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## **EFFECTS OF A DEVELOPED FLIPPED CLASSROOM PACKAGE ON NCE STUDENTS' ACADEMIC PERFORMANCE IN EDUCATIONAL TECHNOLOGY CONCEPTS IN SOUTHWEST, NIGERIA**

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### ***ABSTRACT***

**Purpose:** This study was carried out in Colleges of Education in South-west, Nigeria to investigate the effects of a developed flipped classroom package on academic performance of NCE students in selected concepts of Educational Technology.

**Methodology:** The study adopted 2 x 2 x 3 factorial matrix quasi-experimental design of pre-test, post-test, non-randomized, non-equivalent control group type. Two hypotheses were raised and tested for the study. Data were analysed using inferential statistics. A sample of three hundred and sixty respondents drawn from twelve government owned colleges of education in south-west, Nigeria participated in the study. The research instruments used were grouped into two, namely, Treatment Instrument (TRI) and Test Instrument (TEI) on Educational Technology. The treatment instrument was the flipped classroom package designed to deliver instruction to students in the experimental group. The Test Instrument was used to determine both pre-test and post-test performance of both groups. Instrument reliability was tested using Cronbach Alpha formula and reliability co-efficient of 0.89 was gotten.

**Findings:** Findings from the study revealed that NCE students performed better when taught using flipped classroom package compared with their counterparts taught with conventional method of teaching and that NCE female students performed better than their male counterparts when taught using flipped classroom package in Educational Technology concepts.

**Unique contribution to theory, practice and policy:** It was, therefore, recommended among others that Educational Technologists should expose NCE students to ICT-Based instructional strategies like Flipped classroom to promote students' autonomy to knowledge acquisition, discovery learning and student-centered instructional approach. Educational Technologists should endeavour to develop and utilize FC for teaching Educational Technology Concepts. This will further increase teachers' knowledge on new innovations in ICT-Based instructional strategies. Teacher trainers should endeavour and be encouraged to use flipped classroom as an instructional delivery method for the improvement of instructional quality that would enhance students' centred learning theory which would promote learning styles, peer assisted, collaborative learning, cooperative learning and problem based learning that will bring about active learning for overall development of the learners. The regulatory agency for colleges of education (National Commission for Colleges of Education) should mandate the management of colleges of education to take cognizance of importance of flipped classroom and put it into use. This study was premised on the students' centred learning theory identified above. This implies that the students' centred learning theory could be applied to similar studies in the future.

**Keywords:** Flipped classroom, Conventional Method, Academic performance and NCE students

## INTRODUCTION

Educational Technology as a course is used to develop students' practical experience on the production of instructional materials which is regarded as one of the basic ingredients of learning. The practical experience will be of assistance to the teachers in training when they proceed on teaching practice and also in their future teaching pursuit. Osuji (2008) noted that during the period of teaching practice, trainee-teachers are provided with the opportunity to engage in profitable experiences under the guidance and supervision of experienced professionals such as the regular teachers of the co-operating schools. The merit in this practice is that trainee teachers are guided and trained to become competent professionals in their chosen career. Teaching practice upgrades trainee-teachers professionally, and prepares them for the effective performance of their functions as classroom teachers.

Teaching practice is an aspect of teacher education that gives teaching an attribute of a profession. Ogonor and Badmus (2006) defined teaching practice as the period when trainee-teachers are aided to put into practice the theories and principles of education which they have learnt in the classroom as they teach students in the schools of practice. Nigeria in her National Policy on Education (FRN, 2013) stressed the need to make education a tool to meet the needs of individual citizens and society at large in consonance with the realities of our immediate environment and modern world. In response to the transformation agenda of the federal government and the widespread criticism that the existing NCE programme is tunnel visioned, National Commission for Colleges of Education (NCCE) has revised and updated the existing NCE minimum standards documents (NCCE, 2012).

Yusuf (2012) regarded the present era as the knowledge age where information is available anytime, anywhere and to whomever has the appropriate medium to access, share or distribute as applicable. This fact cannot be ignored in this part of the world because the development of any nation has been argued to be dependent on its level of educational advancement and as it is today; no country can claim to be educationally advanced except it embraces technology for its educational activities (Olagunju, 2003; Nancy, 2008). Several studies (Lim & Morris, 2009; Şimşek, Özdamar, Uysal, Kabak, Berk, Kılıçer & Çiğdem, 2009; Peşman & Özdemir, 2012) posited that educational technology holds a very important place in the implementation of the theories produced by educational scientists for the betterment of existing condition in educational system. İşman (2003) opined that one of the innovations of technology is the Internet.

However, Yiğit and Özden (1999) and Yusuf (2006) posited that new Internet-based education techniques have removed traditional place and time obstacles and have provided students' access to information through information and communication technology (ICT) tools whenever and wherever they may be. Oshinaike and Adekunmisi (2012) posited that multimedia access to knowledge is one of the possibilities of Information and Communication Technology that has very great impact on learning. The instructional media have emerged in a variety of resources, and equipment, which can be used to support the teachers' efforts in ensuring effective learning by students. It is recognized that conventional media technologies can no longer meet the needs of our teaching and learning processes. As a result, they are being replaced by multimedia technology.

In the past years, students' performance in teaching practice especially in the areas of production and use of instructional materials is nothing to write home about, that is the performance is poor and was attributed to low understanding of contents and concepts of

some major areas of the practical aspect of the noble profession of teaching which as a result has led to various disheartening situations during the teaching practice and in the field of education generally (Ogonor & Badmus, 2006). Poor performance can bring in self-condemnation, which results in lower self-esteem. Performance is needed at all times in our lives.

Freeman (2007) opined that engaging students in active learning enhances their learning outcomes (performance) and improves their motivation and attitudes toward the subject. Developments in active learning pedagogy, coupled with advancements in instructional technology, have prompted some educators to implement a radical, yet intuitive, educational model called the flipped classroom (Bergmann & Sams, 2012; Thompson, 2011).

In the flipped classroom (also known as the reverse, inverse, or backwards classroom), instructors prerecord lectures and post them online for students to watch on their own so that class time can be dedicated to student-centered learning activities, like problem-based learning and inquiry-oriented strategies (Bergmann & Sams, 2012; Thompson, 2011; Lage, Platt & Treglia, 2000; Wood, Jensen, Bezdek & Otto, 2001). Bergmann and Sams (2012) noted that this approach provides instructors with opportunities to engage a wide range of learning styles and implement pedagogies that encourage problem solving during dedicated class time. The flipped classroom is relatively new phenomenon in education particularly in Nigeria. In addition, flipping the classroom empowers instructors to develop different learning experiences appropriate for each student.

Herreid and Schiller (2013) asserted that a flipped classroom engages and focuses students' learning by combining active, student-centered learning with content mastery that can be applied in the real world. Clark (2013) stated that activities with real-world scenarios could be implemented by hands-on and project-based learning activities during class time to enhance students' understanding and comprehension of the content and to encourage them to verbalize their engagement with such activities. Engagement represents the range of action students take to advance from not knowing, not understanding, not having skill, and not achieving to knowing, understanding, having skill, and achieving (Reeve, 2013). Students' behavioural, emotional and cognitive engagement will exist if there is a relationship with the teacher and instructional support during learning activities (Reeve & Tseng, 2011). While agentic engagement is similar to the other three types of engagement, the concept is uniquely proactive and engages the student to take action before the learning activities take place and to create their own instructional cooperation with the teacher's instruction (Reeve, 2013).

The Flipped Classroom Model (FCM) is receiving increased attention in educational circles and popular press. Toppo (2011) and Tucker (2012) posited that in this model, the traditional practice of spending class time engaged in direct instruction and completing content related activities for homework is "flipped", so that students receive initial content instruction at home, and spend class time working with their peers in a collaborative setting. The use of videos or other digital technologies to deliver content outside of class is referred to as flipped classroom (FC). Pink (2010) claimed that the concept of flipped classroom is gaining popularity due to the emphasis on the students becoming agents of their own learning rather than the object of instruction. Hamdan, McKnight; Mcknight and Artfstrom, (2013) opined that the flipped classroom (FC) has just been discovered as one of the instruments that can enable educator to make the shift from teacher-driven instruction to student-centered learning. In light of recent advances in technology as well as students' comfortability with



these technologies as observed by Bergman and Sams (2012), the present researchers are interested in using flipped classroom to teach practical teaching skills such as principles of designing and production of instructional media; operations of hardware or equipment; improvisation of media.

In Nigeria and perhaps in teacher education gender issue in ICT is still very prevalent although findings on this issue is equivocal and was identified as a critical factor that affects teachers' attitude toward computer. Liu (1999) found that females have lower scores on computer technology competencies than males. Chen and Tsai (2005) also found that female teachers had less experience working with computer than their male colleagues. Oakes (2001) showed that there are sex differences in language and in communicative competencies. All these prejudice limit the performance level of women in some courses.

The teaching and learning process has been dramatically altered by the convergence of a variety of technological, instructional, and pedagogical developments in recent times (Marina, 2001 & Smith, 2002). Kageni, Smith and Clint (2010) concurred that technology is challenging the boundaries of the educational structures that have traditionally facilitated and supported learning. Recent advances especially in the area of ICT have heralded the development and implementation of new and innovative teaching strategies. Approaches where ICT is used to support learning have been found to benefit the affective learning domain and student-centred by improving students' engagement to task (Jacobsen, 2001). Gender is a factor in every aspect of formal, non-formal and informal education, and has an impact on all participants: learners, teachers and administrators (Green, 2009). The application of the technology and who uses it make ICT extremely gendered. However, in reality, gender issues are not holistically addressed in the application of ICT (Fontaine, 2000). ICT application and activities in education sector allow social stereotypes and gender inequalities (Markauskaite, 2005). ICT is thus a powerful tool for providing educational services for both males and females and, most importantly, meeting the gender equality goal (Olivia, 2009).

### **Statement of the Problem**

With the importance attached to Educational Technology by National Commission for Colleges of Education (NCCE), it is not a course to toy with by any individual or institution of higher learning that wants to be productive in the 21<sup>st</sup> century. The supervisors' reports from the teaching practice exercises in recent time were bad. The poor performance of NCE students in the teaching practice especially in the production and use of instructional materials, as well as in Educational Technology portends danger for teacher education in Nigeria. The present methods of teaching such as lecture method, discussion methods and so on in Colleges of Education do not motivate students to learn with new technologies, learn faster, retain knowledge and able to learn individually and cooperatively (Mudasiru, 2016), unlike the Flipped classroom model that has these potentials. This study thus set out to fill this gap by investigating the effects of flipped classroom on students' academic performance in educational technology concepts in Colleges of Education in Southwest Nigeria.

### **Research Gap**

Several research studies by different Researchers have been carried out on the usefulness and importance of flipped classroom packages on the academic performance of students at various levels and subjects (Makinde, 2017; Strayer, 2012; Agbatogun, 2010). There appears

to be dearth literature on subjects like mathematics and other science subjects. Also, most of the related studied in literature were carried out on primary and secondary schools, but not on colleges of education which is one of the institutions where the teachers of these primary and secondary schools are produced. Hence the need for this study, to investigate effects of a developed flipped classroom package on NCE students' academic performance in selected educational technology concepts in southwest, Nigeria.

### **Objectives of the Study**

This study investigated the effects of flipped classroom on NCE students' academic performance in educational technology concepts in Southwest, Nigeria. Specifically, the study examined:

1. The effects of flipped classroom model and that of traditional method of teaching on students' academic performance in educational technology in Colleges of Education in Southwest, Nigeria;
2. If gender has influence on academic performance of students when taught with flipped classroom model in Colleges of Education in Southwest, Nigeria; and.

### **Research Hypotheses**

The research hypotheses which were tested in the study are:

H<sub>01</sub>: There is no significant difference in the academic performance of students taught Educational Technology concepts using flipped classroom and those taught using the traditional classroom in Colleges of Education in southwest, Nigeria;

H<sub>02</sub>: There is no significant difference in the academic performance of male and female students taught Educational Technology concepts using flipped classroom in Colleges of Education in southwest, Nigeria.

## **LITERATURE REVIEW**

### **Purposes of Flipped Classroom and Approaches**

Jonathan Bergmann and Aaron Sams used flipped classroom for students who absent from the classroom. Also, Bergmann and Sams (2012) asserted that FC reduced the time the teacher used in teaching while students take notes; class time used for activities and problem-solving not too long time lecture as usual (Acton & Knorr, 2013; Clark, 2013; Tucker 2012). On the other hand, Strayer (2012) stated that studying the material before the class made the students become yawned when judged along with the students in a traditional classroom that received the lesson during the class. Nevertheless, Bishop and Verleger (2013) opined that communicating through online videos much superior to the teacher on stage lecture system. Flumerfelt and Green (2013) also affirmed that by using screencast video technology in flipped classroom, promotes academic performance and improve the behavioural attitude of students which leads to better communication among the teachers and the learners. Sequentially, this created chances for active learning (Leicht, Zappe, Messner, & Litzinger, 2012).

Also, Toppo (2013) added that using flipped classroom will improve students' attitude and achievement. In the FC model, teachers move teaching/learning activities from the large group learning area into personal learning area with the use technologies. Several teachers

flip their classroom through these readily available materials. The screencasts and the online videos are available to access by students wherever, any time it is convenient and as many times as they like. It gives them better preparation for the class (Musallam, 2010).

In Nigeria, a series of related studies have been conducted on how to improve instructional delivery. Most of these studies established that there is a significant effects of flipped classroom and other ICT based instructional delivery methods on students' academic performance at all levels of education (Makinde, 2017; Mudasiru 2017; Strayer, 2012; Agbatogun, 2010). However, most of these studies were conducted at the primary and secondary school levels, non was carried out at colleges of education that are saddled with the responsibility of training teachers especially on educational technology concepts thereby creating gap for looking at the effects of a developed flipped classroom package on NCE students' academic performance in educational technology concepts in southwest, Nigeria.

### **THEORETICAL AND CONCEPTUAL FRAMEWORKS**

Constructivist learning is the idea that learning is based on the construction of abstract concepts in mind to characterise reality (Bruner, 1961; Piaget, 1968). A superficial look into the history of learning theories reveals an ever changing and evolving field (Ford & Lott, 2012). Learning theories are grouped into three categories namely; Cognitive, Behaviourism, and Constructivism. A study by Ebert (2012) confirmed that most happen in today's classroom derive its origin from both the Behaviourist and constructivist theories. Even as constructivism has continued to be the main focus of learning theorists, the tools used in education have also become increasingly powerful. These educational tools as explained by the researchers relate to one another under the umbrellas termed educational technology (Ford & Lott, 2012). According to Jones and Brader-Araje (2002), constructivism can be defined as one's perspective and position.

In addition, Jones and Brader-Araje (2002) presented opinions of several authors on constructivism thus; Knowledge, is in the head of a person, and thinking the subject has no alternative but to build what a person know on the basis of his own understanding (Glaserfeld, 1995). The flipped classroom package (online or offline videos) support the principles of constructivism by releasing class time for inquiry-based (activities) teaching (Brandt, 1997). Researchers have used different models to explain the flipped classroom effects on students' performance in school system (e.g. Clark, 2012; Bergmann & Sams, (2012 & 2012); Strayer, 2012) Behavioural, Emotional and Cognitive engagements from BECA engagement model has been used in many studies regarding evaluation of students' performance in flipped classroom (e.g. Herreid, & Schiler, 2013). The framework for this study rooted from the theories of cognitive conflict and constructivism of Piaget (1968) that led to several students-centred learning theories and methods that identify as the main dependent variable while Ability level and Gender (AG) considered as intervening variables in the FCM. Below is the Conceptual Model for Students' Performance in Flipped Classroom.



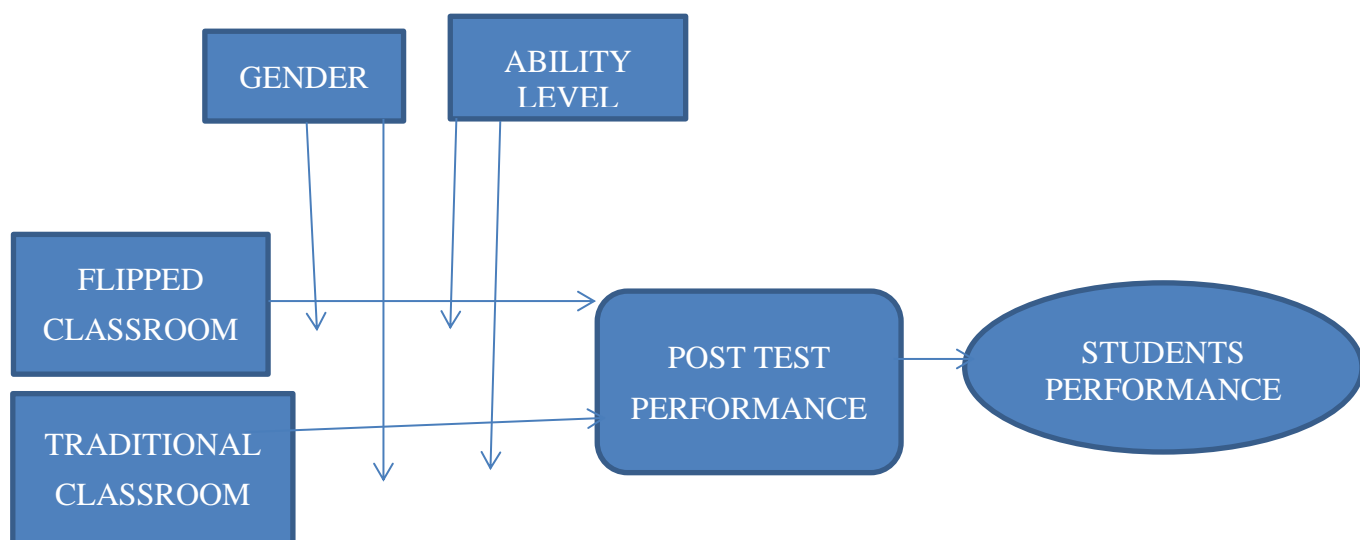


Figure 1. Conceptual Model for NCE Students' Performance in Flipped Classroom.

Source: Researchers-designed conceptual model (Ganiyu & Olasedidun, 2022).

Figure 1 shows the researchers design conceptual framework on flipped classroom (FC) that was implemented to enhance student engagement in an effort to promote academic performance. The FC was used to examine performance of students through the modern technology in education (educational technology) when compared with the traditional classroom (TC). The Engagement on student performance was viewed in the area of gender and level of ability. Likewise, the post-test performance was also assessed in the area of gender and level of ability.

## METHODOLOGY

The study is a quasi-experimental design of pre-test and post-test type. The target population comprised all students in the Colleges of Education in Southwest, Nigeria. The NCE 200 level students were purposively selected for the study because Educational Technology is offered at this level. The researchers used intact classes for the study across the selected institutions. The research instruments that were used in this study were grouped into two namely Treatment Instrument (TRI) and Test Instrument (TEI) on Educational Technology. The treatment instrument was the flipped classroom package that was designed to deliver instruction to students in the experimental group. The Test Instrument was used to determine both pre-test and post-test performance of both the groups. To determine both face and content validity of the instruments, the instruments were validated by three Educational Technology experts and two experts from Measurement and Evaluation. Finally, the reliability of the instruments was determined by administering the instruments on students of Kwara State College of Education, Ilorin, Kwara State, who were not part of the sample of this study. Cronbach alpha was used to determine the reliability of the instrument which yielded 0.89. The researchers and 18 research assistants administered the instruments on the sampled participants. The data were analysed using inferential statistics. Hypothesis one was tested using Analysis of Covariance (ANCOVA) and hypothesis two was tested using T-test.

## RESULTS

**Research Hypothesis 1:** There is no significant difference in the academic performance of students taught Educational Technology concepts using flipped classroom and those taught using the traditional classroom in colleges of Education in Southwest, Nigeria.

**Table 1:** A one-way analysis of covariance (ANCOVA) on the effects of flipped classroom on NCE students' academic performance in Educational Technology concepts.

### Tests of Between-Subjects Effects

### Tests of Between-Subjects Effects

Dependent Variable: Flipped classroom score

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	9202.308 <sup>a</sup>	2	4601.154	115.198	.000	.392
Intercept	10107.175	1	10107.175	253.050	.000	.415
Pre-flipped score	6988.099	1	6988.099	174.959	.000	.329
Gender	677.601	1	677.601	16.965	.000	.045
Error	14259.067	357	39.941			
Total	2077817.000	360				
Corrected Total	23461.375	359				

a. R Squared = .392 (Adjusted R Squared = .389)

A one-way between subjects analysis of covariance (ANCOVA) was carried out to look at the effects of flipped classroom and NCE students' academic performance in Educational Technology concepts. Checks were carried out to confirm homogeneity of regression and linear relationship between covariate (Traditional classroom) and dependent variable (Flipped classroom).

The result on table 1 indicates that the covariate (traditional classroom) has a significant effect on flipped classroom,  $F(1, 357) = 174.96$ ,  $P < .005$ , partial  $\eta^2 = .329$ . This means that students perform better in flipped classroom when compared with traditional classroom.

**Research Hypothesis 2:** There is no significant difference in the academic performance of male and female students taught Educational Technology concepts using flipped classroom in colleges of education.

Table 2 a: student's gender in flipped classroom

### Group Statistics

	Student's gender	N	Mean	Std. Deviation	Std. Error Mean
Flipped classroom score	Male	134	72.32	7.888	.681
	Female	226	77.45	7.593	.505

Table 2 b. T- test on academic performance of male and female students taught educational technology concepts using flipped classroom.

### Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Flipped classroom score	Equal variances assumed	.847	.358	-6.108	358	.000	-5.130	.840	-6.782	-3.479
	Equal variances not assumed			-6.049	270.944	.000	-5.130	.848	-6.800	-3.461

Table 2a and 2b show the result of a two tail independent t-test on academic performance of male and female students taught educational technology concepts using flipped classroom. There was significant difference in scores for males (mean = 72.32, SD = 7.89) and females (mean = 74.45, SD = 7.59);  $t(270.94) = -6.05$ ,  $p < .05$ .

This implies that females' students perform better than their males' counterparts in educational technology concepts while using flipped classroom.

### Discussion of Findings

This study investigated the effects of a developed flipped classroom package on NCE students' academic performance in South-west Nigeria. Findings from the study revealed that NCE students taught using flipped classroom package performed better than students taught using conventional method, this is in accordance with the research findings of Makinde (2017) who summited that students exposed to the flipped classroom performed significantly better than those taught with traditional classroom in Mathematics. The finding also agrees with Strayer (2012) who stated that studying the material before the class made the students become yawned when judged along with the students in a traditional classroom that received the lesson during the class. Therefore, encouragement and enabling environment should be created so that this strategy can see the light of the day.

The effects of flipped classroom package on academic performance of NCE students on selected Educational technology concepts based on their gender examined using research hypothesis 2. The result of the two tails  $t$ -test established significant difference between male and female performance in selected Educational Technology concepts and that NCE female students performed better when taught using FC. This finding on gender influence agreed with findings of Agbatogun (2010) found significant gender variation where males performed better in ICT based learning method. However, Makinde (2017) reported that no significant difference existed in the mean scores performance of male and female students that were

exposed to FC and as well as male and female students that were exposed to TC who had equal performance with those exposed to FC because the result indicates that there was no significant difference in the post-test mean score.

### **Conclusion**

On the basis of the available literature, it is concluded that flipped classroom plays a great role in students' academic performance. Based on the findings, it is noteworthy that there is a significant contribution of gender on flipped classroom as it affects students' academic performance of NCE students especially, on selected educational technology concepts. It was, therefore, concluded that Educational Technologists should expose NCE students to ICT-Based instructional strategies like Flipped classroom to promote students' autonomy to knowledge acquisition, discovery learning and student-centered instructional approach. Educational Technologists should endeavour to develop and utilize FC for teaching other Educational Technology Concepts. This will further increase teachers' knowledge on new innovations in ICT-Based instructional strategies.

### **Recommendations**

Based on the major findings of this study, the following recommendations are made: Educational Technologists should expose NCE students to ICT-Based instructional strategies like Flipped classroom to promote students' autonomy to knowledge acquisition, discovery learning and student-centered instructional approach. Educational Technologists should endeavour to develop and utilize FC for teaching Educational Technology Concepts. This will further increase teachers' knowledge on new innovations in ICT-Based instructional strategies. Finally, government and policy makers in education should endeavour to provide ICT facilities to all COE to promote ICT based teaching\learning among teachers and students

### **REFERENCES**

- Acton, D., & Knorr, E. M. (2013). Different audiences but similar engagement goals: In progress work on two course transformations. Paper presented at WPCPCCE 2013, North Vancouver, Canada.
- Brandt, D. A. (1997). Constructivism: teaching for understanding of the Internet, *Communications of the ACM*, 40(10), 112–117.
- Bergmann, J., & Sams, A. (2012). *Flip your classroom: reach every student in every class every day*. Eugene, OR: International Society for Technology in Education.
- Bishop, J., & Verleger, M. (2013). *The flipped classroom: a survey of the research*. 120th ASEE Annual Conference & Exposition. American Society for Engineering Education. Atlanta.
- Bruner, J. S. (1961). The act of discovery. *Harvard Educational Review*. 31 (1): 21–32
- Clark, K. R. (2013). Examining the effects of the flipped model of instruction on student engagement and performance in the secondary mathematics classroom: An action research study. *Doctoral Dissertation*. Retrieved November 2, 2013, from

<http://search.proquest.com/docview/1437012328/fulltextPDF/142FE33FC477A66BC70/1?accountid=14645>

- Chen, R. S., & Tsai, C. C. (2005). Gender differences in Taiwan university students towards the web-based learning. In Lool. C. K., Jonassen, M., & Ikeda, M.(Eds). *International Conference of Computers in Education, 1 (33)*, 629-632.
- Ebert, A. K. (2012). Behaviourism vs. Constructivism in the Technological Secondary Education Classroom, Theories of Educational Technology, Boise State University. Retrieved July 8, 2013 from <https://sites.google.com/a/boisestate.edu/edtechtheories/behaviorism-vs-constructivism-in-the-technological-secondary-education-classroom-1>
- Federal Republic of Nigeria, (FRN, 2013). *National Policy on Education*. Yaba: Lagos. Revised Edition NERDC Press.
- Flumerfelt, S., & Green, G. (2013). Using lean in the flipped classroom for at risk students. *Educational Technology and Society*, 16(1), 356–366.
- Ford, K., & Lott, L. (2012). The Impact of Technology on Constructivist Pedagogies. Theories of Educational Technology. Boise State University. Retrieved December 10, 2012 from <https://sites.google.com/a/boisestate.edu/edtechtheories/the-impact-of-technology-on-constructivist-pedagogies-1>
- Freeman S, O'Connor E & Parks J. W, et al., (2007). Prescribed active learning increases performance in introductory biology. *CBE Life Sci. Educ.* 6:132–139.
- Glaserfeld, E. V. (1995). Constructivism in Education. The International Encyclopedia of Education. Husen, T. & Postlethwaite, T. N. (eds.), (1), 1-4. Retrieved December 10, 2013 from <http://www.univie.ac.at/constructivism/EvG/papers/114.pdf>
- Hamdan, N., McKnight, P. E., McKnight, K., & Artfstrom, K. M. (2013b). A Review of Flipped Learning. *Flipped Learning Network*. Retrieved from [http://flippedlearning.org/cms/lib07/VA01923112/Centricity/Domain/41/LitReview\\_FlippedLearning.pdf](http://flippedlearning.org/cms/lib07/VA01923112/Centricity/Domain/41/LitReview_FlippedLearning.pdf)
- Herreid, C. F., & Schiller, N. A. (2013). Case study and the flipped classroom. *Journal of College Science Teaching*. 42(5), 62-66.
- İşman, A. (2003). *Öğretim teknolojileri ve materyal geliştirme*, İstanbul: Değişim Yayınları
- Jones, M. G. & Brader-Araje, L. (2002). The Impact of Constructivism on Education: Language, Discourse, and Meaning. *American Communication Journal*, 5 (3). Downloaded August 10, 2021 from <http://acjournal.org/journal/vol5/iss3/special/jones.pdf>
- Lage M. J, Platt G. J & Treglia M, (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *J Econ Educ.* 31:30–43



- Leicht, R. M., Zappe, S. E., Messner, J. I., & Litzinger, T. (2012) Employing the classroom flip to move “lecture” out of the classroom. *Journal of Applications and Practices in Engineering Education*, 3(1), 19-31.
- Lim, D.H. & Morris, M.L. (2009). Learner and instructional factors influencing learning outcomes within a blended learning. *Educational Technology & Society*, 12(4), 282–293.
- Liu, B. (1999). Administrators’ perception of the use of computer in secondary schools administration in Taiwan. *Dissertation Abstracts International*, 50(5), 1161A.
- Makinde, S. O. (2017). Effects of a developed flipped classroom package on senior secondary school students’ performance in mathematics in Lagos, Nigeria. Unpublished Ph.D Thesis, Department of Educational Technology, Faculty of Education, University of Ilorin. Ilorin, Nigeria.
- Mudasiru, R. S. (2017). Colleges of education lecturers’ conceptions and versatility levels in e-learning in Southwest, Nigeria. Unpublished Ph.D Thesis, Department of Educational Technology, Faculty of Education, University of Ilorin. Ilorin, Nigeria.
- Musallam, R., (2010). The effects of screencasting as a multimedia pre-training tool to manage the intrinsic load of chemical equilibrium instruction for advanced high school chemistry students (Doctoral Dissertation, University of San Francisco).
- National Commission for Colleges of Education (2013). *Colleges of Education Minimum Standard of Education Courses*, Abuja.
- Nancy, H. (2008). Enabled Women in Knowledge Societies. Case study: The Philippines and Thailand. *i4d (Information for Development)*, vi (7), pp. 6-8. Retrieved September 12, 2013 from <http://www.ihmsaw.org/resourcefiles/1260067053.pdf>
- Oakes, J. (2001). Opportunities, achievement and choice: women and minority students in Science and Mathematics. *Journal of STAN*, 2001,54.
- Ogonor, B. O. & Badmus, M. M. (2006). Reflective teaching practice among student teachers: the case in a tertiary institution in Nigeria. *Australian Journal of Teacher Education*, 31, (2). 115-126.
- Okafor, F. C. (1988). *Nigerian teacher education: A search for New Direction*. Nigeria: Fourth Dimension publishers
- Olagunju A.M. (2003). An Investigation into Teachers’ Awareness and Extent of Utilization of ICT for Effective Science Education. *Nigerian Journal of Computer Literacy (NJCL)*, 4, 82-101.
- Osuji, S. N. (2008). Teacher education curriculum in Nigeria in the perspective of lifelong education. *The Journal of International Social Research*, 2 (8), 49-59.
- Peşman, H. & Özdemir, Ö.F. (2012). Approach–Method interaction: The role of teaching method on the effect of context-based approach in physics instruction, *International Journal of Science Education (IJSE)* 14 (34), 2127-2145.
- Piaget, J. (1968). *On the development of memory and identity*. Barre, MA: Clark University Press with Barre Publishers.

- Pink, D. (2010). Think tank: Flip-thinking - the new buzz word sweeping the US. The Telegraph. Retrieved from <http://www.telegraph.co.uk/finance/businessclub/7996379/Daniel-Pinks-Think-Tank-Flip-thinking-the-new-buzz-word-sweeping-the-US.html>
- Reeve, J. (2013). How students create motivationally supportive learning environments for themselves: The concept of agentic engagement. *Journal of Educational Psychology*, 105(3), 579–595. doi: 10.1037/a0032690.
- Şimşek, A., Özdamar, N., Uysal, Ö., Kabak, K., Berk, C., Kılıçer, T. & Çiğdem, H. (2009) .İkibinli yıllarda Türkiye'deki eğitim teknolojisi araştırmalarında gözlenen eğilimleri, *Kuramda Uygulamalı Eğitim Bilimleri Dergisi*, 9(2): 941-966.
- Strayer, J. F. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environment Research*, 15, 171–193. doi: 10.1007/s10984-012-9108-4
- Toppo, G. (2011, October 7). Flipped classrooms take advantage of technology. USA Today. Retrieved from <http://usat.ly/pZBzkm>
- Tucker, B. (2012). The flipped classroom: Online instruction at home frees class time for learning. *Education Next*, 12(1). Retrieved from <http://educationnext.org/the-flipped-classroom/#une.edu/pqdweb?did=2530882881&sid=11Fmt=3&clientid=8421&RQT=309&VName=PQD>
- Yigit, Y. & Ozden, M. Y. (1999). Learning the Internet through the Internet: A case study. *Proceedings of WebNet 99 - World Conference on the WWW and Internet*. Charlottesville, VA: Association for the Advancement of Computing in Education, 1635-1636.
- Yusuf, M. O. (2006). Using the Internet for Teaching, Learning and Research in Tertiary Institutions. *The Journal of Nigerian Association of Teachers of Technology, JONNAT*, 6(1), 163 – 171.
- Yusuf, M. O. (2012). Instructional Delivery through Information and Communication Technology Tools: Contextualized Application within Nigerian School System. Conference paper presented at the 33rd Annual Convention and International Conference of Nigeria Association for Educational Media and Technology (October, 2012).