

Effects of Digital Game and Youtube Instructional Package on the Achievement and Interest in Chemistry among Students in Bida Niger State

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Abstract: Digital game based learning is a strategic and tactical guide in learning process combining content with video games to engage learners; YouTube is a video sharing service that allows users to watch videos posted by other users and upload videos of their own. The research design adopted for this research is pretest posttest control (Non-equivalent, non-randomization control, experimental research design). A total number of one hundred and forty two student (142)(77 males and 65 females)for the study were purposively selected for this study from three (3)co-educational schools out of twenty three (23)schools in Bida local government were randomly assign to control and experimental groups. Chemistry achievement test was adapted and validated by two expert in the field of chemistry with the reliability index of 0.748. The chemistry achievement test was administered to students in the pretest, posttest upon treatment of test instrument; the data obtain from pretest and posttest were statistically analyzed using analysis of covariance (ANCOVA) using statistical package for social sciences (SPSS) version 20.0. The result indicates that digital game and youtube instructional package enhanced the achievement of chemistry student; it also shows that male students did better than female students using digital game and youtube instructional package. It concluded thatExposing Learners to digital game and youtube instruction enhance easy assimilation and recall of student's memory in chemistry which they did better than those exposed to conventional method. The male student performed better than the female student in digital game and youtube instructional package, it is recommended that the government should make available necessary gadget to aid teaching and learningand curriculum planners and relevant government agencies should incorporate this approach into secondary school curriculum and thus implemented.

Keywords: Digital game, Youtube, achievement, Chemistry, chemical equation.

I. INTRODUCTION

Background to the Study

Technology is a body of knowledge devoted to creating tools, processing actions and the extracting of materialsFranklin, Ursula (2017). The term "Technology" is wide, and everyone has their way of understanding its meaning. We use technology to accomplish various tasks in our daily lives, in brief; technology is described as products and processes used to simplify our daily lives. We use technology to extend our abilities, making people the most crucial part of any technological system. Technology is also

an application of science used to solve problems. Franklin, Ursula (2017) [1]

Technology is applied in almost everything we do in our daily lives; we use technology at work, we use technology for communication, transportation, learning, manufacturing, securing data, scaling businesses and so much more. Technology is human knowledge which involves tools, materials, and systems. The application of technology typically results in products. If technology is well applied, it benefits humans, but the opposite is true, if used for malicious reasons. Franklin, Ursula (2017) [1]

Educational technology is the use of both physical hardware, software, and educational theoretic to facilitate learning and improving performance by creating, using, and managing appropriate technological processes and resources It encompasses several domains including learning theory, computer-based training, online learning, and where mobile technologies are used, m-learning. Accordingly, there are several discrete aspects to describing the intellectual and technical development of educational technology. It has been found useful in the field of mathematics, physics, biology, chemistry where this technologies have been found to enhance learning. Robinson, Rhonda; Molenda, Michael; Rezabek, Landra (2016). [2]

Chemistry is the study of matter, its properties, how and why substances combine or separate to form other substances, and how substances interact with energy. Many people think of chemists as being white-coated scientists mixing strange liquids in a laboratory, but the truth is we are all chemists. Doctors, nurses and veterinarians must study chemistry, but understanding basic chemistry concepts is important for almost every profession. Chemistry is part of everything in our lives (Bagley 2014) [3]

The role of chemistry in the development of the scientific base of a country cannot be overemphasized and Nigeria is not an exception. Yet with the increasing importance of chemistry to the unfolding world, the performance of Nigerian students in the subject at the secondary school remains a dismal failure. However it is disappointing to note that the students 'performance in chemistry at internal and external examination has remained considerably poor despite the

relative importance of chemistry (Chief Examiners Report 2015, 2016, 2017, 2018). [4][5][6][7]

A chemical reaction is a process that leads to the chemical transformation of one set of chemical substances to another. Classically, chemical reactions encompass changes that only involve the positions of electrons in the forming and breaking of chemical bonds between atoms, with no change to the nuclei (no change to the elements present), and can often be described by a chemical equation. Nuclear chemistry is a sub-discipline of chemistry that involves the chemical reactions of unstable and radioactive elements where both electronic and nuclear changes can occur IUPAC(2016) [8]

The substance (or substances) initially involved in a chemical reaction are called reactants or reagents. Chemical reactions are usually characterized by a chemical change, and they yield one or more products, which usually have properties different from the reactants. Reactions often consist of a sequence of individual sub-steps, the so-called elementary reactions, and the information on the precise course of action is part of the reaction mechanism. Chemical reactions are described with chemical equations, which symbolically present the starting materials, end products, and sometimes intermediate products and reaction conditions.

Several factors have been advanced to affect students 'poor performance in chemistry resulting to wide cry each year when WAEC or NECO releases annual results as a result of students poor achievement especially in the Science related subjects This have been attributed to a number of factors such as lack of chemistry laboratory, lack of qualified teachers, the abstract nature of the subject, substantial trained teachers and poor methods of teaching, poor attitude , gender (Chado, Gimba Babagan & Yahaya, 2016 [9], Crosnoe, Johnson & Elder, 2014 [10]). Student Age, qualification, distance from learning place Chansarkar and A. Mishaeloudis (2011) [11]. Test related variables (Ekpo-Eloma, 2016 [12]). Grade level, school location, school type, student type and socio-economic background (SEB) Yvonne Beaumont Walters, kola soyibo, (2018 [13]).

According to Anthony (2019 [14]) the understanding of balancing of chemical equation is a prerequisite to the comprehension of some learning tasks in chemistry such as chemical equilibrium, electrochemistry and organic chemistry. Balancing chemical equations also is one of the difficult chemical concepts students encounter in both practical and theory. Most chemistry students perform poorly in chemistry because of their inability to write correctly, identify reactants and the products as well as to balance the reaction equation correctly. (WAEC Chief Examiners' Reports of 2015, 2016, 2017 and 2018 [4][5][6][7]).

Although, various efforts have been made by various researchers and science educators to come up with instructional strategies, motivational skills that will promote effective teaching and learning of chemistry concepts, increase and speed up their conceptual understanding and,

enhance students' achievement and general performance, knowledge retention and positive attitudinal changes, but all proved unsatisfactory. Therefore, it becomes necessary to adopt instructional strategy that will promote student active learning in chemistry such as game based instruction and youtube instructional package.

Digital game based learning is a strategic and tactical guide in learning process combining content with video games to engage learners (Prensky 2011 [15]). Digital game-based learning is a research field within the wider context of technology-enhanced learning that has attracted, during the last few years, the interest of both the research and educational community (Chen & Chan, 2010 [16]). Connolly and Stansfield (2017 [17]) define digital game-based learning as "the use of a computer games-based approach to deliver, support and enhance teaching, learning, assessment, and evaluation", whereas Prensky (2011 [15]) also stress the additional educational value of digital game-based learning by defining it as an approach based on the integration of educational content into digital games and leading to the achievement of the same or better results, in comparison to traditional instructional approaches.

Furthermore, researchers have acknowledge that the use of digital game learning offer opportunities for learning by applying trial-and-error approaches, players engage in active explorations, formulate and test hypotheses within the virtual world of the game, and based on feedback, confirm or reject them (Chen & Chan 2011 [16], Whitton 2011 [18]), findings also reveal that digital game help student to assimilate fast due to the fact that student feels they are the one actually taking out the reactions and also their abilities to react any element together in which the game is programmed to tell whether the element can react or not, for that reason they were able to identify element, compound that can undergo reactions. (Chado, Gimba, Babagana and Yahaya, 2016 [9]).

YouTube is a video sharing service that allows users to watch videos posted by other users and upload videos of their own. The service was started as an independent website in 2005 and was acquired by Google in 2006. Videos that have been uploaded to YouTube may appear on the YouTube website and can also be posted on other websites, though the files are hosted on the YouTube server.

The slogan of the YouTube website is "Broadcast Yourself." This implies the YouTube service is designed primarily for ordinary people who want to publish videos they have created. While several companies and organizations also use YouTube to promote their business, the vast majority of YouTube videos are created and uploaded by amateurs. Therefore, there is a wide range of videos available on YouTube. Some include amateur films, homemade music videos, sports bloopers, and other funny events caught on video. People also use YouTube to post instructional videos, such as step-by-step computer help, do-it-yourself guides, and other how-to videos.

Incorporation of YouTube videos into the instruction has been shown to support multimedia learning, capture students' attention, make learning more interesting and enhance the overall learning process (Eick, & King, 2012 [19], Buzzetto-More, 2014 [20]; Duvenger & Steffes, 2012 [21]; Greenberg & Zanetis, 2012 [22]), Hilner, 2012 [23]; Jones & Graham, 2013 [24]; Tan & Pearce, 2012 [25]). More specifically, well selected, YouTube videos have been found to help students engage more deeply with subject matter, and recall the information they've learned longer and expand access to information, promote critical thinking, foster active and flexible learning environments (Burke & Snyder, 2008 [26]; Buzzetto-More, 2014 [20]; Duvenger & Steffes, 2012 [21]; Roodt and Peier, 2013 [27], Snelson, 2011 [28]; Burke and Snyder, 2008 [26], Logan, 2012 [29], Liu, 2010 [30]; Roodt & Peier, 2013 [27]),

Several studies have been carried out over the years to determine factors that influence students' achievement in chemistry. Chemistry is a fundamental science subject that prepares student for science related courses in higher institutions. Adebayo (2014 [31]), opined that interest is a state of curiosity or concern about something or the attention given to something.

A number of factors have been identified to affect students' interest to chemistry like attitude of teachers (Ale, 2010 [31]), content difficulties (Adebayo, 2014 [31]), parental influence, gender, career interests, and social implications of science and achievements (Hallayna and Shanghnessy, 2012 [32]), instructional techniques (Obioma and Ohuche, 2016 [33]), quantity and quality of teachers (Sule, 2011 [35], Eremie and Ekpete, 2018 [34]). Difficulties in applying scientific knowledge and low interest in scientific studies become one of the major challenges in teaching chemistry. Many teachers complained about the low interest of students in learning chemistry (Obioma and Ohuche, 2016 [33]).

Achievement is an important academic factor that has been identified to be influenced by teaching methods. Achievement is the process of getting something done successfully, especially using effort and skills. Hence academic achievement refers to the accomplishment of academic goals, the educational outcomes of student or rather the extent to which a student, a teacher or an instructor has achieved the stated educational objectives. (Fatokun et al 2010 [37]) view achievement as measurable changes in students' behavior in academic as a result of exposure to a given concept. Different findings have emanated from researches carried out on the effects of digital game on student achievement. (Chado et al 2016 [9]) in a study discovered that the achievement of student taught chemical reaction through digital game was a statistical difference in favor of the former.

The moderating effect of gender have been found to affect student achievement in chemistry,

There has been contrasting opinions on gender related issues on students' achievement in chemistry by scholars. While

some observed that gender affect students' achievement in favour of the male. However some researchers observed no gender difference in students achievement Hassan, Gimba, &Chado, 2016 [36],. Fatokun and Aladejana 2010 [37],Olasheinde and Olatoye 2014 [38])

Fatokun and Odagboyi (2010 [37]) viewed gender as a significant factor in students' achievement in chemistry due to interaction patterns. another study reveals that there is a high manipulating skill of males towards digital games than that of females because generally males are attached to gadgets which give them an age over the female students (Chadoet al, 2016 [10]), findings shows that 64% of teens are on YouTube instructional platform in which males are more incline than females and used it more often than females 39% vs 25% (New Pew Research Center Survey, 2015).

Different studies have been carried out in the field of medicine, mathematics, literacy and drama, that is why this study employed the same approach in the field of chemistry.

Statement of the Problem

Writing and balancing of chemical equations, knowing the types of chemical reactions are confusing concept in chemistry because of its mathematical nature. It is the foundation on which the understanding of chemistry is built. poor achievement and interest have been attributed to poor teaching methods used by chemistry teachers. Although several instructional strategies have been used to teach chemistry, but the poor performance of students still persist. Therefore there is need to employ instructional strategy that involve the use of game and YouTube video which promote active learning, such as digital game-based learning, and YouTube instructional package. Therefore this study will determine the Effect of Digital Game and YouTube Instructional package on the Achievement in Chemistry among Senior Secondary School student in Bida Niger State .

II. AIM AND OBJECTIVES

The main aim of the study is to determine the Effects of Digital Game and YouTube Instructional package on the Achievement in Chemistry among Senior Secondary School student in Bida Local Government. The study will attempt to achieve the following objectives:

- i. Determine the effect of digital game and youtube instructional strategies on the academic achievement of students in chemistry.
- ii. Determine the gender effect of digital game and youtube instructional strategy on the academic achievement of students in chemistry.

Research Questions

This study will provide answers to the following research questions:

- i. What is difference between the mean achievement scores of students taught with digital game and

youtube instructional strategy and those taught chemistry with conventional lecture method of teaching in chemistry?

- ii. What is the gender differences between the mean scores of students taught chemistry using digital game and those taught with youtube instructional strategy?

Research Hypothesis

The following null hypothesis will be tested at 0.05 level of significance:

H_{O1} . There is no significant difference in the mean scores of students exposed to digital game and youtube instructional strategy and conventional method of chemistry.

H_{O2} . There is no significant difference in the mean achievement scores of male and female exposed to digital game and youtube instructional strategy of teaching chemistry.

III. METHODOLOGY

The research design adopted for this study is pretest posttest control (Non-equivalent, non-randomization control, experimental research design). The study used three groups; experimental group 1, experimental group 2 and control group. The experimental group 1(EG1) is the group exposed to treatment one (Digital Game X1), the experimental group 2 (EG2) is the group exposed to treatment two (Youtubepackage X2) while the control group (CG) is a group taught using a conventional lecture method(X0).

Table 3.1: Research Design Format

Groups	Pretest	Research instrument	Posttest
Experimental group 1	O1	X1	O2
Experimental group 2	O3	X2	O4
Control group	O5	Xo	O6

Where;

O_1, O_3, O_5 =Pretest scores

O_2, O_4, O_6 = Post test scores for experimental group

X_1 – Treatment (DGI)

X_2 - Treatment (YI)

X_o – Conventional lecture method

Independent variable: digital game, youtube video

Dependent variable: Achievement

Moderating variable: gender,

The population for this study is made up of all Senior Secondary School chemistry students in Bida Metropolis; the target population is eleven public Senior Secondary School two (2) students with total population of two thousand and fifty one (2051) for 2018/2019 session.

A purposive sampling technique was employed in selecting the sample for this study. A purposive sampling technique was used to select three (3) Secondary Schools which were randomly assigned into experimental groups, then a simple random sampling technique was used to select two (2)

secondary schools which was randomly assign into control group. The schools were selected because of their co-educational nature, and the presence of functioning computers in their computer lab (for experimental group). The sample for the study consisted of 142 learners who were captured from the six intact classes in the schools, with experimental groups having 98 students and control having 44 students, which is made up of 77 male and 65 females.

The instrument used for data collection is; treatment instrument and test instrument.

Treatment Instrument: The independent variable of the study is the digital game (DGI) and youtube instructional package(YIP). The game that was selected to support the proposed educational activities was “chemical lab for chemistry”, simulation game which engages players in activities requiring the use of laboratory apparatus to take out reaction, strategic thinking on the element that can react putting them in the selected apparatus, heating if necessary, to have a product. The game allows players to test various reaction between element from different groups, The digital game covered the following topics in chemistry, chemical reaction and balancing of chemical equation, which was adopted by the researcher. The youtube instructional package is a video instruction aim at engaging weak and slow learners for pace learning, the video can be taking back or paused so that the student can get a concept clearly which was adopted from youtubekahn collection

Test Instrument: The instrument used for data collection was Chemistry Achievement Test (CAT) which was adopted from past waec questions. The test items has thirty (20) multiple choice test questions were set on the topic taught with five optional answers (A-E) in which there is only one correct answer.

Test instrument: The Chemistry Achievement Test (CAT) and the Chemistry Interest used was face- validated by two experts, from Federal University of Technology Minna and Government Girls’ Secondary School Minna. Two of them were in science education department and one from chemistry department. The content of each concept was derived from Senior Secondary Education Curriculum Chemistry for SS1-3 (F M E, 2007).

Treatment instrument: Digital Game Instruction (DGI) and Youtube Instructional Package (YIP) were validated by an expert from Federal University of Technology Minna, Department of Educational Technology

To determine the reliability of the test instrument chemistry achievement test (CAT) was pilot- tested on one hundred and forty two SS2 students from the study population. Scores generated from their responses were used to establish the internal consistency of the test items using Cronbach’s Alpha Reliability Coefficient method. Thus an internal consistency estimate of 0.748 was obtain.

Method of Data Collection

An introductory letter seeking for permission to carry out research in the schools sampled will be taken to the school by the researcher, Pre-test will be administered to both groups to determine their entry behavior, and the concept chemical reaction and balancing of chemical reaction will be taught using digital game and youtube instructional package for a period of two weeks. After a period of two weeks, the same test (posttest) will be administered to the same group of learners but the questions will be reshuffled to create an impression to the learners as if different from the ones used in the pretest.

The pretest and posttest scores collected were analyzed using ANCOVA Statistical Package for Social Sciences (SPSS) 20.0.

IV. RESULT AND DISCUSSION

H_{01} . There is no significant difference in the mean scores of students exposed to digital game and youtube instructional strategy and conventional method of chemistry.

To test this hypothesis table 4.1 for the ANCOVA is presented below:

Table 4.1: Summary of $3 \times 3 \times 1$ ANCOVA of a posttest Achievement Scores of Students by gender and treatment

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Intercept	336.191	1	336.191	85.621	.000	.469
Pretest	130.135	1	130.135	34.021	.000	.201
Treatment	160.762	2	80.381	37.513	.022	.973
Gender	6.583	1	6.583	3.093	.217	.601
Treatment * Gender	4.232	2	2.116	.553	.576	.008
Error	1977.210	93	21.260			
Total	19618.00	101				

a. R Squared = .899 (Adjusted R Squared = .891)

Table 4.2 indicated that there is a significant main effect of treatments on student achievement in chemistry [$F_{(1, 93)} = 37.51$, $P(0.02) < 0.05$; $\eta^2 = 0.97$] therefore the null hypothesis is rejected. This implies that there is significant difference in the mean posttest score of student exposed to digital game and

Table 4.3 revealed that student exposed to digital game and youtube learning has the highest posttest mean score of male $x = 13.435$ and the female $x = 12.994$. This implies that male students in DGI and YIP group had the highest contribution to the observed significant difference than the female students.

V. DISCUSSION OF RESULTS

Findings of the study showed that student in the experimental group performed better than the control group. This implies

youtube instructional strategy than conventional method of teaching chemistry

The magnitude of the mean posttest score of student across experimental group and control group is presented in table 4.3

Table 4.2 Estimated marginal mean of student achievement in experimental group

Treatment	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Digital game instruction	13.887 ^a	.263	13.368	14.407
Youtube instruction	14.153 ^a	.304	13.552	14.755
conventional instruction	11.603 ^a	.308	10.994	12.212

a. Covariates appearing in the model are evaluated at the following values: Pretest = 10.2324.

Table 4.3 revealed that student exposed to youtube instructional package and digital game based learning has the highest posttest mean score $x = 14.153$, 13.887 respectively and the control $x = 11.603$. This implies that student in DGI and YIP group had the highest contribution to the observed significant difference followed by the conventional lecture method.

H_{02} . There is no significant difference in the mean achievement scores of male and female exposed to digital game and youtube instructional strategy of teaching chemistry.

Table 4.1 showed that the main effect of treatment on gender is significant [$F_{(1, 93)} = 0.553$, $P(0.217) > 0.05$; $\eta^2 = 0.601$] therefore the null hypothesis is accepted. This implies that gender has no significant effect on student achievement posttest score in chemistry

The magnitude of the mean posttest score of student's gender across experimental group is presented in table 4.4

Table 4.3 Estimated marginal mean of gender on treatment

Gender	Mean	Std. Error	95% Confidence Interval	
			Lower Bound	Upper Bound
Male	13.435 ^a	.225	12.990	13.879
Female	12.994 ^a	.248	12.503	13.486

a. Covariates appearing in the model are evaluated at the following values: Pretest = 10.2324.

that students in the experimental benefitted from the treatment, this may be attributed to the fact that students in both DGI and YIP learn the concept chemical reaction at their own pace, the instruction can be pause or rewind to get a particular concept clearly and student in DGI have the ability to manipulate different element which in turn teach them about element that cannot undergo chemical reaction. This is in agreement with the findings of (Chado 2016 [9] and Wael 2016). This established better performance of student expose to DGI and YIP compare to student using CCI.

The finding of this study showed that the male students performed better than the female student in DGI and YIP group, this implies that male student have high ability to manipulate digital game than the female due to the fact that male students generally are been attached to gadgets which give them an edge over the female student. This is in agreement with the findings of (Chado 2016 [9], Zenbar & Blume, 2009 [39]) which shows that male performed better in mathematics and science tests. Hence, indicating their better mathematical and science ability than the girls. and in disagreement with (Jacob, 2002, in Zenbar & Blume, 2009 [39]). This shows that on average, girls do better in school than boys. Girls get higher grades and complete high school in a higher rate, compared to boys

The major findings

1. There was a significant main effect of treatments on student achievement in chemistry, the digital game and youtube instructional strategy is effective than the conventional method of teaching.
2. There was a significant main effect of gender on student's achievement in chemistry

VI. CONCLUSIONS

In light of the Research discoveries as identified with the speculations formed and tried, the accompanying conclusions were made: Exposing Learners to digital game and youtube instruction enhance easy assimilation and recall of student's memory in chemistry which they did better than those exposed to conventional method. The male student performed better than the female student in digital game and youtube instructional package

VII. RECOMMENDATIONS

In view of the findings of this research work, the accompanying proposals were made for the study:

- Curriculum planners and relevant government agencies should incorporate this approach into secondary school curriculum
- The government should make available necessary gadget to aid teaching and learning

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