbach Alpha was r=078.

Cat was an objective test made up of 25 multiple choice questions. The questions had one correct answer and three distractors. The questions were validated by standard examination body questions bank where they were drawn from. The results of the questions that were administered to a group of students that did not form part of the research but were similar in all respect to the students that formed part of the research were subjected to Kuder Richardson formular 21. The result was 0.83.

Table 1. Independent t test of the difference between treatment (with and without kitchen resources) and students' interest in chemistry.

Method of teaching	N	Mean	Std.	t- Cal
Taught with kitchen resources	26	35.81	4.60	4.96
Taught without kitchen resources	24	27.25	7.38	

Df =48t-critical=2.02. The calculated t value of 4.96 is greater than the critical t value of 2.02. This means that the result is significant.The null hypothesis that stated that there is no significant difference in the interest level of Chemistry students when taught with and without kitchen resources was not accepted The implication is that interest of chemistry students are enhance when they are taught with kitchen resources.

Table 2. Pearson product moment correlation coefficient (r) analysis of the relationship between academic achievement and students' interest when taught using kitchen resources.

Variable	Σx / Σy	Σx^2 / Σy^2	Σxy	R	p-cal
Academic achievement	1821	10030.32	4327.22	-	-
Interest	1166	2662.70	-	0.90	0.72

$P < 0.05$, df = 49, Critical = 0.29.

In each micro-lesson for the experimental group, four experiments were done using Chemistry concepts. The students for this research used kitchen resources chemicals; this was to familiarize the students with the concepts to be taught. Prior to every practical exercise, students were given a document that contained the explanation of the practical to be carried out.

The teaching was done for eight weeks. After the teaching, interest questionnaire was administered to both the control group and experimental group. It had 10 items to measure students' interest (CIQ) in Chemistry. It had four Likert scale levels. A chemistry test (Cat) of 25 items covering questions in Chemistry from topics related to the experiments carried out was administered to the students for 30 min after instruction.

RESULTS AND DISCUSSION

Most home kitchens hold the tools to dozens of fun experiments to expand the imagination of children in the classroom. Kitchen resources provide fun experiments to students thereby increasing their interest in Chemistry (Caroline, 2013) (Table 1).

This work was also collaborated by https://www.guesthollow.com/homeschool/science/chemistry_highschool/chemistry_home.html (2019) that was of the opinion that most Chemistry curriculum were made thick and boring textbooks that make Chemistry students not to be interested in the subject chemistry. Guest hollow high school chemistry in the kitchen is for students who hate Chemistry and in tears because of the scaring Chemistry textbook. The kitchen Chemistry stimulates students' interest in Chemistry.

Chemistry is fun when kitchen resources are used. Fun kitchen projects, like making of ice cream, can be used to demonstrate what a chemical reaction is (https://www.sciencebuddies.org/science-engineering-careers/earth-physical-sciences/chemistry-teacher, 2019).

Table 2 shows that the calculated r-value of 0.90 was greater than the critical r-value of 0.29, given 49 degrees of freedom at 0.05 alpha levels. This indicates that there was a significant relationship between academic achievement and interest of chemistry students. By this result, the null hypothesis of no significant relationship was rejected. From the analysis of data obtained, it was revealed that students' academic performance was dependent on their interest in Chemistry (r = 0.91). This implies therefore that students who do well in a Chemistry class will have high interest. Low interest in Chemistry by students can therefore be said to be a contributing factor why secondary school chemistry performance is poor as there was a positive relationship between interest and academic achievement of students. The Pearson product moment correlation coefficient (r) value was 0.92. This high value of 0.92 and positive value means that there is a strong positive relationship between interest and academic achievement of students. By implication, when interest is high, academic achievement is high and when interest is low, academic performance is low. Benjamin (2014) conducted a study on "The Impact of Performance Assessment on Students' Interest and Academic Performance in Science". The result obtained revealed a significant effect on the use of performance assessment as teaching strategy in the science classroom. This leads to increase in students' interest in class and improves academic achievement of students.

Essien et al. (2015)'s study collaborated this study as data analyzed showed that the r value of 0.15 calculated was greater than the critical value of o.06 at 0.06 significance level. This study agrees with the research carried out by Ngema (2016), Ezike (2018), Kpolovie et al. (2014) and Essien et al. (2015) that had a significant

result when interest of students was compared to their academic achievement. Nhorvien et al. (2016) study the correlation between Science Learning Motivation and Students' Academic Performances; they also found a significant difference in the relationship between the students' interest and their academic achievement.

Taking the students' individual result, it was obvious that a student who scored high in interest test also scored high in Chemistry performance. The positive correlation between chemistry achievement test and interest is in line with the fact that before performance can be achieved, the individual in question must be interested in the job. Inventions are products of interested brains. The working of the brain shuts down when there is no interest.

Interest is very important in how an individual performs a given task. To be successful students must be taught with material that can be seen (Caine and Caine, 2013). Materials around students' homes that they encounter daily can be used to stimulate students' interest (Cox, 2019). Teaching with kitchen materials/resources got students active in the teaching and learning. Students sourced for the materials and came to class with many questions as what the materials will be used for.

This study shows the importance and significant role played by instructional materials (Kitchen resources) in students' achievement, especially in Chemistry. They have positive influence in their 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 was therefore observed that using kitchen resources assisted teachers economically and the government in general. It allowed students to interact better in their lesson. 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.

Conclusion

In view of the contribution of science and technology to the world at large and Nigerians, it benefits children that engage in scientific activities and prepares them for the future society. This research has shown that if kitchen resources are used to teach Chemistry and present science as a funny activity, which is even better if the experiments can be lived in a familiar way, interest of students in chemistry would be enhanced.

Implication for the teaching of Primary Science and Mathematics

This study has revealed the importance of the use of kitchen resources in teaching. When materials from the kitchen are used in primary science and Mathematics classrooms, it brings learning closer to the learner thereby enhancing academic achievement in primary Science and Mathematics.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Akanbi AO (2003). An investigation into student's poor performance in senior secondary school physics. Journal of Teacher Education Trends 1(1):58.

Aina JK, Adedo GA (20!3). Perceived causes of students' low enrolment in science in sec schools Nigeria. International Journal of Secondary Education 1(5):18-22.

Ausubel D (1968). Educational psychology: A cognitive view. New York: Holt Reinhart and Winston.

Bamidele L (2004). Students' Poor Performance in Physics. A Bane to our Nation's Technological Development. Nigerian Journal of Science Education and Practice 2(1):174-17

Benjamin A (2014). The Impact of Performance Assessment on Students' Interest and Academic Performance in Science. Master of Education [Concentration in Science Education) Thesis. The Digital Library Services Centre The Alma Jordan Library, The University of the West Indies at St. Augustine, Trinidad and Tobago.

Bhowmik M Banerjee, Banerjee J (2013). Role of pedagogy in effective teaching. Basic Research of Education and Review 2(1):1-5.

Bromley M (2017). The process of learning: Comfortable with discomfort (part3) http://www.sec-ed.co.uk/best practice/the-process-of-learningcomfortable-with-discomfort-part-3/

Caine A Caine (2013). Brain based learning theory: the principles explained and what they mean for good classroom practice. https:pdfs.semanticsscholar.org

Caroline S (2013). Kitchen Chemistry: Science fun for young children.Michigan State University Extension https://www.canr.msu.edu/news/kitchen_chemistry_science_fun_for_young_children

Castro GD, Garcia RA (2010). Aprendemosquimica a travesdeldescubrimiento de los elementosquimicos en el cuerpohumano en la ensenanzasecundaria. RevistaElectronica de DidacticasEspecificas 3:26-37.

Chan YL, Norlizah CH (2017). Students' Motivation towards Science Learning and Students' Science Achievement. International Journal of Academic Research in Progressive Education and Development 6(4):174-189.

Cox J (2019). How to Motivate Students to Love Science.K-12 News, Lessons & Shared Resources By Teachers, For Teachers. https://www.teachhub.com/how-motivate-students-love-science Educational Leadership (15):327-338 Retrived 10th August 2019 www.ascd.org/ASCD/pdf/journals/edlead/e

Deutsch N (2003). Nellies English projects: Collaborative writing projects. Retrieved February 10, 2019, from http://www.nelliemuller.com/Collaborative_Projects.htm

Dwyer MB (2002). Training strategies for the twenty-first century: Using recent research on learning to enhance training. Retrieved February 7, 2004, from http://www.tandf.co.uk/journals

Essien EE, Akpan OE, Obot IM (2015). Students' Interest in Social Studies and Academic Achievement in Tertiary Institutions in Cross River State, Nigeria.European Journal of Training and Development Studies (2)2:35-40.

Ezike BU (2018). Classroom Environment and academic interest as correlates of achievement in Senior Secondary School Chemistry in Ibadan South West Local Government Area, Oyo State Nigeria. Global Journal of Educational Research 17:61-71.

Gagne RM, Briggs LJ (1977). Principles of instructional design. New York: Holt, Reinhart and Winston.
Herzog W, Aeschlimann B, Makarova E (2016). How to foster students' motivation in mathematics and science classes and promote students' STEM career choice. A study in Swiss high schools. International journal of Educational Research 79:31-41.
Home Experiment (2011). Exploring Acids and Bases Retrieved from http:/www./scifunchem wise.edu/home expts/acid base: html.
Jiménez-Liso MR, Jiménez –Liso M, Avraamidou L (2013). Scientific practices in teacher education: the interplay of sense, sensors, and emotions Nunley in the body of the work year should be corrected to 2019 not 2013.
Johnson P (2005). Kitchen chemistry. Retrieved from http://www.kitchenchemstryiscali.co.uk
Kusurkar RA, Ten Cate Th J, VosCM P, Westers P, Croiset G (2012). How motivation affects academic performance: a structural equation modelling analysis. Advances in Health Sciences Education 10.1007/s10459-012-9354-3
Hermit A (2007). The role of motivation in education. A-Z Education: Motivation 2007:http://contributor, yahoo.com/use.
Kpolovie PJ, Joe AI, Okoto T (2014). Academic Achievement Prediction: Role of Interest in Learning and Attitude towards School. International Journal of Humanities Social Sciences and Education (IJHSSE) 1(11):73-100.
Ngema MH (2016). Factors that Cause Poor Performance in Science Subjects at Ingwavuma Circuit. Master of Education in the subject. Natural Science Education at the University of South Africa Pretoria, http://hdl.handle.net/10500/23003
Nhorvien JPL, Jessie JBS, Elvira AT, Agaton PP Jr, Maria EDD, Romiro GB (2016) Science Learning Motivation as Correlate of Students' Academic Performances.Journal of Technology and Science Education (6)3.
Nunley K (2019). Why Punishment - Based Systems Don't Work: Yet we're stuck with them http://www.help4teachers.com/punishment.htm
Omoesewo EO (2009). Views of Physics teachers on the need to train and retrain physics teachers in Nigeria. African Research Review 3(1):314-325.
Osbome J, Simon S, Collins S (2003). Attitudes towards science: A review of the literature and its implications. International Journal of Science Education 25:1049-1079.
Dsborne J, Dillon J (2008). Science education in Europe: Critical reflections. London: The Nuffield Foundation.
Parvin J (2008). Daily telegraph reporter; children losing interest in science through their education https://www.telegraph.co.uk
PINTO CG (2003). Didactica de la Quimica y vidacotidiana-Anales de la Real Sociedadespanola de Quimica 1:44-52.
Risa T, Pupung P (2019). The Influence of Interest and Motivation on College Students' Language and art Appreciation Learning Outcomes. International Journal of Education 11(2):130-135
Rocard MP, Jorde D, Lenzen D, Walberg-Henriksson H, Hemmo V (2007). Science Education a renewed pedagogy for the future of Europe. European Communities, Belgium.
Sukor R, Mohd AAF, Norhasnida Z, Nor Khaizura AR (2017). Influence of Students' Motivation on Academic Performance among Non-Food Science Students Taking Food Science Course.International Journal of Academic Research in Progressive Education and Development 6 (4)104-112.
Sylwester R (1996). Celebrating Neurons, ASCD. Retrieved February 7, 2004 from http://members.aol.com/Rss51540/brain2.htm.
Viadero D (1996). Brain trust. Education week. Retrieved January 29, 2004, from http://www.edweek.org/ew/1996/03brain.h16
Wikipedia (2019). What is academic performance.