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Impact of Flipped Classroom Model Academic Performance among 200 Levels Integrated Science Students in Energy and Matter Concepts in University of Uyo, Uyo Akwa Ibom State, Nigeria

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Abstract
The study investigated the Impact of flipped class room model in the teaching of integrated science among 200 level students at University of Uyo, Uyo, Akwa Ibom State, Nigeria. The research design for the study was quasi experimental control group design. one research question was stated and one null hypothesis was formulated for testing. The population of the study was 230 students; out of which 82 students were selected to participate in the study. They were grouped in two: the experimental group (EG) which comprises of 42 students and the control group (CG) which also comprises of 40 students. The data was collected using a research instrument tagged Prosperities of Energy and Matter Performance Test (POEMAT) with reliability coefficient of 0.78. The sampled students were exposed to the treatment for the period of six weeks those in the experimental group were taught using the flipped class room model while those in the control group were taught using the lecture method of instruction. The data obtained was subjected to t-test statistical analysis at 0.05 level of significance. The findings of the study revealed that, flipped class room model enhances students' academic performance in understanding the energy and properties of matter concepts in integrated science. Some recommendations were made which include: the use of flipped class room model should be encouraged in the teaching and learning of integrated science and other science subjects in tertiary institutions among others.

Keywords: Flipped Classroom Model, Performance, Energy and Properties of Matter.

Introduction

Science educators at all levels of education are still searching for how best to stimulate effective teaching –learning process by the use of appropriate instruction strategy. Etukudo, (2002) advocated for pedagogical and didactical basis that can adequately cater for the changes and demands that have taken place in the field of science-technology and other related disciplines. Kochhar (2007) opined that the best of the curriculum and the most perfect syllabus of any programme or course of study remain dead unless quickened into life by the appropriate instructional strategies and effective, dedicated and competent hands (teachers). Therefore, the goals of any teaching-learning process among others should be for positive result. Therefore, there is need for more students' centred strategies such as video online strategies.

Educational technology has become a fast-growing delivery tool in all educational institutions at all levels with the increased availability of the internet, computers, tablets, smart phones and other education applications. Lemmer (2013) stated that students' today expect more from a class room experience than a passive learning opportunity that consist mostly of one-way communication with limited student interaction. Instead they prefer class room experience that encourage and help them develop knowledge for themselves. The flipped class room responds to the needs of modern learning and provides an effective model of reinvention. The flipped class room according to Bergmann and Sam (2012) is a pedagogical model in which the typical lecture and homework element of a course is reversed, short video lectures are viewed by students at home before the class room session while the in-class time is devoted to exercise projects or discussions. The video lecture is often seen as the keys ingredient in the flipped class room. Such lectures are posted online or selected from an online repository for the students to access while pre-recorded lecture could be in audio format.

In flipped classroom, students use technology at home watch online video lectures, demonstrations and explanations of assignments, while the class time is spent doing what is traditionally called "homework". The teacher is a learning facilitator, able to work one-to-one with students, clarify assignments, engage in discussion or collaborate on project s (Tomlinson, 2016). This teaching approach could be good for teaching science courses like properties of energy and matter.

Properties of Energy and Matter (SED 225) is a 200 level course for integrated science students that requires pre-requisite knowledge in both chemistry and physics. It is a physical science that is designed to cultivate in student's adequate scientific appreciation of the physical and natural concepts in science. The teaching and learning process of the course helps the students to acquire science skills such as observation, classifying, drawing, formulating hypothesis, predicting, designing with control where necessary, reporting results, making conclusions, to mention just a few. The course content include: meaning and measurement of energy, resources of energy, energy of the universe, energy cycle, properties of matter and others.

The course serves as foundation for the understanding of physical concepts in integrated science that is why the course is very important among the science taught, but despite the important position occupied by the course among integrated science courses, it is faced with poor performance amongst the students as reported by science educators and lecturers teaching the course (Muhammad, 2014; Akinoglu & Tandogan 2015; and Sabiru & Muhammad 2015). The students studying the course (SED 225) are from different educational background, those with UTME are admitted into 100 level while those that have undergone Nigeria Certificate in Education and diploma programmes; are admitted through direct entry into 200 level. On this basis, the students came with varied experiences, abilities and learning difficulties. If all students will benefit from an instructional strategy, it must have the capacity to cater for the

individual differences in learning. The flipped classroom model was used to determine the capacity to meet the need of learners with varied abilities. Therefore, the flipped classroom model caters for all categories of students. The learners can play the video as many times as possible for better comprehension which is different from what is obtained in expository approach.

In the traditional lecture method, students often try to capture what is being said at the instant the speaker says it. They cannot stop to reflect upon what is being said and they may miss significant point because they are trying to ascribe the instructor's words (Noel, Daniels & Martins, 2015). By contrasts, the use of video and other pre-recorded media puts lecture under the control of students. They can watch, re-wind, and fast forward as needed. This ability may be of particular values to students. Lectures that can be viewed more than once may also help those for whom English is not their first language (Hansch, Hillers, McChonachie, Newman, & Schimidt, 2015).

Pearson (2013) says that in a flipped learning setting, teachers make lessons available to students to be accessed whenever and where ever it is convenient for the students, at home, in class, on the bus or even from a hospital bed. Teachers can deliver this instruction by recording and narrating screen casts of work they do on their computers, creating videos of themselves teaching or curating video lessons from trusted internet sites. Students watch the video or screen casts as many times as they need to, enabling them to be more productive learners in the classroom. Since direct instruction is delivered outside the group learning space. Teachers can then use in class time to actually engage students in the learning process and provide them with individualized support.

Problem of the Study

Energy and property of matter is a core course for BSc (Ed) Integrated Science students at University of Uyo, Akwa Ibom State, Nigeria. Students learn the chemical electrical and physical properties of matter. Learning the properties is needed to understand most related science concept and it is needed in preparing an effective science lesson. Despite the importance of the course, the performance of students on the course has been reported to be poor. The poor performance may be associated with the non-usage of stimulating and effective teaching strategies as has been the practice with many science teachers. Searching for a more stimulating and effective teaching strategy could improve the poor performance situation especially at the ICT development stage we are in now. The present study in an attempt to contribute towards sourcing for a more stimulating and effective science teaching approach that could enhance students' interest on the subject and better student's performance in science.

Research Question

The study seeks to answer one research question:

1. What is the difference in the academic performance between the students taught energy and properties of matter concepts using the flipped classroom model and those taught the same concepts using the lecture method of instruction?

Null Hypothesis

One hypothesis was formulated and tested at 0.05 level of significance.

H_{01}: There is no significant difference in the mean academic performance scores between students taught energy and properties of matter concept using the flipped classroom model and those taught the same concept using the lecture method of instruction.

Methodology

The design for the study was quasi-experimental specifically nonequivalent control group design. The population of the study comprised of all regular and long vocation term (LVT) integrated science students studying at University of Uyo, Uyo, Akwa Ibom State, Nigeria. University of Uyo has a total of 125 students offering long vocation training for B.Sc Ed Integrated course and therefore the population of 230 students in the regular integrated science programme. A random sampling was used to select 82 200 level integrated science students as subject of study 42 students were from regular while 40 students were from the LVT programme making 82 students. The teams were randomly assigned experimental and control groups respectively.

One instrument named by the researchers as Energy Properties of Matter Performance Test (EPOMAT) was used for data collection. The instrument was on the main theme which is energy and properties of matter with sub-themes such as transport properties, inter atomic potentials, mean free path, ideal and non-ideal gases , equilibrium position, thermal expansion to mention a few. The questions were multiple choice. Four options were presented with only one correct option with the other three as distracters the original questions in the instrument were 30 items submitted to two Senior Lecturers at University of Uyo, Uyo, Akwa Ibom State, Nigeria teaching the course, and another two Lecturers at Federal University of Technology, Ikot Abasi, Akwa Ibom State with the rank of Senior and Chief Lecturer. This was done to determine the content and face validity of the items,. Based on the recommendations and imputes of the validators. The researchers came up with a twenty-five item questions which was administered to the students. The reliability coefficient was found to be 0.78 using a test, retest method after two weeks interval. Before the commencement of the treatment to the treatment to the students, the instruments were pretested on both the students in the experimental and control groups. The students in the experimental group were taught using the flipped class room model where by the concepts taught were recorded in the video while the teacher was teaching the concepts and all the videos were sent to the students in their whatsapp group since all the students in the same course were made to register and log into created

whatsapp group. Only students in the experimental group had the password to log into the pages.

The students were asked to view the videos at their own convenient time while the students in the control group who have no access to whatapp page were taught same concepts using the lecture method of instruction by the researchers. The two groups were taught the same concepts and topics for the period of six weeks after which the items in the instrument used for post-test.

Result

The data collected from the study was analyzed and presented in Table 1 and 2 according to the research question and hypothesis.

Research Question: What is the difference in the performance between the subjects taught energy and properties of matter concepts using the flipped classroom model and those taught the same concepts using the lecture method of instruction?

Table 1: Mean and Standard Deviation of Pre-test and Post-test (POMAT) of Students in Experimental and Control Groups

Teaching Strategies	N	Types of Test	Mean (x)	SD	MD
Experimental group (EG)	42	Pre-test	11.64	3.13	11.01
		Post-test	17.32	6.24	
Control group (CG)	40	Pre-test	5.63	0.03	
		Post-test	6.21	2.16	

Source Data from the field, 2016

The result in Table 1 reveals that the experimental group (EG) has a mean score (x) of 17.32 and a standard deviation (SD) of 2.16. The difference of the experimental and control groups were 3.13 and 0.03 respectively. The answer to research question 1 is that there is a significant difference in the academic performance of the students in the experimental and control groups in favour of the students in the experimental group taught using flipped class room model who have mean scores of 17.32 while the students in the control group taught using the lecture method have scores of 6.21 and the differences in mean post-test scores is 11.01.

Null Hypothesis 1: There is no significant difference in the mean academic performance scores between students taught energy and properties of matter concepts using the flipped class room model and those taught the same concepts using the lecture method of instruction.

Table 2: Mean, Standard Deviation and t-test Comparisons of Energy Properties of Matter Concepts using the Flipped Classroom model and those Taught using the Lecture Method of Instruction.

Teaching Strategies	N	Mean (x)	SD	T	P	Decision
Experimental group (EG)	42	17.32	6.24			
				34.37	0.001	Significant
Control group (CG)	40	6.21	2.16			

Source: Data from the field, 2016
S – significant at P ≥ 0.05.

The results in Table 2 show that the t-values is 34.37 and the p-value if 0.001 which is less than P ≥ 0.05 set for the experiment. This shows that students taught using flipped class room model achieved significantly higher than their counter parts in the control groups. Therefore, the null hypothesis is rejected.

Discussion of Findings

The result in Table 1 provide answer to the research question one. It revealed that there is a significant difference in the performance scores of the students in the experimental and control groups. The results obtained is in line with the findings of Musallam (2010) who conducted a research on flipped learning model to determine the effects of pre-training (receiving instruction prior to in-class instruction) on in-class learning in school chemistry. His study found that students who had studied the materials outside the class room perform better than their counterparts who learn in the classroom. The study is also in line with the study conducted by Marlowe (2012) who investigated the effects of flipped class room and associated differentiation was studied to measure the impact on students' performance and stress level, students watched video lectures outside the class and complete assignment during class period. Students reported lower stress level and displayed positive feelings towards the treatment, and performed better in their performance tests.

Result in Table 2 affirmed that there is a significant high mean performance scores difference between the students in the experimental group taught with flipped classroom model and those taught with the lecture method. The flipped video before a class is termed as the use of advanced organizer proposed by Ausubel. This result is contrary to the findings of Glynn (2013) who conducted a research on the effects of flipped classroom on performance and students' attitude to secondary chemistry in a sub urban high school chemistry course. The results revealed no significant change in performance with only marginal improvement in positive attitude towards chemistry.

The result is in line with the findings of water-parez and Dong (2012) who found out that flipping a di8gital Engineering course at California state university Los Angeles increase professor student interactions and make learning more active. The shift seems to have deepened students understanding and improving their design skill. The educational implication of these findings among others is that the use of lecture method solely does not enhance improved academic performance of integrated science students. There is therefore the need for integrated science teachers to access innovative instructional strategies for effective teaching-learning process at all levels of education.

Conclusion

Integrated science students exposed to flipped class room model reformed better than their counter parts exposed to lecture method of instruction. Therefore, the flipped class room model is viable and has potential to enhance students' academic performance integrated science because it serves as an advance organizer as proposed by Arsubel and an activity kit where learner participates and has options of reviewing treated material. This implies that; effective use of innovative instructional strategies by competent teachers can improve students' academic performance.

Recommendations

Based on the findings of this study the following recommendations were made:

1. The use of flipped classroom model should be encouraged in the teaching and learning of integrated science and other science subjects.
2. The teachers should be encouraged and sponsored by their employers to attend workshops, seminars and conferences regularly to update and upgrade their knowledge on innovation and effective instructional strategies at all levels of education.

References

Akinoglu, O. & Tandogan, R. (2015). The effects of problem – based Active Learning in Science Education on Students' Academic Performance, Attitude and Concept Learning. *Eurasia Journal of mathematics. Science and Technology* 3, 71-81.

Bergmann J. & Sam, A., (2012). How the flipped class room is radically transforming learning. Retrieved on Tuesday, 3, 2013 from http:www. *The daily riff. Com* article how the flipped class room is Radically Transforming Learning. P 5536.

Etukudeo, U. E., (2002). The effects of formula approach on the teaching of simultaneous linear equations. *Journal of Science Teachers Association of Nigeria*, 37(1&2), 44-50.

Glynn, J., (2013). The Effects of flipped class room model on Academic Performance and Students' Attitudein Secondary Chemistry. A master's Thesis Montana State. University Bozeman, Montana.

Kochhar, S. K., (2007). Methods and techniques of teaching: *New Delihi; Sterling publishers Pvt, Ltd*.

Le-mamer, A., (2013). A view from the Flit side: "Invented Class room" to enhance the legal Information literacy of International L.L.M. Students. *Law Library Journal*, 105 (4), 461-491.

Marlowe, C. A., (2012). The effects of the flipped class room on Students Performance and Stress. A master of Science Thesis. Montana State University Bozeman, Montana.

Muhmmad B. A. (2014). Impact of conceptual instructional method on students' academic performance in practical Chemistry among Secondary School Students in Zaria Educational zone, Kaduna State, Nigeria. *Bayyero Journal of Education in Africa* 3 (1), 122-129.

Musallam, R. (2010). The effects of screen casting as a multimedia pre-training tool to manage the intrinsic role of chemical Equilibrium for Advanced High School Chemistry Students' A Doctoral Dissertation, University of Sanfrancisco.

Noel, M. D., Daniels, F. M. & Martins, P. (2015). The future of lecture method as a teaching strategy in community nursing. *Journal of Family Medicine & Community Health* 2 (9) 1067 (1-4).

Pearson & The flipped Learning netrunk (2013). Flipped learning professional development Retrieved on Monday, 16th November, 2015: from *http//www. Pearson school. Com/flippedlearning*.

Sabiru, D. Y. and Muhammad B. A., (2015). Effects of using Ausubel's Theory on Chemistry students' Academic Performance and Wait-time in Chemical Formulae in Secondary Schools in Kastina. *Umar Musa 'Yar adua University Journal of Educational Research*. 5 (1), 23-31.

Tomlinson, C. A. & Tinghe, J. (2006) Integrated differentiated Instructional and Understanding by design. Alexandring Virginia. ASED

Warter-Parez & Dong J., (2012). Flipping the class room. How to embed Inquiry and Design Projects into Digital Engineering lecture. Paper presented at ASCE PSW Conference. California Polytechnics State University, San Luis Obispo.