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Flipped classroom teaching approach on physics education students' academic achievement: A case study of college of education Akwa Ibom state Nigeria

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Abstract
Flipped classroom approach of teaching and learning has finally come to stay as an approach to instructional delivery. Students and teachers communicate through this medium by transmitting the instructional content. This paper presents the results of research studies carried out to determine the effect of flipped classroom teaching approach on physics education students' academic achievement: Implication for pre-service teachers. The study adopted a quasi-experimental research design. The population of the study consisted of all the year 2 physics education students in the college of education Afaha-Nsit Akwa Ibom State which are ninety-eight (98), while the sample was fifty (50). Two objectives, two research questions and two hypotheses guided the study. Mean, standard deviation and Analysis of variance (ANOVA) were the statistical tools used for the study. The findings revealed that there is a significant difference in the academic achievement and retention level of physics education students taught with flipped classroom approach and their counterpart taught with the conventional teaching method. Conclusions and recommendations were also made.

Keywords: flipped classroom, academic achievement and social network

Introduction
The present-day society is driven by science and technology with the aim of improving life for humanities. The educational sector cannot be left out since science and technology are linked to our everyday activities in life. This calls for innovative teaching method like flipped classroom teaching approach which has the potential of affecting learning positively by changing the attitude and perception of students about learning. Bergmann (2012) [3] described learning in the 21st century as a type of learning that focuses on innovative pedagogy which enables learners acquired knowledge by using other pedagogical approaches which increase their higher order thinking, promotes communication, critical thinking and creativity. One of such innovative pedagogy is the flipped classroom which involves the process of learning both within and outside the classroom with the help of internet and mobile devices.

Gustafson and Branch (2002) [9] observed that the use of flipped classroom teaching approach in teaching physics education offers instructors and learners different forms of advantages, for instance, it helps instructors to collect practical data before, during and after instructional delivery. Saxana (2014) [15] emphasis on the impact of flipped classroom instructional strategy on the 21st-century learners as it exposes learners to discovery-based learning and open-ended experimental learning environment since it makes learners to meaningfully engaged in their learning.

Statement of the problem
A careful observation has shown that school curriculum in all areas of specialization is emphasizing that topics should be related to learners' real-life experiences, thereby stressing the inclusion of the International Standard for Teacher Education (ISTE) into classroom teaching and learning. However, the impact of this standard inclusion has not yet been achieved and this could be the major problem faced by learners that leads to their poor academic performance in physics education. This could be as a result of the instructional delivery approach used by the instructors in delivering the instructional content. Therefore, this study seeks to investigate the effect of flipped classroom teaching approach on physics education students' academic performance in the College of Education Afaha Nsit, Akwa Ibom State.

Purpose of the study
This study specifically sought to determine;
1. Determine the performance of physics education students taught with flipped classroom approach and those taught with the conventional teaching approach.
2. Determine the retention level of physics education students taught with flipped classroom approach and their counterpart taught with the conventional teaching approach.

Research Questions
The following research questions guided the study:
1. What is the mean difference in the performance of physics education students taught with flipped classroom approach and those taught with the conventional teaching approach?
2. To what extent does flipped classroom approach enhance the retention level of physics education students?

Research Hypotheses
The following hypotheses were tested for this study:

1. There is no significant difference in the performance of physics education students taught with flipped classroom approach and those taught with the conventional teaching approach.
2. There is no significant difference in the retention level of physics education students taught with flipped classroom approach and those taught with the conventional teaching approach.

Review of Related Literature

This study is anchored on two theories which are; theory of constructivism and theory of retention. Theory of constructivism by Jean Piaget (1975) [13] uphold that learning is an active process in which learners construct new ideas based on the existing knowledge. The constructivist sees learning as the process of filling new information with existing experiences while collaborating with peers in other to create new knowledge. Bruner (1966) [6] emphasis on the understanding of the concepts under study by the learners, that learners need to be active during the learning process and also apply value reasoning in order to gain a deep understanding of the concept. Bruner highlighted three stages of cognitive growth among learners which are not aged specific to be:

- Enactive stage: This stage helps a child to recognize actions that involve motor response.
- Iconic stage: At this stage, a child recognizes the world with images, which is the child uses diagrams and visual images to visualize concepts.
- Symbolic stage: At this stage, a child uses abstract ideas, symbols and language to understand his world. Applying this theory to this study implies that when learners friendly approach is by instructors in delivering learning content, learning becomes student-centred thereby making them becomes knowledge creators instead of depending on the instructors as the only source of knowledge.

Theory of retention of learning was propounded by Atkinson-shiffrin (1968) [1]. The theory opined that human memory consists of three stages which are sensory memory (SM), short-term memory (STM) and long-term memory (LTM). In sensory memory, information can be stored for a very short period of time which prompted a continuous displacement of the previous information for new once to come in. The short-term memory (STM) only hold information for about 10-30 seconds and if the information is not processed into long-term memory the information got lost. While the long-term memory (LTM) holds information permanently with constant practice. Oladele (1998) [12] opined that instructors should encourage learners with practical since continuous input in short-term memory will lead to lost of information. Applying this theory to this study implies that learning should always go with constant rehearsal for effective retention of the concepts taught.

Concept of flipped classroom

Summers and Gosselin (2013) defined flipped classroom as a hybrid approach to learning using technology to move the classroom lectures to homework status and using face-to-face classroom time for interactive learning. Bishop and Verleger (2013) [4] defined flipped classroom as an educational technique that consists of two parts; interactive group learning activities inside the classroom and direct computer-based individual instruction outside the classroom. Stranyer (2007) in a study conducted an experiment on the university students, environment and learning activities. The study was conducted on didactic classroom and flipped classroom. The result revealed that students taught with flipped classroom approach had a higher level of collaboration, creativity and critical thinking ability that the didactic group that only memorized the concepts. Therefore it was concluded that flipped classroom learning approach should be encouraged.

Greg-Green (2014) [8] conducted a study on the effect of flipped classroom approach on English students in Clinton-dele high school U.S.A. The study adopted a quasi-experimental design with a population of seven hundred and thirty-six (736) high school students. a sample of two hundred and forty-nine (249) students was selected for the study. The English class was divided into two groups; one as a control group and the other as an experimental group. After a year course, 19% fail English course in the control group while 50% passed in the experimental group, at the conclusion, the result revealed increment in the in the number of students getting "A" and "B" overall average in the flipped classroom group. Therefor flipped classroom approach was recommended for the course as an approach to learning.

Academic Achievement

Dictionary.com defined academic achievement as students' success in meeting short or long-term goals in education. Michael (2006) opined that academic achievement is the extent to which learners achieved their educational goals during their stay in school. Baker (2000) [2] carried out a study on the impact of the flipped classroom and students' academic achievement in high school class. Sixty-five (65) high school students participated in the study, and quasi-experimental design was used for the study. The result revealed that participant of flipped classroom group had higher scores than their counterpart. Therefore it was recommended that flipped classroom approach should be used as a platform for teaching and learning in the high school.

Social Network

Boyd and Ellyson (2007) [5] defined a social network as an application site that is used for both educational and non-educational purposes to construct profiles through which they can find other users with whom they share a connection for the purpose of learning and sharing information. Rouse (2016) [14] opined that social networking is the practice of expanding the number individuals' business and social contacts by making connections through individuals, often through social media such as WhatsApp, Facebook, Google+, etc. Norm (2012) [11] emphasises the fact that social networking sites help learners get engaged in their learning via online resources to explore the content of their learning so as to improve their level of understanding about a particular concept.

Methodology

The population of this study consisted of all the year two level Physics Education students in the Department of Curriculum and Teaching, College of Education Afaha-Nsit, Akwa Ibom State, who offer the course "Mechanics and properties of matter". They are ninety-eight (98) in number, while the

sample size for the study was fifty (50). The instrument for data collection was Physics Achievement Test (PAT), and the study adopted a quasi-experimental design.

Data Analysis Procedure

Since each research question has a corresponding hypothesis, mean and standard deviation were used in addressing the research questions while Analysis of variance (ANOVA) was used in testing the null hypotheses.

Research Question one

What is the mean difference in the performance of physics education students taught with flipped classroom approach and those taught with the conventional method?

Table 1: Mean and standard deviation of students taught using flipped classroom approach and those taught using the conventional method.

Method	N	Pre-test mean	SD	Post-test mean	SD
Flipped classroom	25	34.50	4.63	78.91	7.90
Conventional approach	25	32.21	4.57	66.21	7.12

The result in table one revealed that students taught with flipped classroom approach had a mean score of 34.50 and a standard deviation of 4.63 during the pre-test, and after the post-test they had a mean score of 78.91 with a standard deviation of 7.90, while students taught using the conventional approach of teaching had a mean score of 32.21 and a standard deviation of 4.57. After the post-test, they had a mean score of 66.21 and a standard deviation of 7.12.

Research Question two

To what extent does flipped classroom approach enhance the retention level of physics education students?

Table 2: Mean and standard deviation of students' retention level of physics education students.

Method	N	Pre-test mean	SD	Post-test mean	SD
Flipped classroom	25	36.32	4.43	81.10	7.84
Conventional approach	25	31.51	3.36	76.00	7.33

The results in table 2 revealed that physics education students taught with flipped classroom approach had a mean score of 36.32 and standard deviation of 4.43 during the pre-test, and in the post-test mean of 81.10 with a standard deviation of 7.84. While those taught with conventional approach during the pre-test had a mean score of 31.51 with a standard deviation of 3.36, during the post-test they had a mean score of 76.00 and a standard deviation of 7.33.

Hypothesis one

There is no significant difference in the performance of physics education students taught with flipped classroom approach and those taught with the conventional approach.

Table 3: ANOVA of differences in academic performance between the flipped classroom and conventional class.

Academic performance	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	44.594	2	13.860	32.527	.000
Within Groups	53.406	96	94		
Total	97.892	98			

Table 2.1 disclosed a significance difference in the academic performance of physics education students taught with flipped classroom approach and those taught with the conventional approach. This is as a result of F1, 96 calculated value of 32.527 greater than the critical value of 2.98. Therefore the null hypothesis was rejected.

Hypothesis Two

There is no significant difference in the retention level of physics education students taught with flipped classroom approach and those taught with the conventional teaching approach.

Table 4: ANOVA of difference in retention between the flipped classroom and conventional approach.

Retention level	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	41.568	2	7.054	44.594	.000
Within Groups	56.432	96	51.192		
Total	98.001	98			

Table 4 revealed a significant difference in the retention level of physics education students using flipped classroom approach and those taught using the conventional approach. This is as a result of F1, 96 calculated value of 44.594 greater than the critical value of 3.26. Therefore the null hypothesis was rejected.

Discussion of finding

From the above analysis, it is clearly seen that flipped classroom approach of teaching has a significant effect on

students' academic performance and retention. Johnathan (2012) observed that flipped classroom approach of teaching improves students' level of understanding, recall and integrate what has been learnt. Kizlik (2014) [10] posit that there is no right method for teaching a particular lesson, therefore the rightness of an instructional approach depends on several factors like age and the developmental level of the learner. Clark (2011) [7] also concord that students who flipped their class lessons performed better than their counterparts in the area of knowledge retention. The researcher also notices that statistically there is a significant difference in the retention level of students who learn with flipped classroom approach and those who learn with the conventional teaching method.

Educational Implications for pre-service teachers

The educational implications of these findings for pre-service teachers are that flipped classroom teaching approach will help both the students and the pre-service teachers to convert and realign into creation and sharing of knowledge within and outside the educational system. It will also reshape the responsibilities of both students and teachers in the process of learning.

Conclusion

Flipped classroom approach has greatly enhanced the teaching profession. From the studies, it is realised that this approach has a significant effect on the academic performance and retention level of learners in the process of their learning.

Recommendation

Based on the findings of this study, the following recommendations were made;

- Facilitators should adopt flipped classroom teaching approach as their teaching approach in this 21st-century learning system.
- The learning environment should be prepared as to meet the 21st-century learning standard for effective learning.
- Stakeholders in education should organize training and re-training programs for both teachers and pre-service teacher.

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