

The Effects of Flip Classrooms on Students' Academic Performance in Educational Technology in Sokoto State University, Sokoto, Nigeria

ISMAILA, Abdullahi Abubakar¹ & MUHAMMAD, Nasiru D/Daji²

Department of Curriculum Studies¹ & Department of Science Education²
Faculty of Education, Sokoto State University, Nigeria^{1&2}

Abstract: *This research investigated the effects of Flip classrooms on students' academic performance in educational technology at Sokoto State University, Sokoto, Nigeria. 3 objectives and 3 hypotheses guided the research. A quasi-experimental research design included a pre-test and post-test on two equivalent groups selected as experimental and control. The population of the study was 250, and the sample that was chosen was 95. The findings revealed that there is a significant difference in the mean academic performance of students in the Flip classroom and those in the conventional classroom, there is no significant difference in the performance of male and female students in the Flip classroom, and there is no significant difference in students' academic performance in the urban and rural areas in flip classrooms. Based on these results there are some recommendations: implementation of Flip classroom methodology, gender-neutral approach in Flip classroom, and equity in rural and urban settings.*

Keyword: *Flip Classroom, Conventional Classroom, Learning, Academic Performance.*

Introduction

Teaching is the oldest profession that starts when a child is born. Parents are the first teachers of any individual in this world. The teaching profession is the mother of all professions with a lot of tasks. A teacher needs to plan, design, and develop/implement all of these to deliver in their lesson/classroom. The way a teacher of two decades ago planned, designed, and developed/implemented differs from a teacher of the 21st century. The contemporary time is the era of technological innovations. Technological resources cover all aspects of human endeavour such as education, health, socio-economy, and political sectors. The technological resource makes teaching and learning easy, enjoyable, affordable, and concrete for learners. Ever since the invention of radio and television, the resources have been used in education. Teaching to a big audience is made possible by employing various media. Thus, there were significant technological advancements in the second half of the 20th century that led to a significant decrease in the cost and increase in the availability of technology. The introduction of the Internet

completely changed communication forms and methods as well as accessibility. Information and communication technologies are being used in a wide range of industries, including education, therefore this revolution is still ongoing (Etedali, 2021).

There is not just a rapid shift to online teaching and learning, but documents on how the pandemic sponsored a wholesale rethink and pivoting of our practices as teacher educators that goes beyond just a temporary adjustment caused by the pandemic. The lockdowns triggered a reappraisal of the efficacy of teachers' and learner practices and a rethink of the foundations of our pedagogy for change. This reappraisal has implications for the delivery of teaching and learning in higher education beyond the pandemic (Creely & Lyons, 2022). This shows that researchers all over the world must investigate the implications of technological resources during and after that is; post Covid-19 pandemic in teaching and learning. This study assessed the effects of flipped classrooms on students' academic performance in educational technology at Sokoto State University, Sokoto-Nigeria. The COVID-19 pandemic has hastened the shift to e-learning, where comprehensive platforms have been developed to provide online educational content, and teachers are eager to achieve maximum student interaction. However, this will not be sufficient, as certain skills such as problem-solving must be acquired through face-to-face interaction in which the student exercises the skill directly under the teacher's guidance. Hence the FC method in blended learning was regarded as one of the most suitable educational solutions for bridging these gaps (Naser, Alamassi, Shana, Yousef & Hajar, 2023).

Since the identification of the primary demands of the educational system is based on the modification of the pedagogical model in this particular order, the teaching strategy known as "flipped learning" is regarded as one of the most creative techniques developed by teachers (Santillán-Aguirre, Jaramillo-Moyano, Santos-Poveda, Hernández-Andrade, 2023). A flipped Classroom is also called a flipped model, flipped learning, or flipped laboratory. The genesis of flipped learning or classroom can be inquired that it was first implemented by Professor Erik Mazur in his physics class at Harvard University in 1991. He permitted his students to prepare material and pace for their learning. After that, they applied interactive learning in the class (Khadafi, Idrus, and Martriwati, 2022). By moving direct instruction from the group learning environment to the individual learning environment, FC transforms the group learning environment into a dynamic, interactive learning environment where the teacher supports students as they apply concepts and engage creatively with the subject matter. In other words, flipped learning is a learner-centred strategy that encourages active participation in the production of new knowledge and aims for conceptual depth. FC restructures the learning process to accommodate each learner's unique learning pace and needs. FC is built on the idea that learning can happen anywhere, the learner receives the topic material before the session and then enters the classroom prepared and knowledgeable about it. While students collaborate, practical exercises related to the analysis and synthesis steps can be made (Candaş, & Altun, 2023). Peer collaboration or cooperation is a concept that many progressive educators who are now working to enhance the learning environment and the students they educate have wholeheartedly embraced.

FC is a didactic innovation that can greatly contribute to facilitating students' cognitive activity and individualization of learning, cooperative learning, innovativeness and openness, metacognition and learning of learning, and students' independence. It is important to emphasize that it is a didactic innovation developed from the bottom up, which means it originated from the teachers and instructional practice (*Plešec, Pejić & Valenčič, 2023*). With its hybrid approach, which blends online and in-person learning, FC requires us to rethink the standard didactic techniques we are accustomed to. Outside of the classroom, the teacher or other specialists create digital platforms and technological instruments to collect new information from the pupils (Voskoglou, 2023).

Online learning is a way to receive assistance from teachers in a way that is distinct from traditional classroom learning. Teachers offer video, audio, or audio-visual lectures online that students can view or use for individualized instruction. In this way, even if they are unable to attend class, students can still study. The FC instructional strategy has received much attention recently. The notion was that rather than using time for an instructor to introduce a concept (often via lecture), the instructor created a video lecture, screencast, or vodcast/podcast that teaches students the concepts, freeing up valuable class time for more engaging and collaborative activities. Instructors could provide direct support to students in real time while working on material previously completed at home. Instructors could devote more time to expanding students' understanding and spending more one-on-one time with students during class. The instructor guided and facilitated the students (Sheerah & Yadav, 2022). Sokoto State Government is among the state governments in the country that are working assiduously to improve the educational system through accepting new technological innovations in teaching and learning at all levels of education in the State.

In this era of the 21st century, no sector will achieve its designed goals without integrating technological resources into its activities. It has been observed by the researchers that; the majority of teachers and students of tertiary institutions in Sokoto State owned either a Smartphone, a personal computer, or both, this shows that they have a technological tool for teaching and learning that can be used for FC and educational technology students in Sokoto State University are among them. This study acted as a standard against which results from various researchers can be compared. Insufficient information exists regarding the impact of FC on the academic achievement of students at Sokoto State University, located in Sokoto State, Nigeria, the study's site. inadequate study on how FC affects students' academic achievement.

Statement of the Problem

Many researchers have written about the advancements of technology in education/classroom which is how it makes teaching easy, enjoyable, and concrete. It is hoped that the use of technology in the classroom would improve student learning outcomes and experiences while also making it easier to transform the classroom environment into one in which students may foster their creativity and problem-solving skills. Delivering high-quality training and designing learning environments that are appropriate for a certain set of students require technology integration in education (Wawan, Zuniati, Windarsih, Aziz, Mispani, & Agustina, 2023). Undoubtedly, a lot of students may have been using FC, but the question is whether or not FC reflects their

academic success, and is there a difference in FC use between male and female students? There may not be any differences between students from rural areas and those living in urban communities using FC. These will expose the benefits attached to integrating FC in teaching and learning.

Objectives of the Study

The objectives of this study are to:

1. Investigate how FC improve students' academic performance more than a conventional classroom.
2. Find out how male and female students' academic performance differs through the use of FC.
3. Examine the extent to which student academic performance from urban and rural areas varies with the use of FC.

Research Hypotheses

The following null hypotheses were formulated to guide this study:

Ho₁. There is no significant difference between the use of FC and CC for the improvement of students' academic performance.

Ho₂. There is no significant difference between the academic performance of male and female students in the use of FC.

Ho₃. There is no significant difference between the academic performance of students from urban and rural areas concerning the use of FC.

Literature Review

FC gives students room to learn independently with or without a teacher's intervention, later they may interact with a teacher who now is called a facilitator, and they can only guide students in making the right decision. With this, students can possess a clue on how to assimilate and accommodate knowledge/skills. FC uses a Network, Bluetooth, and Xender just to mention but a few, to gather information by a teacher and disseminate it to learners/teachers or student to students. FC empowers independent learning students and helps in the provision of insight regarding connecting teachers and learners through the network.

A systematic analysis of the body of knowledge that has been approved by numerous academics and can improve education quality is known as literature. The associated literature will be reviewed in this study based on the research's variables. FC is the use of either audio, audio-visual, video, or blended classroom (conventional and use of technological resources) in the classroom setting. Zenzen, Karlimah & Syarip (2023) investigated "Elementary School Teachers' Perceptions on Video-based Mathematics Learning in Flipped Classroom Model Towards Learning Quality". The researchers used mixed methods, whereby questionnaires and interviews served as instruments for data collection, but for this study, quasi-experimental research will be used. It was found that most teachers positively perceived using video-assisted mathematics instruction in measurement topics. Teachers stated that video-assisted instruction helped students understand measurement concepts and made learning more engaging and enjoyable for elementary school students. The study was conducted in Tasikmalaya.

Plešec, Pejić, and Valenčić (2023) explored "Teachers' Perceptions of Flipped Learning and Teaching: Planning, Implementation and Evaluation". The study was a survey, but this research is a quasi-experimental. The results also showed that teachers

mostly use flipped learning and teaching for content that is challenging to their students. According to these teachers, the main advantage of flipped learning and teaching is that students can watch the video at home several times, while the limitations are mainly connected to the accessibility of computers and the Internet, student's responsibility in the process, and work overload for students and teachers when it comes to implementing innovation. The study presents a qualitative study that illustrates the views, perceptions, and experiences of seven Slovenian and two Croatian teachers who have experience with flipped learning and teaching.

The managerial facilitation provided by the instructor enhances students' willingness to keep on studying in developmental English learning, student's English writing proficiency, and their attitude toward flipped. Results also suggested that managerial facilitation on flipped learning cultivates students' learning habits and changes students into active learners, Yoshida (2022) investigated the "Effects of Managerial Facilitation Strategies on Flipped Learning for Developmental English Education", experimental research was used (experimental group and control group) for data collection. The research was conducted in Japan. The study investigated the effects of managerial facilitation strategies on flipped learning for developmental English education, but in this research effects of flipped classrooms will be investigated on educational technology among students of Sokoto State University, Sokoto State-Nigeria.

Pilu and Nur (2023) explored "Trends and Outcomes in Flipped Learning-based Instruction in Teaching Reading: A Systematic Literature Review". The identification, screening, feasibility, and inclusion phase found thirty-one articles between 2015 and 2022 from the Scopus database with a premium Scopus account to access all sources without limits. The research is a systematic literature review on teaching reading, the result showed that Flipped Learning has positive outcomes in influencing students' performance, especially if combined with other methods. The systematic literature review summarizes study findings on trends and outcomes of flipped learning-based instruction in teaching reading.

Khadafi, Idrus and Martriwati (2022) conducted a study in Indonesia, titled "The EFL Learners' Perception of Flipped Learning Method for Increasing Writing Ability". They used a survey design and a questionnaire served as their instrument for data collection, the results revealed that students have a positive attitude toward the use of flipped classrooms to increase their writing ability.

Mujtaba, Athar, Churi, and Moreno-Guerrero, (2022) in their study titled "Impact of flipped classroom approach on students' learning in post-pandemic: survey research on public sector schools". The researchers used a survey research method and they used questionnaires for data collection. They found that FC is a useful teaching strategy that improves student performance, engagement, and learning in the classroom. Overall, it can be said that many students preferred the flipped classroom strategy to conventional education. The study was carried out in Pakistan.

Ardiansyah, Aryanti, Ujihanti, Risnawati, Asyari, Meirani and Ahmad (2023) revealed in their research "Flipped Classroom Versus Traditional Classroom to Improve Students' Reading Comprehension Attainment During Covid-19 at SMA Negeri 7 Prabumulih". Quasi-experimental research and purposive sampling were used, the research was conducted in Indonesia. This implies that the use of a Flipped classroom design helps students achieve greater.

These findings confirmed that to promote quality in mathematics education teachers must design and implement practical activities that through flipped learning encourage the construction, argumentation, and interpretation of situations focused on the workplace. In addition, these results provide useful information regarding the impact and feasibility of flipped learning in mathematics education at the postgraduate level. Therefore, this research contributes to knowledge about the effectiveness and use of flipped learning with the support of digital tools to promote quality mathematical training at the postgraduate level in a hybrid modality that was established once the confinement period ended (Cardoso-Espinosa, Cortes-Ruiz & Zepeda-Hurtado, 2023). All these were found out in their research titled “Satisfaction of Postgraduate Students with Hybrid Flipped Learning to Develop Their Mathematical Competencies”. The questionnaire was the instrument used with a cross-sectional design. In this research, quasi-experimental use through pre-test and post-test.

Aidoo, Anthony-Krueger, Gyampoh, Tsyawo, and Quansah (2022) in their research show a significant increase in the performance and critical thinking skills in the pre-and post-test scores in chemistry learning outcomes and female pre-service teachers performed better with higher scores than their male colleagues. The study titled “A Mixed-Method Approach to Investigate the Effect of Flipped Inquiry-Based Learning on Chemistry Students Learning”. They used a quasi-experimental and convenient sampling technique. FC is negligible concerning students' performance in mathematics. This gives a strong indication that the application of the FC methodology weakens mathematics students (Voskoglou, 2023). It was found out in his research “Assessing the Effectiveness of Flipped Learning for Teaching Mathematics to Management Students” with the use of quasi-experimental research. The study was conducted in Greece.

Kawimbe (2022) revealed this in his research titled “Assessing the Impact of the Flipped Classroom Model on Students' Academic Performance in Zambia during COVID-19: Students' Perspective”. A quasi-experimental was used for data collection and the study was conducted in Zambia. Findings show that in general, students resist learning the topics on their own outside the classroom in the FC.

Sawani (2022) explored “Student Perceptions on a Flipped Online Learning Classroom for Auditing Course”. Survey research and questionnaires were used as instruments for data collection and revealed that the study is still premature to generalise the effectiveness of flipped learning. The study was conducted in Malaysia.

Summary of Reviewed Literature and Uniqueness of the Study

Based on the various studies reviewed by Zakiyah *et al.*, (2023); Plesec *et al.*, (2023); Yoshida (2022); Pilu *et al.*, (2023); Khadafi *et al.*, (2022); Mujtaba *et al.*, (2022); Ardiansyah *et al.*, (2023); Cardoso-Espinosa *et al.*, (2023); Aidoo *et al.*, (2022) revealed that FC improves students' performance significantly, while Voskoglou (2023); Kawimbe (2022); Sawani (2022) based on their findings, FC would not be concluded that can be used to improve students' performance significantly. This study will serve as a benchmark for the outcomes. The Sokoto State University, Sokoto State, Nigeria, where this study will be conducted, has insufficient research on the impacts of FC on students' academic performance.

FC gives students room to learn independently with or without a teacher's intervention, later they may interact with a teacher who now is called a facilitator, and they can only

guide students in making the right decision. With this theory, students can possess a clue on how to assimilate and accommodate knowledge/skills.

Methodology

The study adopted a quasi-experimental design including a pre-test and post-test on two equivalent groups selected as experimental and control. In this design, the experimental group will be taught with FC while the control group will be taught without FC for 6 weeks. The two groups will take a pre-test and post-test for academic performance/achievement. Researchers make the distinction between a population and the universe of people to which the study could be generalized. The target population for the study consists of all three hundred level (UG III) students offering educational technology in the faculty of education at Sokoto State University, Sokoto, Nigeria. The total number of educational technology students is 250. Details of the population are shown in Table 1:

Table 1: Name of Departments and Population of the Study:

S/N	Name of the Departments	Population
1	Educational Foundations	129
2	Science Education	121
Total		250

Source: Office of the Head of Departments, (2023).

A random sampling technique will be employed to select the sample from the departments. The researchers relied on every member of the population that could be selected to participate as a representative of the whole. The chosen sample is 95, which is in line with the Raosoft sample size calculator. Raosoft is a software programme that gives a researcher a ready-made and correct sample of a given population. Once a researcher enters the population, it will give the sample to be chosen from the population. According to Raosoft, 5% is a common choice for margin of error that can be accepted, and 95% was selected as the confidence level. The names of departments, populations, and sample sizes are presented in Table 2.

Table 2: Name of Departments, Population, and Sample Size:

S/N	Departments, Faculty of Education	Populatio n	Sample Size
1.	Educational Foundations	129	$97 \times 129 / 250 = 50$
2.	Science Education	121	$93 \times 121 / 250 = 45$
Total		250	95

An achievement test on educational technology tools was used for this research. The pre-test was given at the start of the study to see if there was a significant difference in the sample subjects' academic ability level before treatment. The post-test was also given to both the experimental and control groups following treatment to determine achievement. Five (5) questions were taken directly from the Department of Science Education at the Faculty of Education, Sokoto State University at the end-of-semester examinations and they answered only three questions out of five, all questions carried equal marks. The

questions were chosen to explore how FC affected students' academic success and performance.

Data on students' performance in the study was gathered using the accomplishment pre-test and post-test as a tool. portions A and B make up the two portions of this instrument. Section A of the instrument is for the student's personal information, and Section B has five essay-writing questions based on contents and topics chosen from educational technology. The chosen topics were taught to students in the classroom during research while adhering to the UG III academic contents. Questions were given to both to assess the performance of the experimental and control groups. The instrument is presented in Appendix A.

Data was analyzed in four stages which are: demographic information, students' academic performance/achievement using FC, differences between males' and females' academic performance using FC, and students' differences from urban and rural areas' academic differences using FC. The quasi-experimental design data collected was analyzed using Statistical Package for Social Science (SPSS) version 25:0; the study used frequency counts and simple percentages to elucidate the respondents' demographic data and the t-test for research hypotheses.

Results

Hypothesis 1: There is no significant difference between the use of FC and CC for the improvement of student's academic performance.

Table 3: The use of FC and CC for the improvement of student's academic performance:

Group	N	Mean	Std. Dev.	P-value	Decision
CG	50	24.40	10.28	0.046	Rejected
EG	45	28.84	11.12		

Since the p-value is 0.046 <0.05 the stated null hypothesis is rejected. This indicated that there is a significant difference in the mean academic performance of students in Flip Classroom and those in the conventional classroom. This difference can be seen in the mean of the two groups. There is a treatment effect in the experimental group.

Hypothesis 2: There is no significant difference between the academic performance of male and female students in the use of FC.

Table 4: The academic performance of male and female students in the use of FC:

Gender	N	Mean	Std. Dev.	P-value	Decision
Male	22	28.10	11.07	0.70	Accepted
Female	23	29.48	11.38		

The p-value is 0.70 >0.05, this makes the researcher accept the stated null hypothesis. The null hypothesis that there is no significant difference in the performance of male and female students in the flip classroom is accepted. Therefore, this strategy is gender friendly. It challenges both genders and lowers the gender disparity.

Hypothesis 3: There is no significant difference between the academic performance of students from urban and rural areas concerning the use of FC.

Table 5: academic performance of students from urban and rural areas concerning the use of FC:

Location	N	Mean	Std. Dev.	P-value	Decision
Urban	23	28.52	10.93	0.11	Accepted
Rural	22	23.41	10.18		

The p-value of 0.11 is greater than 0.05. Therefore, the stated null hypothesis cannot be rejected. The null hypothesis that says there is no significant difference in students' academic performance in the urban and rural areas in flip classrooms is accepted. Therefore, the techniques show no variation in the performance of urban and rural students.

Discussion of Findings

The findings indicated that there is a significant difference in the mean scores of academic performance of students in Flip Classroom and those in the conventional classroom. There is a treatment effect in the experimental group. This is in line with that of Zakiyah *et al.*, (2023); Plesec *et al.*, (2023); Yoshida (2022); Pilu *et al.*, (2023); Khadafi *et al.*, (2022); Mujtaba *et al.*, (2022); Ardiansyah *et al.*, (2023); Cardoso-Espinosa *et al.*, (2023); Aidoo *et al.*, (2022) revealed that FC improves students' academic performance significantly.

Conclusion

This study throws light on many important facets of instructional strategies and results. Firstly, it draws attention to a notable difference in academic achievement between students in Flip Classroom environments and those in traditional classrooms, indicating the possible effectiveness of this cutting-edge teaching strategy. Further evidence of the Flip Classroom's potential to promote gender equality in academic accomplishment comes from the lack of a discernible performance gap between male and female pupils. Furthermore, the fact that there was no appreciable difference in the performance of children from rural and urban areas in Flip Classrooms points to the possibility that this approach could be used to close the achievement gap in a variety of socio-economic settings. These results highlight the potential of Flip Classrooms as a teaching strategy for raising student achievement and advocating for educational equality.

Recommendations

Based on the research findings, here are some recommendations:

1. **Implementation of Flip Classroom Methodology:** Given the significant difference in mean academic performance between students in Flip Classroom and those in conventional classrooms, educators should consider incorporating Flip Classroom methodology into their teaching practices. This approach can enhance students' engagement, participation, and understanding of course materials, leading to improved academic performance.
2. **Gender-Neutral Approach in Flip Classroom:** Since there is no significant difference in the performance of male and female students in the Flip Classroom setting, educators should continue to foster an inclusive and gender-neutral learning environment. This entails ensuring that instructional materials and

teaching strategies are accessible and relevant to all students, regardless of gender.

3. **Equity in Rural and Urban Settings:** Despite no significant difference in academic performance between students in urban and rural areas within Flip Classrooms, it's crucial to address any existing disparities in access to resources and educational opportunities. Educators and policymakers should prioritize initiatives aimed at bridging the urban-rural educational divide, such as improving infrastructure, providing technology access, and offering targeted support to students in underserved communities.

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Appendix A

The Effects of Flip Classrooms on Students' Academic Performance in Educational Technology in Sokoto State University Instrument (EFCSAPETSSUI)

Section A

Personal Data

Gender: Male []

Female []

Strata: Rural []

Urban []

Section B

Examination Questions Based on the Research Hypotheses

Instruction: Answer only THREE questions, all questions carry equal marks.

1. a. The specialist defined educational technology as the combination of technology in education and technology of education. Discuss!
 - b. Write a short note on the following dimensions of educational technology:
 - i. Educational Technology I (ET I)
 - ii. Educational Technology II (ET II)
 - iii. Educational Technology III (ET III)
2. a. Define Instruction.
 - b. Briefly explain the following:
 - i. Media Mediated Instruction.
 - ii. Teacher Mediated Instruction.
 - iii. Learner Mediated Instruction.
 - iv. Resource Person Mediated Instruction.
3. a. Mention five (5) roles of instructional technology media in teaching and learning.
 - b. Enumerate 5 functions of the Nigerian Association for Educational Media and Technology (NAEMT).
4. a. ASSURE is an acronym that stands for various steps in a model. Elucidate!
 - b. Select a topic based on your subject area and make an effective instructional plan using the "ASSURE" model.
5. a. Define improvisation.
 - b. State four (4) reasons for improvisation.
 - c. List and explain in brief three (3) approaches to improvisation of instructional materials.