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EFFECT OF FLIP TEACHING APPROACH ON COLLEGE OF EDUCATION STUDENTS' INTEREST AND ACHIEVEMENT IN ORDINARY DIFFERENTIAL EQUATION IN SOUTH-SOUTH GEO-POLITICAL ZONE, NIGERIA.

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Abstract

The study investigated the effect of flip teaching approach on College of Education students' interest and achievement in Ordinary Differential Equation (ODE) in South-South Geo-Political Zone, Nigeria. The study used a pretest-posttest non-equivalent group quasi-experimental design, wherein two research questions and two hypotheses addressed the design. Purposive sampling was used to choose 78 NCE III students from two intact and control classes. The ODE Interest Scale (ODEIS) and ODE Achievement Test (ODEAT), whose reliability indices were determined using Cronbach Alpha and Kuder-Richardson-20 techniques, were used to collect the data. The mean as well as the standard deviation were used to examine the data, and ANCOVA was used to test the hypotheses at the.05 level of significance. The findings demonstrated that, in comparison to standard teaching methods, the flip teaching technique had a considerably positive impact on students' interest in and achievement in ordinary differential equations. Therefore, it was suggested that ordinary differential equations be taught and learnt in colleges of education using the flip teaching approach.

Keywords: Flip teaching approach, Interest, Achievement, Ordinary Differential Equation

Introduction

Differential equations are studied by mathematicians from several angles, with the solution that is, the set of functions that solves the equation getting much of their attention. The only differential equations whose solutions may be found without first figuring out exactly how they work. Research on differential equations is conducted in several fields, including engineering, physics, meteorology, and applied and pure mathematics. These professions are

all concerned with the characteristics of distinct differential equations. Pure mathematics stresses the existence and uniqueness of the solution, whereas practical mathematics stresses the in-depth explanation of the techniques for approximating solutions. Differential equations can be used to represent almost any physical, technical, or biological process, including information transfer between neurones, bridge design, and celestial motion. Due to the absence of a closed-form solution, differential equations, like the ones used to solve real-world issues, might not necessarily be resolved immediately.

A differential equation, according to Wilsky (2013), is a mathematical formula that connects the value of an unknown function of one or more variables with derivatives of different orders. Differential equations are vital in many fields, such as engineering, physics, economics, and others. In many branches of science and technology, a differential equation arises whenever a deterministic relation between some continuously fluctuating values (modelled by functions) and their rates of change in space and/or time (expressed as derivatives) is known or envisioned. Calculating the speed of a ball falling through the air while accounting for gravity and air resistance is another use for differential equation modelling. The widespread use of differential equations in pure and practical mathematics, physics, meteorology, and engineering is the main focus of the characteristics of differential equations of diverse types (ordinary, partial, linear, and non-linear differential equations). Calculating the speed of a ball falling through the air while accounting for gravity and air resistance is another use for differential equation modelling. Since ordinary differential equations are the basis for all other kinds of differential equations, they will be the subject of this study.

An Ordinary Differential Equation, or ODE for short, is a mathematical equation that has one independent variable and its derivative. One independent variable serving as the unknown function in an ordinary differential equation is referred to as the dependent variables. An ordinary differential equation, as defined by Dass (2013), is a differential equation including derivatives with respect to a single independent variable. There are numerous first and second order generic forms in which an ODE can arise. The derivatives are traditional because partial derivatives are only applicable to functions of many independent variables. The main causes of ODE's complexity are the numerous forms it can take and the ways it can be coupled.

Understanding the application of ODE is essential for learning how to solve partial differential equations. Shows the trajectory of a projectile shot from a cannon. In both mathematics and research (social and scientific), differentials and derivatives are the most accurate tools for applying when describing changes mathematically. Examples of particular mathematical fields are geometry and analytical mechanics. Among the various scientific disciplines are physics, astronomy, geology, chemistry, biology, infectious illnesses, genetic variety, and economics (stock trends, interest rates, and shifts in the price of the market

equilibrium).. These disciplines include, among many others, physics, astronomy, geology, meteorology, and chemistry (celestial mechanics). ODE is widely used in science, technology, and even the social sciences, thus it's critical that educators explain these ideas to their students. College students must finish the ODE course in order to receive their third-level national certificate in education. The majority of Nigerian educational institutions in the south-south geopolitical zone have external examiners who have observed that NCE III students who study ODE in the mathematics department usually do poorly on the course.

Given the number of retakes, this implies that there are more repeat students than the typical number in the class. The low achievement was caused by low student involvement, inadequate use of the teaching style and approach, unqualified teachers, insufficient time allowed for instruction, and a lack of mathematics laboratory facilities, according to the reports of the external examiners. Numerous research pertaining to academic attainment have examined both the normal learning strategy and the flipped learning approach. On the basis of post-test results, however, another study claims that there is a significant difference favouring flipped learning (Dixon, 2017). Some (Frag & Harmon, 2017; Crawford, 2017) argue that there aren't any noticeable distinctions between the flipped and conventional methods. Put another way, there seems that there is disagreement on whether the flipped teaching method is noticeably superior to the standard teaching method, based on all of the studies.

With flipped learning, students receive instruction on how to interact with family, friends, and the public while adhering to the course objectives. They are also given reading assignments (via electronic materials such as video-audio materials) to complete at home. After that, the teacher will supervise an interactive session in which the students participate in more in-depth cognitive thinking. According to Ifeanyi (2022), flipped learning is a form of blended learning in which learners receive the material digitally at home and practice utilizing it in class. This contrasts with the more common method of teaching new content in class instead of assigning homework and projects that need independent work from the students at home. Among these options is the flipped classroom method, a relatively recent educational fad that is expected to gain popularity in postsecondary education over the coming years (Dixon, 2014). Blended learning is a cutting-edge method to education that upends the conventional notion of in-person training. This method uses technology effectively while offering a unique teaching-learning experience. The flipped classroom is one cutting-edge teaching strategy; unlike traditional in-person instruction, it allows students to do their homework before class at any time and from any location. Because of this, educators usually use digital resources to prepare their courses' subjects and provide their students with access to them before to class.

Using this approach, educators guide their pupils to pertinent learning materials and inform them of them ahead of time. When students attend the Ordinary Differential Equations class, they are going to engage in the method of instruction and learning with greater success

and have extra time to devote to the activities and consequences supporting the topic (Webb & Doman, 2016). This approach aims to alleviate student cognitive disparities by flipping the classroom. Using the use of flipped educational technology, students are given new possibilities to learn disciplines that are not usually taught in a traditional classroom context (Kim, Park, & Joo, 2014). The flipped teaching approach's founders, Bergmann and Sams (2012), emphasise that the approach's main focus is on the significant and captivating activities that occur during classes, rather than only using video courses.

In this study, the dependent variables were the students' academic achievement and interest. The goal was to determine the effects of using the flipped teaching strategy on the students as opposed to the traditional ODE teaching method. The purpose of the flipped teaching approach is to complement and reinforce classroom procedures while also personalising learning outside of the classroom. It is expected that this study will provide insight into the feasibility of the flipped classroom in ODE. Thus, the purpose of this research is to ascertain how NCE III mathematics students' interest in and performance in ODE are impacted by the flipped teaching approach.

Research Questions

The questions that follow directed the study in accordance with its overall goal.

1. What is the difference in the mean interest rating scores of NCE III students in Ordinary Differential Equation taught using the Flip teaching approach and those taught using the traditional teaching approach?
2. What is the difference in the mean achievement scores of NCE III students in Ordinary Differential Equation taught using Flip teaching approach and those taught using traditional teaching approach?

Hypotheses

In accordance with the study questions, the subsequent hypotheses were evaluated at the 0.05 level of significance.

H_{01}. There is no significant difference in the mean interest rating scores of NCE III students in Ordinary Differential Equation taught using Flip teaching approach and those taught using traditional teaching approach

H_{02}. There is no significant difference in the mean achievement scores of NCE III students in Ordinary Differential Equation taught using Flip teaching approach and those taught using traditional teaching approach

Methodology

A non-equivalent control group was included in the quasi-experimental pretest and follow-up design of the investigation. The study was carried out in Nigeria's geopolitical south-south

zone. Because all schools of education have resources that might make conducting a study in the area easier, the research area was used. Additionally, the presence of smartphones among the pupils in the study area may help with their studies. The NCE III students enrolled in education colleges made up the study's population. Purposive sampling was used to select a sample of four schools. There were 78 pupils in the study's sample. Intact classrooms were used so as not to interfere with the regular teaching and learning activities in the schools. Two groups received instruction using the flip teaching style (experimental) from the four intact classes, while the other group received instruction using the usual teaching approach (control). The experimental group had 43 pupils, while the control group consisted of 35 individuals.

The researchers created two instruments: the ODE Achievement Test (ODEAT) and the ODE Interest Scale (ODEIS). Thirteen items on the ODEIS were designed to gather information about students' interest in ordinary differential equations. Each was rated from strongly agree (SA), agree (A), disagree (D), and strongly disagree (SD) on a four-point scale. 50 dichotomously scored multiple-choice questions with four possible answers—A, B, C, and D—were included in the ODEAT. These questions were designed to gather information about students' performance in ODE. Both first- and second-order differential equations were tested. Five professionals performed face-validation on the devices. Three of the experts were from the Mathematics department, specialising in differential equations, while the other two were from the Federal College of Education Obudu, specifically in measurement and evaluation. The Crobach Alpha approach was utilised to establish the dependability coefficient of the ODEIS due to its polytomously scaled elements. A reliability coefficient of 0.75 was attained. Twenty NCEIII students in a College of Education that was not involved in the study were later subjected to ODEAT trial testing. Because the ODEAT items had dichotomous scoring and the reliability coefficient determined was 0.73, the Kuder-Richardson-20 technique was utilized to obtain the reliability coefficient of the ODEAT.

Procedure

The school dean's acknowledgement letter is obtained by the researchers for identification and acknowledgement. In order to obtain permission to use their students for the study, the researcher went to the selected colleges. Following approval, the researchers enlisted the help of four regular ODE lecturers—one from each college—as research assistants. The main goal was to make sure the students didn't know they were being utilised for an experiment in case they decided to alter their behaviour. The goal of the study was sufficiently communicated to the researchers. The study assistant for the group being studied underwent four days of classroom instruction on the flip teaching style, whilst two members of the group serving as a control were trained to use the traditional teaching approach. The trial itself ran for fourteen weeks. The research assistants received five days of training during

the first week. The students in both groups were given the instruments as a pretest on the sixth day. The experiment was carried out during the regular lecture periods listed on the school schedule. Thirteen weeks of one-hour sessions per week made up this. For the two groups, two sets of lesson plans were created, but the experimental group's lesson plan was prepared for a flip teaching approach, while the control group's lesson plan was prepared for a traditional teaching approach. Each lesson plan was identical in terms of its content, precise goals, length, and assessment. To ascertain the impact of the treatments on the students' interest and progress in geometry, items from the same ODEIS and the ODEAT were rearranged and given to the students as a post-test at the 13-week mark. The professors graded the ODEIS and the ODEAT questions that the students responded to. In the ODEAT, every right answer received one point, whereas every incorrect answer received 0 points. In order to address the study objectives, the obtained data were analysed using the mean and standard deviations, and the null hypotheses were evaluated at the 0.05 level of significance using Analysis of Covariance (ANCOVA).

Results

Research question 1:

Table 1: shows the mean and standard deviation of the NCE III ODE students' interest rating scores when taught utilizing a flip teaching method versus a regular teaching method.

Groups		Pretest		Posttest		
	N	$\bar{X}$	SD	$\bar{X}$	SD	Mean Difference
Experimental group	43	10. 18	2.46	15.21	1.80	5.03
Control group	35	7.92	1.03	9.37	1.33	1.45

Note: N = Number of Respondents, $\bar{X}$= Mean, SD = Standard deviation

The findings presented in Table 1 indicate that the intervention and control groups' respective average variances of 5.03 and 1.45 indicate a beneficial impact of the flip teaching style on students' interest in ODE.

Table 2: shows the results of a statistical analysis of covariance (ANCOVA) comparing the impact of the flip teaching strategy on students' interest in ODE against a regular teaching strategy.

Source	Type III Sum of Squares	Df	Mean square	F	Sig.	Partial eta square	Dec

Corrected Model	2672.123[a]	2	1340.530	63.127	.000	.632	
Intercept	1682.723	1	1682.723	73.031	.000	.431	
Pre interest	755.287	1	755.287	35.451	.000	.377	S
Groups	16101.155	1	16101. 155	73.539	.000	.686	
Error	1401.00	72	19.877				
Total	180377.00	78					
Corrected total	4099.134	75					

Note: S = Significant, NS = Not Significant, η2p = partial eta squared

The hypothesis is rejected as Table 2's results demonstrate a substantial influence of the flip teaching strategy on students' interest in ODE of mathematics ($F(1, 75) = 73.54$, $p < .05$, $\eta 2p = .686$). The specific likelihood value of 0.00 is smaller than the statistically important level of 0.05, which explains this. Moreover, the upshot size of ($\eta 2p = .686$) shows that the employment of the flip teaching style accounts for 68.6 per cent of improvements in students' interest in ODE. Thus, it can be concluded that students' interest in Ordinary Differential Equations is much increased by the flip teaching strategy.

Table 3: shows the mean as well as the standard deviation of the academic achievement results of students who were taught using a flip teaching method compared to students who were taught using a traditional method.

Groups		Pretest		Posttest		
	N	$\bar{X}$	SD	$\bar{X}$	SD	Mean Difference
Experimental group	43	9. 21	2.19	14.21	1.50	5.00
Control group	35	6.52	1.09	8.55	1.12	2.03

Note: N = Number of Respondents, $\bar{X}$= Mean, SD = Standard deviation

The findings presented in Table 3 indicate that the experimentation and control groups' respective average variances of 5.00 and 2.03 indicate a beneficial impact of the flip teaching style on students' interest in ODE.

Table 4: Covariance Analysis of Variance (ANCOVA) showing how the flip teaching method affects students' performance on tshe ODE

Source	Type III Sum of Squares	Df	Mean square	F	Sig.	Partial eta square	Dec

Corrected Model	902.054[a]	2	128.865	58.035	.000	.741	
Intercept	971.790	1	971.790	437.652	.000	.755	
Pre interest	755.287	1	755.287	40.901	.000	.407	S
Groups	80001.113	1	80001. 113	61.511	.000	.505	
Error	315.306	72	17.612				
Total	193300.00	78					
Corrected total	1217.360	75					

Note: S = Significant, NS = Not Significant, η2p = partial eta squared

The hypothesis is rejected as Table 4's results demonstrate a substantial consequence of activity-based education on pupils' concentration in mathematics' geometric content ($F(1, 75) = 61.61$, $p < .05$, $\eta 2p = .505$). This is due to the fact that the precise probability value of 0.00 is less than the significance level of 0.05. Furthermore, the effect size of ($\eta 2p = .505$) shows that the usage of teaching strategy accounts for 50.5% of improvements in students' achievement in ODE of mathematics. Therefore, it can be concluded that the flip teaching strategy considerably improves students' performance in ODE of mathematics.

Discussion

The study's conclusions demonstrated that the flip teaching strategy significantly increased NCE III students' interest in ODE. The results show that increasing students' interest in ODE is more successful when using the flip teaching method. The aforementioned results are consistent with earlier research by Eze (2023), which showed that flipped learning was a more successful teaching tactic than traditional methods for raising students' interest in trigonometry.

The aforementioned results may be explained by the fact that students who are exposed to flip teaching become involved in self-learning, which may spark their curiosity in learning and enhance their interest in ODE. Additionally, the results demonstrated that the flip teaching strategy significantly improved NCE III students' performance in ODE. The results suggest that the flip teaching strategy is a useful way to raise students' ODE performance. The results support earlier research by Ifeanyi (2022), which showed that students who received flip instruction outperformed those who received lecture instruction. The aforementioned results might be the result of students being exposed to flip teaching, which allows them to independently research facts, collaborate with peers to solve challenges, and improve learner retention, all of which can raise accomplishment levels.

Conclusion

The performance of students in ODE is a significant worry for engineers and physicians, since the fundamentals of modelling in Nigeria are becoming a source of concern for educators. Based on this, the current study examines how students' attention and performance in ODE are affected by the Flip teaching technique. The study's conclusions led to the conclusion that students' interest in and performance in ODE are significantly improved by the flip teaching style. Therefore, the results shed light on how effective it is for colleges to implement the flip teaching method in order to raise students' interest in and performance in learning, especially ODE.

Recommendations

The study's conclusions led the researchers to make the following recommendations:

1. ODE should be taught and learnt in education colleges using the flip teaching approach.
2. To use the flip teaching method, computers should be installed or provided by the government in the mathematics lab.

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