

## EFFICACY OF FLIPPED CLASSROOM INSTRUCTION ON STUDENTS' ACADEMIC PERFORMANCE IN VOCATIONAL EDUCATION IN TERTIARY INSTITUTIONS IN KATSINA STATE, NIGERIA

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### **Abstract**

This study investigated the efficacy of flipped classroom instruction on students' academic performance in vocational education in tertiary institutions in Katsina state, Nigeria. The study was guided by four objectives, four research questions, and three hypotheses. The population of the study comprised 350 undergraduate vocational education students, from which a sample of 200 students was selected using simple random sampling. The participants were assigned to two independent groups: the experimental group (flipped classroom) and the control group (conventional lecture method), with 100 students each. Data were collected using a structured instrument titled Flipped Classroom Academic Performance and Engagement Scale (FCAPES), consisting of a performance test and a 4-point Likert-scale questionnaire. The reliability of the instrument was determined using Cronbach's Alpha, which yielded reliability indices of 0.84 for the performance test and 0.88 for the questionnaire, indicating high internal consistency. Although the study involved two independent groups, making ANOVA generally less applicable, it was still used alongside the independent-samples t-test to analyze mean differences in academic performance between the two groups. Cronbach's Alpha was used to answer the research questions related to the internal consistency of the instrument, while t-test and ANOVA were used to test the hypotheses. Findings revealed that students exposed to flipped classroom instruction achieved significantly higher academic performance, engagement, and collaboration than those taught using conventional methods. Despite challenges such as limited digital resource access and varying levels of instructor readiness, the flipped classroom approach proved effective in promoting active learning, deeper understanding, and critical thinking among vocational education students. In conclusion, the flipped classroom model demonstrates strong potential for improving instructional quality and learner outcomes in vocational education, especially when adequately supported and systematically implemented. The study recommends systematic adoption of flipped instruction supported by adequate digital infrastructure, capacity-building programs for instructors, and adaptive instructional frameworks to enhance teaching and learning outcomes in Nigerian tertiary institutions.

**Keywords:** Flipped classroom, Academic performance, Vocational Education.

### **Introduction**

Educational technology is central to flipped instruction, with platforms like Moodle, Google Classroom, and Microsoft Teams enabling content access, interaction, and feedback (Turban et al., 2018). AI and adaptive learning systems further personalize instruction, allowing students to engage with content according to their progress and comprehension levels (McAfee & Brynjolfsson, 2017).

Despite its advantages, flipped learning presents challenges, including student adaptability, digital access disparities, faculty preparedness, and curriculum restructuring (OECD, 2019). Students may resist the approach, fail to complete pre-class work, or encounter limited access to resources, while educators face increased workload, the need for pedagogical skill development, and designing engaging in-class activities (Herreid & Schiller, 2013; Strayer, 2012; Fulton, 2012). Proposed solutions include scaffolding pre-class tasks, providing offline alternatives, clearly communicating benefits, collaborative material development, and offering professional development to enhance instructional proficiency.

The theoretical foundation of flipped learning aligns with constructivist principles, emphasizing active engagement, collaboration, and reflection as core processes in knowledge construction (Piaget, 1970; Vygotsky, 1978). Bloom's Taxonomy further suggests that higher-order thinking analysis, evaluation, and creativity is enhanced when students engage with learning materials prior to in-class discussions (Anderson & Krathwohl, 2001).

Empirical studies indicate that flipped classrooms improve learning outcomes across disciplines. Bergmann and Sams (2012) report greater engagement and deeper comprehension among students, while Herreid and Schiller (2013) highlight enhanced collaborative problem-solving and immediate feedback. However, successful implementation requires careful planning, access to digital resources, and institutional support (Kim et al., 2014). This study aims to examine the effectiveness of the flipped classroom in enhancing students' academic performance, engagement, and collaborative learning. Using a quasi-experimental design, it compares flipped and traditional instruction while investigating instructional technology, active learning strategies, knowledge retention, and problem-solving skills. Findings will provide evidence-based recommendations for educators, policymakers, and institutions seeking to integrate flipped learning into broader curricular frameworks (Bergmann & Sams, 2012; Herreid & Schiller, 2013; Kim et al., 2014).

### **Statement of the Problem**

Conventional lecture-based methods in higher education have been widely criticized for promoting passive learning, limited engagement, and surface-level understanding, thereby hindering the development of critical thinking, problem-solving, and collaborative skills required in modern academic and professional environments. Research shows that traditional lectures often fail to create opportunities for active participation and deeper cognitive processing (Bishop & Verleger, 2013). Although digital learning technologies are increasingly available, many institutions in Nigeria continue to rely predominantly on teacher-centered instructional approaches, resulting in decreased motivation, poor academic achievement, and inadequate readiness for dynamic workplace demands (Owolabi & Adedayo, 2021).

The flipped classroom model where content acquisition occurs outside the classroom while class time is devoted to active, collaborative learning offers a promising alternative to traditional pedagogy. Studies suggest that flipped instruction enhances engagement, improves academic performance, and supports higher-order learning skills (Bishop & Verleger, 2013). However, in the Nigerian tertiary education context, empirical evidence on the effectiveness of flipped classroom instruction remains limited, with most existing studies focusing broadly on e-learning rather than on structured flipped pedagogies (Owolabi & Adedayo, 2021). This gap necessitates a systematic examination of the flipped classroom as an instructional strategy for improving student performance, engagement, and collaborative learning in vocational education programs in Katsina State and beyond.

### **Objectives of the Study**

This study aims to:

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1. Determine the effect of flipped classroom instruction on students' academic performance in vocational education against the conventional lecture method in tertiary institutions in Katsina state.
2. Assess students' opinion of engagement, collaboration, and self-directed learning in flipped classroom environments in tertiary institutions in Katsina state.
3. Identify the challenges encountered by educators and students in implementing flipped classroom instruction in vocational education programmes in tertiary institutions in Katsina state.
4. Examine the strategies employed by educators to address implementation challenges and enhance the effective use of the flipped classroom instruction in tertiary institutions in Katsina state.

### Research Questions

Based on the objectives, the study was guided by the following research questions:

1. What is the effect of flipped classroom instruction on students' academic performance in vocational education in tertiary institutions in Katsina state?
2. What is students' opinion of engagement, collaboration, and self-directed learning in flipped classroom settings in tertiary institutions in Katsina state?
3. What challenges do educators and students encounter in implementing flipped classroom instruction in vocational education programmes in tertiary institutions in Katsina state?
4. What strategies are employed by educators to address implementation challenges and ensure effective delivery of flipped classroom instruction in tertiary institutions in Katsina state?

### Hypotheses

The following null hypotheses are formulated to guide the study:

H<sub>01</sub>: There is no significant difference in academic performance between students taught vocational education using flipped classroom instruction and those taught using the conventional lecture method in tertiary institutions in Katsina state.

H<sub>02</sub>: There is no significant difference in students' perceived engagement between those exposed to flipped classroom instruction and those exposed to the conventional lecture method in tertiary institutions in Katsina state.

H<sub>03</sub>: There is no significant difference in students' perceived levels of collaboration and self-directed learning between flipped classroom and traditional classroom settings in tertiary institutions in Katsina state.

### Methodology

This study adopted a mixed-methods research design, combining a survey and a quasi-experimental design to investigate the effects of the flipped classroom approach on students' academic performance, engagement, and collaborative learning. The population comprised 350 undergraduate vocational education students from Hassan Usman Katsina Polytechnic and the Federal College of Education, Katsina. From this population, 200 students were randomly selected and assigned to either the experimental group (flipped classroom for vocational education) or the control group (conventional lecture method) with 100 students in each group. Data collection involved three key instruments: academic performance assessments (quizzes, examinations, and assignments), a 4-point Likert-scale questionnaire designed to measure student engagement, collaboration, and comprehension, and instructor feedback to provide qualitative insights on student participation and instructional outcomes. Quantitative data were analyzed using t-tests and ANCOVA, enabling comparison of group differences and

controlling for potential covariates. Qualitative data obtained from open-ended survey responses and instructor comments were analyzed through thematic analysis to identify recurring patterns and perceptions about the flipped classroom experience.

**Results**

**Research Question One:** What is the effect of flipped classroom instruction on students’ academic performance in vocational education in tertiary institutions in Katsina state?

**Table 1: Mean and Standard Deviation of Respondents on Academic Performance (Flipped Classroom)**

S/N	Items	X	SD	Decision
1	Flipped class boosts test scores.	3.87	0.34	Strongly Agree
2	Flipped model yield better grades	3.40	0.49	Agree
3	Flipped learning enhances understanding.	3.22	0.41	Agree
4	Flipped teaching improves retention.	3.47	0.50	Agree
5	Flipped classroom fosters deeper learning.	3.52	0.50	Strongly Agree
6	Flipped approach ensure content mastery.	3.35	0.48	Agree
7	Flipped model increases student achievement.	3.70	0.46	Strongly Agree
8	Flipped instruction leads to higher marks.	3.28	0.45	Agree
9	Flipped instruction promotes knowledge gain.	3.13	0.33	Agree
10	Flipped teaching supports academic success.	3.42	0.49	Agree
<b>Grand Mean</b>		<b>3.44</b>		

Table 1 shows a strong positive opinion of the flipped classroom’s impact on academic performance. With a grand mean of 3.44, respondents agree that the model enhances learning outcomes more effectively than traditional teaching. High ratings for improved test scores (X=3.87) and overall achievement (X=3.70) reflect its clear benefits. Respondents also note gains in understanding (X=3.52), retention (X=3.47), and content mastery (X=3.35). Low standard deviations (0.33–0.50) indicate strong consensus. Overall, the flipped classroom is widely viewed as promoting deeper learning and better academic results.

**Research Question Two:** What is students’ opinion of engagement, collaboration, and self-directed learning in flipped classroom settings in tertiary institutions in Katsina state?

**Table 2: Mean and Standard Deviation of Respondents on Engagement and Collaboration**

S/N	ITEMS	X	SD	DECISION
11	Flipped class encourages active participation	3.04	0.10	Agree
12	I feel more engaged in flipped learning	3.35	0.40	Agree
13	Group work is helpful in flipped classes	3.74	0.44	Strongly Agree

14	Flipped activities make me think more	3.27	0.45	Agree
15	I enjoy collaborating with peers in flipped learning	3.21	0.41	Agree
16	Flipped environment keeps me interested	3.33	0.47	Agree
17	Active learning helps me understand better	3.33	0.53	Agree
18	I learn a lot from classmates in flipped settings	3.55	0.40	Strongly Agree
19	Flipped classroom makes learning interactive	3.54	0.51	Strongly Agree
20	I feel a sense of teamwork in flipped activities	3.50	0.50	Strongly Agree
<b>Grand Mean</b>		<b>3.39</b>		

Table 2 indicates that students hold positive perceptions of active learning, engagement, and collaboration in the flipped classroom, reflected in a grand mean of 3.39. They agree that flipped classes promote active participation ( $X=3.04$ ), deeper thinking ( $X=3.27$ ), and better understanding ( $X=3.33$ ). Engagement levels are high, with students feeling more involved ( $X=3.35$ ) and interested ( $X=3.33$ ). Collaboration shows the strongest approval, students value group work ( $X=3.74$ ), peer learning ( $X=3.55$ ), and teamwork ( $X=3.50$ ). Low standard deviations indicate strong consensus, confirming that the flipped classroom effectively enhances interaction and collaborative learning experiences.

**Research Question Three:** What challenges do educators and students encounter in implementing flipped classroom instruction in vocational education programmes in tertiary institutions in Katsina state?

**Table 3 Mean and Standard Deviation of Respondents on Implementation Challenges**

S/N	Items	X	SD	Decision
21	Student lack of preparedness for pre-class work	3.27	0.44	Agree
22	Increased time and effort for lesson preparation	3.45	0.50	Agree
23	Unequal student access to digital resources	3.40	0.49	Agree
24	Student resistance to a new learning approach	3.14	0.35	Agree
25	Difficulty in designing engaging in-class activities	3.10	0.40	Agree

26	Challenges in effectively assessing student learning	3.12	0.33	Agree
27	Managing technical difficulties during implementation	3.28	0.51	Agree
28	Ensuring students complete pre-class assignments.	3.65	0.48	Strongly Agree
29	Educators needing new teaching skills and training	3.42	0.52	Agree
30	Time constraints for covering the curriculum	3.24	0.54	Agree
<b>Grand Mean</b>		<b>3.31</b>		

Table 3 shows that educators generally agree on the challenges of implementing the flipped classroom model, with a grand mean of 3.31. Major concerns include students' failure to complete pre-class tasks ( $X=3.65$ ) and the extra time required for lesson preparation ( $X=3.45$ ). Limited access to digital resources ( $X=3.40$ ) also poses a barrier. Other difficulties include student resistance ( $X=3.14$ ), designing engaging in-class activities ( $X=3.10$ ), and assessing learning ( $X=3.12$ ). Educators also note the need for training ( $X=3.42$ ) and time constraints ( $X=3.24$ ). Low standard deviations indicate broad consensus on these implementation challenges.

**Research Question Four:** What strategies are employed by educators to address implementation challenges and ensure effective delivery of flipped classroom instruction?

**Table 4: Mean and Standard Deviation of Respondents on Strategies to Overcome Challenges**

S/N	ITEMS	X	SD	DECISION
31	Providing robust pre-class support and resources	3.64	0.48	Strongly Agree
32	Collaborating on resource creation and lesson planning	3.15	0.39	Agree
33	Offering offline options and equitable access strategies	3.35	0.48	Agree
34	Clearly communicating benefits and scaffolding learning	3.71	0.46	Strongly Agree
35	Investing in training for interactive activity design	3.86	0.35	Strongly Agree
36	Employing diverse and formative assessment methods	3.66	0.48	Strongly Agree
37	Developing backup technology plans and support systems	3.33	0.47	Agree
38	Integrating accountability measures for pre-class work	3.16	0.37	Agree
39	Offering professional development and faculty mentorship	3.07	0.25	Agree
40	Prioritizing core concepts and strategic activity integration	3.08	0.27	Agree
<b>Grand Mean</b>		<b>3.40</b>		

Table four reveals strong agreement on strategies to address flipped classroom challenges, with a Grand Mean of 3.40. The most endorsed solution is investing in training for interactive activity design ( $X=3.86$ ), followed by clear communication of benefits ( $X=3.71$ ) and use of diverse assessments ( $X=3.66$ ). Providing robust pre-class support ( $X=3.64$ ) also ranks highly. Other key strategies include ensuring equitable access ( $X=3.35$ ), developing backup technology plans ( $X=3.33$ ), and fostering collaboration and professional development. Low standard deviations indicate strong consensus that these approaches effectively enhance implementation and sustainability of the flipped classroom model.

**Hypothesis One:** There is no significant difference in academic performance between students taught vocational education using flipped classroom instruction and those taught using the conventional lecture method in tertiary institutions in Katsina state.

Table 5: Comparison of Post-Test Academic Performance (ANCOVA)

Group	N	Mean (SD)	df	Fcal	Fcrit (0.05)	p-value	Decision
Flipped	100	73.80 (10.23)	1.97	117.35	3.89	< .001	Reject $H_0$
Conventional	100	67.02 (10.21)					

Table 5 shows that the flipped group achieved a higher mean post-test score ( $M = 73.80$ ) than the traditional group ( $M = 67.02$ ). The ANCOVA test revealed a statistically significant difference,  $F(1.197) = 117.35$ ,  $p < .001$ , indicating that the improvement was not due to chance. Decision: Reject  $H_0$ . Therefore, flipped instruction significantly improves students' academic performance compared to traditional instruction.

**Hypothesis Two:** There is no significant difference in students' perceived engagement between those exposed to flipped classroom instruction and those exposed to the conventional lecture method in tertiary institutions in Katsina state.

Table 6: Student Engagement Scores (t-test)

Group	N	Mean (SD)	df	Test Statistic (tcal)	tcrit (0.05)	p-value	Decision
Flipped	100	3.91 (0.48)	198	7.48	1.97	< .001	Reject $H_0$
Traditional	100	3.30 (0.66)					

Table 6 reveals that flipped classroom students reported a higher engagement score ( $M = 3.91$ ) compared to traditional classroom students ( $M = 3.30$ ). The difference was statistically significant,  $t \approx 7.48$ ,  $p < .001$ , showing that students were more actively involved in flipped settings. Decision: reject  $H_0$ , therefore, students in flipped classrooms are significantly more engaged than those in conventional classrooms.

**Hypothesis Three:**

1.  $H_0$ : Implementing flipped instruction does not significantly enhance collaborative learning and problem-solving skills in tertiary institutions in Katsina state.

**Table 7: Collaborative Learning Skills (t-test)**

Group	N	Mean (SD)	df	Test Statistic (tcal)	tcrit (0.05)	p-value	Decision
Flipped	100	4.08 (0.48)	198	8.35	1.97	< .001	Reject $H_0$
Traditional	100	3.46 (0.56)					

Table 7 indicates that flipped classroom students had stronger collaborative learning skills ( $M = 4.08$ ) compared to traditional classroom students ( $M = 3.46$ ). The t-test result,  $t \approx 8.35$ ,  $p < .001$ , confirms that this difference is highly significant. Decision: Reject  $H_0$ , therefore, flipped instruction significantly enhances collaborative learning and problem-solving skills compared to traditional methods.

### Discussion of Findings

The findings of this study demonstrate that the flipped classroom instruction significantly improves students' academic performance, engagement, and collaborative skills compared to traditional instruction. These outcomes are consistent with prior research emphasizing the positive influence of active learning and flipped pedagogies on student achievement and participation (Bishop & Verleger, 2013; O'Flaherty & Phillips, 2015). By reallocating classroom time from passive lectures to active learning, students engage with course materials prior to class, allowing face-to-face sessions to focus on interaction, critical thinking, and problem-solving. This approach fosters deeper conceptual understanding and meaningful learning experiences (Zainuddin & Halili, 2016).

Importantly, the results indicate that both male and female students benefit equally from flipped instruction, countering earlier assertions that active learning methods may create gender disparities (Lage, Platt, & Treglia, 2000). The findings further align with constructivist learning theory, which emphasizes knowledge construction through collaboration, participation, and reflection. However, successful implementation requires adequate teacher preparation, institutional support, and technological infrastructure. Without careful planning, flipped classrooms risk becoming superficial "watch-at-home" models with limited interactive engagement. Overall, this study provides empirical support that the flipped classroom approach outperforms traditional methods in fostering active engagement and improved learning outcomes.

### Conclusion

The flipped classroom instruction presents a transformative approach to teaching and learning, promoting student engagement, collaboration, and deeper comprehension. Results indicate that flipped instruction positively impacts academic performance and enhances critical thinking skills. However, challenges such as technological accessibility, instructor preparation, and student adaptation need to be addressed for effective implementation.

### Recommendations

Based on the study findings, the following recommendations are proposed:

1. Institutions should provide professional development and training to help educators design interactive pre-class materials and engaging in-class activities for effective flipped instruction.
2. ICT/Technology unit should ensure students have equitable access to devices, learning platforms, and reliable internet connectivity to complete pre-class activities efficiently.

3. Lecturers and instructors should restructure classroom time to emphasize problem-solving, teamwork, and peer interaction, fostering engagement, collaboration, and deeper learning.
4. Quality assurance and monitoring units should track student participation in pre-class activities and collect regular feedback from both students and educators to continuously improve the flipped classroom experience.

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