EFFICACY OF FLIPPED CLASSROOM METHOD ON PSYCHOMOTOR SKILLS ACHIEVEMENT OF STUDENTS IN BASIC TECHNOLOGY

By
Oladiran Stephen, OLABIYI
Department of Science and Technology Education, University of Lagos, Akoka
solabiyi@unilag.edu.ng/olabiyidiran@gmail.com

Abstract

The study examined the efficacy of the flipped classroom on psychomotor skills achievement of basic technology students in Nigeria within the blueprint of the pre-test and post-test non-equivalent control group quasi-experimental and survey research design. Four research questions and six null hypotheses guided the study. The experimental group was taught with the flipped classroom while the control group received instruction with the conventional teaching for eight weeks. Two instruments; Basic Technology Psychomotor Achievement Test (BTPAT) with KR-21reliability coefficient of 0.84 and a structured questionnaire on the Likert type was used for data collection. Results showed that a significant difference exists between the psychomotor skills of students taught basic technology using the flipped method. Although, students in the flipped group perform significantly better than students in the conventional group. Also, a significant difference exists between the psychomotor skills of male and female students with male students performed slightly better than female students. Also, the significant difference exists between high, medium and low achievers with high achievers perform better than medium and low achievers. The flipped method makes teaching interesting, easy, and students learn at their own pace, it also gives teacher insights into students learning difficulties. It is thus recommended that the flipped classroom approach should be used by basic technology teachers in Nigeria schools

Key Words: flipped classroom, achievement, basic technology, conventional teaching

Introduction

The most important role of Technical Vocational Education and Training (TVET) is enhancing economic, social and industrial development. It is, therefore, an important approach in preparing human resources within the educational economic system. It is believed that TVET can equip men and women for the job market or self-employment, thereby increasing their self-reliance and self-confidence. TVET is therefore seen as a means to promote human resource development and consequently, can be regarded as a panacea to combat ever-increasing poverty problems in the country. TVET is a form of education that is planned to impart knowledge, skills (competencies), the right attitude, autonomy of identity, perseverance, and character and the work ethic into learners in readiness for work and general employment. This, in turn, leads to productivity, social inclusion and economic development (UNESCO-UNEVOC, 2013) TVET has been found to provide central pedagogical strategies for transmitting inexperienced young people from school-life to realities of working life. TVET is a learner-centered approach to teaching in which the learner and the activities to be learned are the central issues in basic technology.

Basic Technology is one of the pre-vocational subjects within the area of Technical Vocational Education and Training. Basic Technology as stated by the National Policy on Education (FRN, 2013) is one of the compulsory pre-vocational subjects at the Junior Secondary School (JSS) in Nigeria which aimed to prepare students for a future career. It covers counseling on career choices, skills gaining and professional ethics. Therefore, Basic Technology is designed to provide: pre-vocational orientation in technology; basic technological literacy for everyday living and stimulate creativity. In fact, this is the major reason why the Basic Technology curriculum was revised to reflect the national policy orientation

of teaching technology and the world globalization trends in education. The responsibility of every nation and school is to provide opportunities for all to acquire technological literacy and this is in line with the current goals of the National Economic Empowerment and Development Strategies, (NERDC, 2007) (FRN, 2013). The revised Basic Technology Curriculum covers the following themes: You and Technology (ICT inclusive), Safety, Materials, and Processing, Drawing Practice, Tools and Machines, Applied Electricity and Electronics, Energy and Power, Maintenance and Building. The contents under each theme are made to reflect the basic nature of technology; where the knowledge, skills, creativity, and attitude needed by the students are explained in detail.

Academic Achievement is the extent to which a learner is profiting from instructions in a given area of learning i.e., the achievement is reflected by the extent to which skill or knowledge has been imparted to the student. Academic achievement also denotes the knowledge attained and skill developed in the school subject, usually designated by test scores (Karthigeyan & Nirmala, 2012). Students' achievement refers to performance in a school subject as designated by a score or mark obtained in an achievement test. According to Anene (2005) achievement is quantified by a measure of the student's academic standing in relation to those of other students of his age. There has been much concern about the apparent drop in the standard of technical education at the secondary school level in Nigeria. Stakeholders in TVET have always been concerned about the academic achievement of students. Students' achievement level as a cause of differential learning outcomes has attracted the attention of educational researchers and industries. In Nigeria classrooms, students with different achievement levels are mixed together and given the same treatment without considering their individual differences (Yusuf, 2004). Innovative teaching strategies such as virtual classroom that could cater for individual differences and bridge the gap between students' achievement levels should be encouraged. Studies revealed that high ability students do perform better than the medium and lower ability students (Aluko, 2004; Fajola, 2000; Gambari, 2010; Yusuf, 2004.

As new technologies become available, they are often embraced in educational innovation to enhance traditional instruction and in order for teachers to focus on instruction and address all the demands placed upon them in a technologically advanced society, many have turned to alternative approaches to instruction. The flipped classroom approach is one of the most recent and popular technology-infused teachings in which learning new concepts takes place at home while they practice is conducted in the classroom (Unal & Unal, 2017). According to Milman (2012), embedding technology and meeting students on their terms has become a popular way to address all of the challenges and because of that, the flipped classroom has emerged as a method of instruction that is growing in popularity. The flipped classroom is defined by the Flipped Learning Network (2014) as an instructional method that moves direct instruction outside of the classroom in order to make room in the classroom for a more interactive learning environment where students can actively engage in the content. Flipped classrooms refer to the practice of assigning lectures outside of class and devoting class time to a variety of learning activities (Sarah & Matthew, 2016) flipped classroom is characterized by course structure: instructional content e.g., prerecorded class lectures are assigned as homework before coming to class. In-class time is then spent working on problems, advancing concepts, and engaging in collaborative learning (Findlay-Thompson & Mombourquette, 2014).

The flipped classroom is defined as shifting direct learning out of the large group learning space and moving it into the individual learning space, with the help of one of several technologies (Hamdan, McKnight, McNight, & Arfstrom, 2013). The main objective of the flipped classroom approach is to shift the learning of new content and concepts to before class in the form of videos and spending in-class time applying the material through complex problem solving deeper conceptual coverage, and peer interaction (Gajjar, 2013; Gojak, 2012; Sarawagi, 2013; Strayer, 2012; Tucker, 2012). A flipped classroom, therefore, is explained as a method of instruction where the teacher creates a video of the concept or procedure to be introduced and has students view the video at home before class as their homework. In a flipped classroom, students engage with lectures or other materials outside of the class to prepare for an active learning experience in the classroom. Before class time, students are asked to watch short online

lecture videos prepared or selected by their teachers followed by small online activities (a short quiz, online discussion, one-paragraph summary, and concept map, among others). During the class, students are asked to engage in concepts by participating in individual and/or group activities with the guidance of the teacher.

Furthermore, In principle, the in-class time would then be freed up to allow students to engage in tasks that allow for deeper learning around the content in which students can discuss topics with their peers, collaborate around project-based learning activities, or modeling activities while the teacher facilitates the experience (Milman, 2012). Removing the instructional content from in-class time allows the teacher more time for one-on-one engagement with individual students (Roehl, Reddy & Shannon, 2013), also equally important, in the flipped classroom model is student-centered (McLaughlin, Roth, Glatt, Gharkholonarehe, Davidson, Griffin, & Mumper, 2014). That is, students are responsible for watching lectures on their own and coming to class prepared for in-class activities and discussion. One of the most common means of moving instruction outside the classroom in a flipped classroom format has been to require students to watch prerecorded video lectures or screencasts prior to attending class (Abeysekera & Dawson 2015) Because the lecture is such a large portion of a class even within the flipped classroom, it seems reasonable to examine whether prerecorded lectures have any impact, deleterious or positive, on learning.

What is interesting about the flipped classroom to instruction for technical teachers is the instructional time gained within the scheduled class time (Brunsell & Horejsi, 2013). By using the flipped classroom instructional, teachers are able to use class time to develop understanding in students. They are able to present students with more meaningful tasks that develop problem-solving skills. Students are then able to collaborate, justify, and defend their processes while the teacher facilitates and guides them. Students are able to walk away from the experience more engaged in their own learning and with the ability to analyze new situations by thinking critically about technology concepts and ideas (Brunsell & Horejsi, 2013). The benefits of the flipped classroom according to Unal & Unal (2017) include the following: (i) students move at their own pace, (ii) doing homework in class gives teachers better insight into student difficulties and learning styles, (iii) teachers can more easily customize and update the curriculum and provide it to students 24/7, (iv) classroom time can be used more effectively and creatively, (v) teachers using the method report seeing increased levels of student achievement, interest, and engagement, (vi) learning theory supports the new approaches, and (vii) the use of technology is flexible and appropriate for 21st-century learning.

Gender has been identified as one of the factors influencing student's psychomotor achievement in vocational education (Howden, 1998) and the issue of gender has assumed prominence in TVET discourse. Gender is a sense of awareness of being male or female. It is a behavioral pattern and attitude perceived as masculine or famine within culture (Coleman, 2002) Howden (1998) remarked that disparities exist between male and female student's performance in technical vocational education, hence an attempt was made to understand how the flipped method of classroom instruction can lead to improved student psychomotor achievement and creativity in basic technology subject and improve student perceptions about technical subjects in order to encourage course consumption in the future.

Statement of the Problem

Technical vocational education and training in Nigeria have come under scrutiny in recent years due to the low psychomotor achievement of students as observed by various examination bodies. Available reports from chief examiners of Junior WAEC organized by the National Examination Council (NECO) and Basic Education Certificate Examination (BECE) in their appraisal report attest to the poor performance among basic technology students. National data released by junior examination certificate showed that 66% of all junior secondary school students that took the junior WAEC exam perform below the benchmark with a score of 50. Based on this data, 66% of all junior school students that took the exam in 2012 were underprepared to take science and technical subjects at senior secondary school, which will lead to low enrolment in science and engineering courses in tertiary institutions.

The National Examination Council (NECO) has blamed the poor performance of basic technology students in Nigeria on old-fashioned approaches to the teaching of the subject. As an attempt to part ways with the old fashioned methods, the stakeholder has recommended more stimulating, problem based innovative teaching strategies. Yet, there is evidence as confirmed by Omeje (2002) that a large number of basic technology teachers still teach conventionally. It does appear as if these innovative approaches have not been sufficiently portrayed as an effective alternative to the conventional method, both for achieving better learning psychomotor skills, creativity in basic technology and sustaining students' interest in the subject. Therefore, the problem of this study posed as a question is: How would the use of flipped classroom approach can lead to improved student psychomotor achievement, creativity in basic technology and sustain students' interest in technology and engineering courses.

Purpose of the Study

The purpose of the study is to determine the efficacy of flipped classroom on students' psychomotor achievement and creativity in basic technology. Specifically,

1. It determined the effectiveness of the flipped classroom approach on psychomotor achievement and creativity of students;
2. compared the academic achievement of male and female students in Basic Technology; and
3. examined the difference in the mean achievement scores of high, medium and low achiever students in Basic Technology using flipped classroom and conventional teaching approach.

Research Questions

1. What is the difference in the mean achievement scores of students taught Basic Technology with Flipped Classroom Approach and those taught with Conventional Teaching Approach?
2. Is there any difference in the mean achievement scores of Male and Female students in Basic Technology?
3. Is there any difference in the mean achievement scores of high, medium and low achiever students using the Flipped Classroom Approach and Conventional Teaching Approach?

Research Hypotheses

1. There is no significant difference in the mean achievement scores of students taught Basic Technology with the Flipped Classroom and Conventional Teaching Method.
2. There is no significant difference in the mean achievement scores of Male and Female students in Basic Technology.
3. There is no significant difference in the mean achievement scores of high, medium and low achiever students using the Flipped Classroom and Conventional Teaching Method.
4. There is no significant interaction effect of treatment and ability level on students' psychomotor skill achievement in basic technology.
5. There is no significant interaction effect of gender and ability level on students' psychomotor skill achievement in basic technology.
6. There is no significant interaction effect of treatment, gender and ability level on students' psychomotor skill achievement in basic technology.

Methodology

The study adopted a pre-test, post-test, non-equivalent control group quasi-experimental design using a non-randomized, non-equivalent, pretest, posttest experimental research design. Quasi-experimental is an experiment where the randomization of subject and control groups is not possible (Nworgu, 2006). The researcher randomly assigned the intact class to the experimental and control group. This was necessary in order not to disrupt the normal classes of students and time table. Two levels of independent primary variables (experimental and control groups), two levels of gender (male and female)

and three levels of academic achievement (high, medium and low) were investigated on students' performance in basic technology. The survey research design was also used to determine students' perceptions of the flipped classroom. The research design layout is as shown in Table 1.

Table 1.
Research Design Layout

Groups	Pre-test	Treatment	Post-test
Experimental	O1	Flipped Classroom	O2
Control	O3	Conventional	O4

Two schools in Educational Districts four of Lagos State was used for the study. The schools were sampled based on (facilities and manpower), school type (private schools), gender composition (co-educational schools). The two schools were randomly assigned to the experimental group (flipped classroom) and control group (conventional teaching) respectively. Intact classes of the students classified into gender (males and females) and achievement levels (high, medium and low) were used. Both the pre-test and post-test were administered under similar conditioned to both the experimental and control groups. The distribution of the sample for the study is shown in Table 2.

Table 2.
Distribution of Sample for the Study

Groups	Gender		Achievement Levels		
	Male	Female	High	Medium	Low
Flipped Classroom	39	28	17	42	08
Conventional Teaching	33	30	14	37	12

From Table 2, the groups comprised a total of 130 students, 67 students were exposed to the Flipped Classroom (Experimental Group), 63 students were exposed to the Conventional Teaching Method as a delivery medium (Control group). 72 males and 58 females. Students were stratified into academic levels (high, medium and low) based on their performance in the last promotion examination in a basic technology subject. The high-level students, in this study, we're the ones whose average scores in previous school examinations in basic technology fall within the upper 75% above. The medium achievement level students' scores were within the middle 50% above, while students whose scores fall within the lower 25% were classified as students in low achievement levels.

Research Instruments

The instrument for determining psychomotor achievement was the basic technology psychomotor achievement test (BTPAT). BTPAT, which was used to test the psychomotor achievement of students, was developed by the researcher. The BTPAT consists of two sections. Section 1 consists of students' Biodata**,** this includes the name of school, class, sex, the stratum of the student. Section 2 of BTPAT was used as pretest and posttest consist of 50 multiple choice items with option A to D selected from past junior secondary school examination (JSSE) question papers in Basic Technology and covered topics related to tools, machines, process, pictorial drawing, and orthographic projection as contained in the junior secondary school year three syllabus. These topics were chosen because students performed poorly in junior secondary school certificate examination in Nigeria. The initial 50 items of BTPAT were subjected to content and face validation by two lecturers from Science and Technology Education Department, Technology subject teachers; and test and measurement specialists from Educational Foundation Department, University of Lagos, Akoka, Lagos.

The validation entailed checking the BTPAT items against the topics and content of the lesson plan, language editing and appropriateness of tests to target participants. Ten items were removed based

on experts' recommendation and the face validated BTPAT was tested for difficulty index and discrimination power. Items with difficulty power 0.4-0.6, discrimination power of 0.2 and above, and distractor index of negative was retained (Akinsola & Awofala, 2009) based on this, five items were removed leaving the final 40 items for the BTPAT which was piloted at Federal Government College, Ijanikin, Lagos. The reliability coefficient of BTDAT was to be 0.84 using Kuder Richardson (KR-21) each item on BTPAT was scored 2 marks, thus a total score of 80 marks was obtainable.

Procedure

The researchers prepare two (2) sets of lesson plans for the teaching of the topics set out for the study. These lesson plans were prepared from the units in the test blueprint. Each set contains eight (8) lesson plans that lasted for eight weeks and for eighty minutes duration. One set of lesson plans was written based on the flipped classroom and the subject teacher in the experimental group applied this lesson plan at different stages of the instructional process, while the second set was prepared based on the conventional method in teaching basic technology. One week intensive training program was organized for the teachers of the experimental group that were involved in the study. The conduct of the study took place during the normal school lesson periods.

On the first day, before the lesson commenced, BTPAT was administered as a pretest to both the experimental and control group after, which proper teaching commenced by using the prepared lesson plans. The experimental group was taught with flipped classroom lesson plans, while the control group was taught with conventional teaching lesson plans. Each lesson lasted for eight minutes and treatment lasted for 8 weeks. At the end of the treatment, the re-ordered BTPAT was administered on both as a posttest. In order to prevent the hallo effect which might result from over-familiarity with the pretest? The scores obtained from both groups were compared to determine the efficacy of the teaching method that was used in the study.

In the experimental group, 67 students were exposed to the use of a flipped lesson, the lesson planning process involves getting the package ready. The researcher starts with the objective, by breaking it into lessons that students need to be able to see. Usually, the first two lessons are really very basic and a review of something that they should know from the previous lesson. From there, the teacher breaks that objective apart so that they cover each of the lessons knowing that is a lot to facilitate in between. Then from there, a day to two days before every lesson researcher makes sure that the presentation is ready. The teacher makes different slides that can be run through and which more just helps the teacher stay organized and gives the students a visual to have at the front of the room. The instructional strategies with the flipped classroom and putting the lessons on videos have the option to pause and rewind and replay it.

Flipped lessons were delivered after creating eight-week lesson plans (unit), Researchers created content videos with different methods depending on the lesson content of their traditional lectures using presentation software (PowerPoint & Keynote) to present lesson content with teacher commentary. Also, researchers selected screen capture software (Screencast & Matic) to record their computer screens accompanied by teacher voice commentary. They used standard video cameras (camcorder) to record themselves teaching the lesson content in front of a whiteboard. The length of the videos varied from 25 to 40 minutes. After the videos were created, they were uploaded into the classroom websites (Moodle Learning Management System) and allowing students to view them at home in place of homework. Students then are able to come into class with prior knowledge of the new learning and are able to interact with more authentic tasks and problems then they might otherwise be able to do at home on their own.

The control group consisted of 63 students who were taught using conventional teaching, in this method, the teacher presented information on the selected topics to the whole class while learners listened and carry out the necessary task and assignment at the end of each lesson. The topics taught in the experimental and control group lasted for eight weeks.

Table 3:
Test Item Specifications in Basic Technology

S/No	Topics	Level of Cognitive Domain			Total
		Knowledge	Comprehension	Application	
1	Use and maintenance of hand tools	2	2	2	6
2	Machines	2	2	2	6
3	Pictorial drawing	2	2	2	6
4	Orthographic drawing	2	2	2	6
5	Construction of simple project	2	2	2	6
	Total	10	10	10	30

Data Analysis Technique

Data collected were analyzed using appropriate descriptive and inferential statistics of the statistical package for social sciences (SPSS) program. In testing for possible post-experimental differences in achievement and male and female students, the analysis of covariance (ANCOVA) was used and the hypothesis was tested at 0.5%level of significance.

Results

Research Question 1:
What is the difference in the mean achievement scores of students taught Basic Technology with Flipped Classroom and those taught with the Conventional Teaching method?

Table 4:
Result of statistical analysis of pre-treatment and post-treatment achievement scores based on instructional approach experimental (Flipped Classroom) and control (Conventional)

Instructional Approach	**Pre-Test**		**Post-Test**			**Mean Difference**
	Mean	**SD**	**Mean**	**SD**	**N**	
Flipped Classroom	8.655	1.646	13.155	2.224	67	4.50
Conventional Teaching	8.184	1.639	9.658	1.847	63	1.47

The results in table 4 above show that the experimental group taught Basic Technology with Flipped Classroom had a mean score of 8.655 (SD=1.646) in the pre-test and a mean score of 13.155 (SD=2.224) in the post-test making a pre-test, post-test mean difference of 4.50. Meanwhile, the control group taught Basic Technology with Conventional Teaching had a mean score of 8.184 (SD=1.639) in the pre-test and a mean score of 9.658 (SD=1.847) in the post-test making a pre-test, post-test mean difference of 1.47. This shows that students in the experimental group taught Basic Technology with Flipped Classroom perform better than the students in the control group taught Basic Technology using conventional. Hence, the Flipped Classroom method is more effective when compared with the conventional teaching method.

Research Question 2:
Is there any difference in the mean achievement scores of male and female students in Basic Technology?

Table 5:
Results of statistical analysis of pre-treatment and post-treatment achievement scores based on gender

Gender	Pre-Test		Post-Test			Mean Difference
	Mean	SD	Mean	SD	N	
Male	8.437	2.558	11.613	2.141	72	3.18
Female	8.425	2.807	11.375	2.316	58	2.95

The results in table 5 show that male students had a mean score of 8.437 (SD=2.558) in the pre-test and a mean score of 11.613(SD=2.141) in the post-test making a pre-test, post-test mean difference of 3.18. Meanwhile, the female students had a mean score of 8.425 (SD=2.807) in the pre-test and a mean score of 11.375 (SD=2.316) in the post-test making a pre-test, post-test mean difference of 2.95. This shows that both groups benefited from the treatment, with male students slightly performed better than female students.

Research Question Three: Is there any difference in the mean achievement scores of high, medium and low achiever students using the Flipped Classroom and Conventional Teaching Method?

Table 6:
Results of statistical analysis of pre-treatment and post-treatment achievement scores based on high, medium and low achievers in the flipped group and conventional group

Levels	Pre-Test		Post-Test			Mean
	Mean	SD	Mean	SD	N	Difference
High	9..744	1.208	13.385	2.301	31	3.641
Medium	7.978	1.474	11.032	2.339	81	3.054
Low	8.111	1.847	10.370	3.027	18	2.259

Table 6 showed that high, medium and low achievers benefited from the treatment. However, there was the difference in their mean scores, High Achievers students taught Basic Technology had a mean score of 9.744 (SD=1.208) in the pre-test and a mean score of 13.385 (SD=2.301) in the post-test making a pre-test, post-test mean difference of 3.641. Meanwhile, Medium Achievers students had a mean score of 7.978 (SD=1.474) in the pre-test and a mean score of 11.032 (SD=2.339) in the post-test making a pre-test, post-test mean difference of 3.054, and Low Achievers` student had a mean score of 8.111 (SD=1.847) in the pre-test and a mean score of 10.370 (SD=3.027) in the post-test making a pre-test, post-test mean difference of 2.259. This implies that all the groups benefited from the treatment, with high achievers having better mean gain scores than medium and low achievers.

Table 7 below answered hypotheses 1 to 3

Table 7:
Result of statistical analysis of pre-treatment and post-treatment achievement scores based on instructional approach Experimental (Flipped Classroom) and control (Conventional) Groups

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	768.662[a]	12	64.055	25.222	.000	.673
Intercept	166.196	1	166.196	65.440	.000	.308
Pretest	122.307	1	122.307	48.158	.000	.247
Method	270.006	1	270.006	106.315	.000	.420
Gender	.019	1	.019	.007	.932	.000
Levels	24.724	2	12.362	4.868	.009	.062
method * gender	7.073	1	7.073	2.785	.097	.019
method * levels	2.793	2	1.397	.550	.578	.007
gender * levels	1.607	2	.803	.316	.729	.004
method * gender * levels	5.723	2	2.862	1.127	.327	.015
Error	373.332	147	2.540			
Total	22279.000	160				
Corrected Total	1141.994	159				

a. R Squared = .673 (Adjusted R Squared = .646)

Research Hypothesis 1 (H_{O1}):
There is no significant difference in the mean achievement scores of students taught Basic Technology with Flipped Classroom and those taught with Conventional Method

Analysis of post-treatment achievement scores of the students in the experimental and control groups using the Analysis of Covariance as contained in table 7 above shows that an F (1, 159) =106.32, $p < .05$ for the main effect (treatment) was significant, this indicates that the method of instruction produced a significant effect on the achievement scores of students when covariate effect (pre-test) was controlled. The result indicates that there was a significant difference between students exposed to the flipped classroom than those exposed to conventional teaching method

Research Hypothesis 2 (H_{O2}):
There is no significant difference in the mean achievement scores of male and female students in Basic Technology.

Results of statistical analysis of pre-treatment and post-treatment achievement scores based on gender are presented in Table 7 above. The analysis of post-treatment of male and female students taught Basic Technology using Analysis of Covariance as contained in Table 7 above shows the difference in means between the two groups was statistically not significant (F (1, 159) = 0.007, p=.932,) hence it was concluded that there was no significant difference in the achievement of male and female students in Basic Technology. Hypothesis two is therefore accepted.

Research Hypothesis 3 (H_{O3}):
There is no significant difference in the mean achievement scores of high, medium and low achiever students using the Flipped Classroom and Conventional Teaching Method.

A result of the statistical analysis of pre-treatment and post-treatment achievement scores based on the achievement level of the student is presented in Table 7 above. The analysis of post-treatment of high, medium and low levels of students achievement taught Basic Technology using Analysis of Covariance as contained in Table 7 above shows the difference in means between the three levels was statistically not significant (F (2, 159) = .550, p=.578,) hence it was concluded that there was no significant difference in the ability levels in Basic Technology. Hypothesis three is therefore not rejected.

Research Hypothesis 4 (H_{O4})
There is no significant interaction effect of treatment and ability level on students' psychomotor skill achievement in basic technology.

Analysis of post-treatment of high, medium and low achievers students taught basic technology using the Analysis of Covariance as contained in Table 7 above shows that the main effect of treatment on achievers level indicates that F (2, 159) = .550, p = .578 for the main effect was not significant at 0.05 level. This indicates that there was no significant difference in the post-test mean scores of the high, medium and low achievers. This implies that the use of the flipped classroom approach was not influenced by the ability level of the students.

Research Hypothesis 5 (H_{O5}):
There is no significant interaction effect of gender and ability level on students' psychomotor skill achievement in basic technology.

The analysis of the post-treatment achievement of students by gender and ability levels using the Analysis of Covariance as contained in table 7 shows that the interaction effect of treatment and ability levels was statistically not significant F (2, 159)= .0.316, P=.729. Thus it was concluded that there was no interaction effect of gender and ability of students in basic technology.

Research Hypothesis 6 (H_{O6}):
There is no significant interaction effect of treatment, gender and ability level on students' psychomotor skill achievement in basic technology.

The result of analysis of the post-treatment achievement of students by method, gender and ability levels using the Analysis of Covariance as contained in table 4b shows that the interaction effect of treatment method, gender, and ability levels was statistically not significant F (2, 159)= 1..316, P=.327. Thus it was concluded that there was no interaction effect of the method, gender, and ability of students in basic technology.

Discussion

The result presented in table 4a&b showed a significant main effect on students' achievement in basic technology. the result indicates that students' achievement in basic technology was greatly improved when they taught with a flipped-classroom than when they taught with conventional teaching. This finding is supported earlier findings (Abeysekera & Dawson, 2015)) which associated improved content learning and achievement of the learner to learner-center teaching strategies. The conventional teaching approach has not only been condemned for underscoring teacher activities at the expense of students' participation. (Gambari, Balogun, & Alfa, 2014) and (Awofala, Arigbabu & Awofala, 2013) but it could have a damaging influence on students' achievement in basic technology. The flipped classroom method was found to be more effective in promoting and increasing students' achievement in basic technology than conventional teaching in the study because flipped classroom frees up instructional time traditionally spent on passive instructional techniques and makes room for more authentic, modeling, and project-based learning experiences (Strayer, 2007; Tucker, 2012) which added to the achievement in basic

technology. This supports the assertion of Salvin (1995) regarding the effectiveness of the incentive and task structure associated with the flipped classroom. The similar studies have associated the effectiveness of flipped classroom to the opportunities it gives students to discuss, solves problems, create solutions, provide ideas, helps each other and improves achievement and perception (Awofala, Arigbabu & Awofala, 2013)

The significant effect of gender on student achievement in basic technology as indicated in Table 5a&b was in agreement with the work of researchers who believe that gender stereotyping is still dominant in the Nigerian educational system. (Awofala 2010, Awofala 2008). The gender-based difference is due to the individual's perception of owns ability and sex-role stereotyping (Schiefele & Csikszentmihalyli 1995). The result of the present study suggested the non-existence of differential existence between boys and girls within and outside might and gender difference in basic technology achievement might disappearing. The present study result implied that the flipped classroom could be used to advance learning and close gender disparity in learning in basic technology. Thus, this learning method could be used to captivate the attention of the students. It can also be attributed to the fact that this method implores the use of various stimuli (images, sounds, and movement) and address the needs of diverse types of learning (visual, psychomotor, and affective).

Analysis of levels of achievement results contained in Table 6a&b showed a significant effect of treatment on students' level of ability in basic technology. The results of hypothesis three reveal that there is a significant difference in the mean achievements in favor of high achievers taught basic technology with the Flipped Classroom. This result agrees with the findings of Aluko (2004) in chemistry, Fajola (2000) in biology, Gambari (2010) in physics and Yusuf (2004) in social studies which revealed that high ability students do perform better than the medium and lower ability students. The flipped classroom is student-centered (McLaughlin et al. 2014). That is, students are responsible for watching lectures on their own and coming to class prepared for in-class activities and discussion.

The majority of students agreed that the flipped classroom was a valuable learning experience in general, and they perceived the flipped materials adequate to achieve the learning goals. Furthermore, the results suggest that a flipped learning method fostered students' participation more effectively than conventional teaching. With regard to the perception, this research reveals that the flipped-classroom methodology had a significant influence on students' perceptions toward the basic technology.

Conclusion

The study was designed to examine the efficacy of the flipped classroom on psychomotor skills achievement and perception of students in basic technology. It also examines the influence of gender and levels of achievement as moderator variables on the dependent measure. The study found that the flipped classroom was very effective in enhancing students' achievement in basic technology than conventional teaching. Gender is not a factor in students' achievement as shown in the study, putting succinctly, irrespective of the nature of gender students will record improve achievement in basic technology when a flipped classroom is employed in teaching basic technology. Also, the level of achievement was also improving with the use of a flipped-classroom method, both high, medium and low achievers benefited from the use of the flipped approach. The result indicates that flipped is a workable alternative to the use of a conventional method in teaching basic technology in Nigerian junior secondary schools. It is believed that if the flipped classroom is well utilized in teaching basic technology in junior secondary schools, students will develop the required psychomotor skill and creativity as outline in basic technology objectives and further empower students to further their careers in engineering and applied for sciences program.

Recommendations

Based on the result of the study, the following recommendations were made:

1. Basic technology teachers should be motivated to make use of the flipped classroom in their teaching as the method will empower teachers to cater for diverse students in the classroom and ultimately developing the psychomotor skills and creativity in students

2. The government through the ministry of education and technical education board should support basic technology teachers by organizing training and seminars for teachers on how best to make use of a flipped classroom method and ensure a conducive learning environment.
3. Basic technology teachers should be encouraged in Nigerian schools especially for teaching technological-based and other practical oriented courses. This could be achieved if the government and other TVET stakeholders could provide adequate infrastructure and training of teachers on its usage

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