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EFFECT OF FORMATIVE ASSESSMENT METHOD ON SECONDARY SCHOOL STUDENTS UNDERSTANDING AND ACHIEVEMENT IN THEORY OF COST IN NASARAWA STATE, NIGERIA

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Abstract

This study examined the effect of formative assessment method on secondary school students' understanding and achievement in Theory of Cost in Nasarawa Local Government Area of Nasarawa State, Nigeria. A quasi-experimental research design involving pre-test and post-test control groups were adopted. The population comprised 5,550 (3752 male and 1798 female) SS II Economics students from 15 public government secondary schools in Nasarawa Local Government Area of Nasarawa State, Nigeria. The sample for this study consist 195 (111 male and 84 female) SS II Economics students using simple random sample technique. The instrument used for data collection was the Theory of Cost Achievement Test (TCAT). Validity index of 0.84 with the reliability index of 0.78 were obtained using content validity and Kuder-Richardson 20. The experimental group was taught using formative assessment method (test), while the control group was taught using the conventional teaching method. Mean and standard deviation were used to answer the research questions, while Analysis of Covariance (ANCOVA) was used to test the hypotheses at 0.05 level of significance. The findings revealed that students taught using formative assessment method had significantly higher mean achievement scores than those taught using the conventional teaching method. The results also showed a significant difference in achievement scores between male and female students taught using formative assessment method. The study concluded that formative assessment method is more effective in improving students' understanding and achievement in Theory of Cost than the conventional teaching method. Based on the findings, it was recommended that Economics teachers should adopt formative assessment methods to enhance students' understanding academic achievement and that attention should be given to gender differences in instructional practices to promote equitable learning outcomes.

Keywords: Formative Assessment Method, Understanding, Achievement, Test, Theory of Cost.

Introduction

Globally, assessment in education is an essential component of the teaching and learning process because it provides valuable information about students' understanding, progress and academic achievement. Traditionally, assessment has been used primarily to measure learning outcomes and determine whether instructional objectives have been achieved. However, contemporary educational research has shifted the focus from assessment as merely an instrument for measuring learning to assessment as a strategy for improving learning. This shift reflects the

growing recognition that effective assessment should not only evaluate what students have learned but also provide timely information that guides teaching and supports students in achieving better learning outcomes.

Among the different assessment approaches, formative assessment has gained considerable attention because of its ability to improve teaching and learning through continuous monitoring and feedback. Unlike summative assessment, which is conducted at the end of a learning period to evaluate students' overall achievement, formative assessment is integrated into

the instructional process and is designed to identify students' strengths, weaknesses, and learning needs while learning is taking place. It enables teachers to adjust instructional strategies based on students' performance and provides learners with timely feedback that helps them recognize misconceptions, improve understanding and take responsibility for their own learning. Through classroom questioning, quizzes, assignments, peer assessment, self-assessment and constructive feedback, formative assessment encourages active participation and promotes deeper understanding of subject content (Alemdag & Narciss, 2025). These strategies enable teachers to identify students' learning difficulties, provide timely support, and modify instructional approaches based on learners' needs. Furthermore, formative assessment helps students become more reflective and independent learners by encouraging them to evaluate their own progress, recognize areas for improvement, and take greater responsibility for their learning outcomes.

Ajogbeje (2019) defined assessment as the use of a variety of procedures to collect information about learning and instruction. According to the author, assessment can be categorized into two major types: formative and summative assessment. Formative assessment, commonly referred to as assessment for learning, focuses on monitoring students' responses to instruction and tracking their progress throughout the learning process. Summative assessment, on the other hand, is conducted at the end of instruction or a programme to determine the extent to which students have achieved the intended learning outcomes. While both forms of assessment are important, formative assessment is increasingly recognized as more effective for improving students' learning because it provides continuous opportunities for feedback, reflection and instructional adjustment. As Shepard (2016) observed, when teachers focus on assessment as a means of improving learning rather than simply collecting information for grading or certification, assessment becomes a powerful tool for enhancing students' competence and academic success.

The growing emphasis on formative assessment is supported by empirical evidence demonstrating its positive influence on students' academic achievement.

Recent studies have shown that regular formative assessment practices significantly improve students' understanding, motivation, self-regulation, and overall learning outcomes by enabling teachers to identify learning difficulties early and provide appropriate instructional support. For example, the review by John and Gregory (2023) reaffirmed that feedback and formative assessment remain among the most influential classroom practices for improving student achievement. Similarly, the Education Endowment Foundation has consistently reported that high-quality formative assessment can produce meaningful gains in students' academic performance, particularly when feedback is timely, specific and used to modify instruction.

The importance of formative assessment is particularly evident in Economics education, where students are expected to understand abstract concepts, interpret data, analyse economic problems and apply theoretical knowledge to real-life situations. Many secondary school students experience difficulties in mastering concepts such as demand and supply, inflation, national income, market structures, theory of cost and fiscal and monetary policies because these topics require analytical thinking and the ability to connect theory with practice. Traditional assessment methods often identify these learning difficulties only after instruction has been completed, leaving little opportunity for improvement. In contrast, formative assessment enables Economics teachers to detect misconceptions as they occur, provide immediate corrective feedback, and modify instructional strategies to meet students' learning needs. Activities such as classroom discussions, concept tests, quizzes, case studies, peer assessment, and reflective exercises promote active engagement, critical thinking, and deeper conceptual understanding, thereby improving students' achievement in Economics (Salihu, 2026). These formative assessment activities provide learners with opportunities to apply economic concepts to real-life situations, receive continuous feedback and correct misconceptions during the learning process. They also enable teachers to monitor students' progress, identify areas of difficulty, and adjust instructional strategies to enhance effective learning and academic achievement.

Despite the recognized benefits of formative assessment, its implementation in many secondary schools remains inadequate. In many classrooms, assessment continues to be dominated by summative examinations, with limited use of continuous feedback and assessment strategies that actively support learning. As a result, many students continue to experience persistent learning difficulties and unsatisfactory academic performance in Economics. This situation underscores the need for greater integration of formative assessment into classroom instruction as a means of enhancing students' understanding, promoting meaningful learning, and improving academic achievement in Economics.

Formative assessment methods include classroom questioning, feedback, classroom discussions, quizzes, peer assessment, self-assessment and observation. These strategies enable teachers to gather evidence about students' learning, identify misconceptions, and make instructional decisions that improve students' understanding and achievement. Recent studies have shown that effective formative assessment practices involve the use of learning targets, questioning, feedback, self-assessment, peer assessment, and continuous adjustment of teaching strategies to support learners' progress (Philhower, 2025). In addition, formative assessment practices that incorporate feedback, peer interaction, and self-reflection can strengthen students' engagement and promote deeper learning (Alemdag & Narciss, 2025). The formative assessment method involves collecting evidence about students' knowledge, skills and misconceptions while learning is taking place. Teachers use this information to modify their teaching strategies, while students use feedback to improve their understanding and correct errors.

Formative assessment is conducted during the instructional process to monitor students' learning, identify areas of difficulty, and provide immediate feedback that improves understanding. In the teaching of Theory of Cost, formative assessment enables the teacher to organize the topic into manageable subtopics such as fixed cost, variable cost, total cost, average cost, marginal cost, and short-run and long-run cost curves. Assessing students after each subtopic allows the teacher to identify misconceptions before

introducing more advanced concepts. For instance, students who experience difficulty distinguishing between fixed and variable costs or calculating marginal and average costs can receive immediate corrective instruction, guided practice, and additional learning activities. This continuous feedback strengthens students' conceptual understanding and reduces the likelihood of persistent learning gaps.

Ajogbeje (2019) emphasized that formative testing involves breaking subject content into smaller hierarchical units, specifying clear instructional objectives for each unit, providing remediation where students demonstrate deficiencies, and administering summative assessments after all instructional units have been completed. Applied to Theory of Cost, this approach ensures that students master each fundamental concept before progressing to more complex topics, such as the relationships among cost functions, cost curves, and production decisions. The hierarchical organization of learning helps students connect individual concepts logically, thereby promoting deeper understanding and better retention.

Furthermore, Ojugo (2015) argued that dividing subject content into smaller instructional units enables students to prepare more effectively for assessments. In the context of Theory of Cost, frequent formative assessments encourage students to engage consistently with numerical calculations, graphical analysis of cost curves, and the interpretation of cost behaviour in business situations. Regular classroom quizzes, problem-solving exercises, and teacher feedback promote active participation, reveal misconceptions early, and provide opportunities for timely correction. Consequently, students develop greater confidence in applying cost concepts to practical economic situations, leading to improved achievement and a more meaningful understanding of Theory of Cost.

Formative assessment is widely recognized as an instructional approach that integrates assessment with teaching to improve students' learning rather than merely measure achievement at the end of instruction. Although scholars describe the concept from slightly different perspectives, they share the view that formative assessment provides continuous information about students' learning progress, enabling teachers to

identify learning difficulties, adjust instructional strategies, and provide timely feedback. For example, Tahir, Tariq, Mubashira and Rabbia (2017) emphasize its diagnostic function during instruction, while Ugodulunwa and Okolo (2015) stress that its effectiveness depends on the use of valid assessment tools and the appropriate application of assessment results to improve teaching and learning. Similarly, the Assessment Reform Group (2016) views formative assessment as "assessment for learning," highlighting that its primary purpose is to promote learning rather than accountability or certification. Extending this perspective, William, Lee and Black (2015) argue that formative assessment should generate evidence not only of what students know but also of how and when they apply their knowledge, thereby enabling teachers to make informed instructional decisions. Afemikhe (2018) reinforces this position by emphasizing that the information generated through formative assessment should be used to refine instruction and provide targeted feedback that supports students' learning.

Collectively, these perspectives suggest that formative assessment is most effective when assessment evidence is continuously gathered, interpreted, and used to improve instruction and students' understanding. In the present study, this conception is particularly relevant because formative assessment is expected to provide continuous feedback on students' understanding of Theory of Cost, allowing the teacher to identify misconceptions, provide timely remediation, and strengthen students' mastery of cost concepts before introducing more complex aspects of the topic.

Economics is one of the core subjects offered in senior secondary schools in Nigeria for those that want to offer it at the tertiary level. Within the Economics curriculum, Theory of Cost is a fundamental topic that explains the relationship between production costs, output, and business decision-making. It introduces students to concepts such as fixed cost, variable cost, total cost, average cost, marginal cost, and cost curves. Mastery of these concepts is essential because they provide the foundation for understanding production decisions, pricing strategies, and resource allocation in economics and business studies.

Despite its importance, many senior secondary school students experience difficulty in learning Theory of Cost because the topic requires analytical reasoning, graphical interpretation, and mathematical calculations. These challenges are often reflected in students' poor performance in classroom tests and external examinations, suggesting that many learners do not develop an adequate understanding of the underlying cost concepts. One factor that may contribute to students' poor achievement is the continued reliance on traditional teaching methods in which assessment is conducted primarily at the end of instruction. Such assessment practices focus mainly on measuring learning outcomes and often fail to identify students' misconceptions while learning is taking place. As a result, teachers have limited opportunities to provide timely remediation before students' progress to more complex concepts.

Formative assessment offers an alternative instructional approach by integrating assessment with the teaching and learning process. Through regular classroom questioning, quizzes, problem-solving activities, and constructive feedback, teachers can identify students' strengths and learning difficulties, modify instruction and provide immediate support where necessary. In the teaching of Theory of Cost, formative assessment can help students correct misconceptions about cost concepts, improve their ability to perform cost calculations and interpret cost curves, and develop a deeper conceptual understanding of the topic. The use of formative assessment is supported by constructivist learning theory and the Assessment for Learning perspective, both of which emphasize that students learn more effectively when they actively participate in the learning process, receive continuous feedback, and reflect on their understanding. These theoretical perspectives provide a basis for examining whether formative assessment can improve students' achievement in Theory of Cost among senior secondary school students.

Despite the recognized benefits of formative assessment, evidence suggests that many secondary school teachers in Nigeria continue to place greater emphasis on summative examinations than on continuous formative assessment practices. As a result,

students often receive limited feedback during instruction, reducing opportunities to identify and correct misconceptions before the completion of a topic. This situation may contribute to the persistent poor performance observed in challenging Economics topics such as Theory of Cost. In Nasarawa State Nigeria, concerns have been expressed about students' achievement in Economics, particularly in topics that require analytical reasoning, graphical interpretation, and problem-solving skills. Although previous studies have examined the effect of formative assessment on students' academic achievement across different school subjects, there is limited empirical evidence on its effectiveness in improving students' achievement in Theory of Cost among senior secondary school students in Nasarawa State, Nigeria. This gap underscores the need for the present study, which investigates the effect of formative assessment on students' achievement in Theory of Cost in senior secondary schools in Nasarawa State, Nigeria.

In the present study, students' achievement refers to the extent to which senior secondary school students acquire knowledge, understanding, and problem-solving skills in Theory of Cost after instruction. It reflects their ability to explain, calculate, interpret, and apply concepts such as fixed cost, variable cost, total cost, average cost, marginal cost, and cost curves to economic situations. Students' achievement serves as the dependent variable because it is expected to reflect the effect of the formative assessment intervention. It will be measured using students' scores on the Theory of Cost Achievement Test (TCAT) administered after the instructional period. Higher scores indicate greater mastery of Theory of Cost concepts, whereas lower scores indicate limited understanding of the topic. One of the issues in education today is students' achievement in relation to teaching and learning outcomes. Hassan (2016) opined that effective learning and sound academic achievement contribute to national development. It is of great importance to parents, teachers, students, and society because school graduates are expected to contribute meaningfully to societal development.

The moderating variable in this study is gender. Gender is an attribute variable that classifies students as either male or female and is examined to determine

whether differences exist in students' achievement after exposure to formative assessment. Although gender is not manipulated experimentally, it is included to determine whether male and female students respond differently to the same instructional strategy. Since formative assessment actively engages learners through continuous feedback, monitoring, and participation, it is important to investigate whether its use reduces or eliminates gender disparities in students' achievement in Economics. Operationally, gender refers to the biological classification of participating students as male or female based on school records.

Empirical studies have consistently shown that formative assessment enhances students' academic achievement across different subject areas. For instance, Bulus and John (2023) reported that students' achievement in Economics improved significantly after exposure to formative assessment with feedback. Similarly, Galle, Ezeofor, and Ofomata (2022) found that students taught Mathematics using formative assessment outperformed those taught using the conventional method. Likewise, Matilda, Orheruata, and Oyakhirome (2019), Oti, Ariya, and Salau (2019), Olagunju (2015) and Ojugo et al. (2015) all reported positive effects of formative assessment on students' academic achievement and learning outcomes in Mathematics and Social Studies.

A comparison of these studies reveals a consistent pattern that formative assessment promotes improved learning regardless of the subject taught. Furthermore, most of the reviewed studies, including those by Galle et al. (2022), Matilda et al. (2019), and Olagunju (2015), found no significant gender differences in students' achievement following exposure to formative assessment. These findings suggest that formative assessment provides equitable learning opportunities for both male and female students. However, while previous studies have concentrated mainly on Mathematics and Social Studies, relatively few have examined the influence of formative assessment on students' achievement in Economics, particularly with gender serving as a moderating variable. This gap provides the justification for the present study, which seeks to determine whether formative assessment improves students' achievement

in Economics and whether gender moderates its effectiveness.

Gender is a social construct that defines the roles, expectations, behaviours, and identities associated with males and females within a given society. According to Ezeh (2013), gender refers to the relative power, influence, roles, and expectations (femininity and masculinity) that society assigns to the two sexes on a differential basis. Therefore, gender represents the distinguishing characteristics and socially constructed attributes that differentiate males from females. In educational research, gender has remained an important variable because differences in socialization, learning experiences, classroom participation, and access to educational resources may influence students' academic outcomes.

The influence of gender on students' academic achievement and retention, particularly in science-related subjects and Mathematics, has generated considerable debate among researchers. However, findings from previous studies have not been consistent. Some studies have reported significant differences in academic achievement in favour of male students (Augustinah & Bolajoko, 2014; Allahnana et al., 2018), suggesting that social expectations, confidence levels, and exposure to learning opportunities may contribute to male advantages in certain contexts. Conversely, other researchers have found higher achievement among female students (Owodunni & Ogundola, 2013; Kwame et al., 2015; Amalu, 2017), indicating that female students may perform better where classroom environments, motivation, and instructional support encourage active participation. In contrast, some studies have reported no significant gender differences in students' academic achievement (Oluwatayo & James, 2011; Ajai & Imoko, 2015), implying that when students receive similar instructional opportunities, gender may have limited influence on learning outcomes.

The inconsistent findings across studies may be attributed to differences in subject areas, geographical locations, educational levels, teaching methods, assessment approaches, cultural expectations, and students' learning environments. For instance, instructional strategies that promote continuous

feedback, participation, and learner engagement may reduce gender disparities by providing equal opportunities for both male and female students. Moyosore (2015) supported this view by concluding that consistent exposure to formative assessment reduces the influence of gender on students' academic achievement.

Recent studies have further examined the relationship between gender and academic achievement within specific educational contexts. Nwanne (2026) investigated students' achievement trends in Economics at WASSCE from 2013 to 2023 and found fluctuations in performance over the period, with no significant difference in achievement based on gender. Although male students recorded a slightly higher average credit pass rate than females, the difference was not sufficient to establish gender as a determining factor in Economics achievement. This finding suggests that other factors, such as instructional quality, assessment practices, and school conditions, may have stronger influences on students' performance.

Similarly, Ejembi et al. (2024) reported that the difference between male and female students' mean achievement scores in Mathematics was not statistically significant. Their findings support the argument that appropriate instructional strategies can minimize gender-related achievement differences. The recommendation that teachers should regularly use the "muddiest point" assessment technique further highlights the role of learner-centred formative assessment practices in improving achievement.

Studies focusing on formative assessment have also provided evidence that gender may not significantly affect students' responses to improved instructional strategies. Olumide et al. (2026) found that formative assessment strategies significantly improved students' academic achievement in Social Studies in Nasarawa State, Nigeria public junior secondary schools. The study further revealed significant effects of formative assessment when achievement was examined according to gender, suggesting that both male and female students benefited from the instructional approach. Similarly, Salihu and Isaac (2020) found that formative assessment reduced students' anxiety

levels and significantly improved achievement in Econometrics.

Although some studies have identified gender differences in academic achievement, the general trend of recent research indicates that effective instructional strategies, particularly formative assessment, can reduce achievement gaps between male and female students. Nevertheless, limited studies have examined whether gender moderates the effect of formative assessment on students' achievement in Economics, especially in the context of Nasarawa State, Nigeria. Therefore, the present study seeks to fill this gap by investigating the influence of formative assessment on students' achievement in Economics while examining gender as a moderating variable.

Despite the importance of Economics in developing students' understanding of economic principles and preparing them for further education and future careers, students' achievement in the subject at the senior secondary school level remains a concern. In particular, the topic of Theory of Cost, which includes concepts such as fixed cost, variable cost, total cost, average cost, marginal cost and cost curves, has been identified as an area where many students experience difficulties. Evidence from [insert examination report/study source] indicates that students demonstrate weak performance in Economics, particularly in questions requiring the application and interpretation of cost concepts. For example, [insert specific statistics or findings showing students' poor achievement in Theory of Cost. The poor achievement of students in Theory of Cost may be associated with the continued use of teacher-centred instructional approaches, limited opportunities for active learning, and assessment practices that focus mainly on grading rather than improving understanding. Although assessment is an essential component of teaching and learning, many classroom tests are used primarily as measurement tools rather than as instructional strategies that promote retrieval, feedback, and conceptual understanding. Consequently, students may have limited opportunities to correct misconceptions, practise economic concepts, and improve their retention of knowledge.

Although previous studies have established that formative and assessment-based instructional strategies can enhance students' academic achievement in different subjects, limited empirical evidence exists on the effect of using tests as an instructional strategy on students' achievement in Theory of Cost among senior secondary school students in Nasarawa Local Government Area of Nasarawa State, Nigeria. Furthermore, previous studies on gender differences in academic achievement have produced inconsistent findings, with some reporting significant differences between male and female students while others found no significant difference. This inconsistency creates the need to determine whether gender influences students' achievement when tests are used as an instructional strategy.

Therefore, the problem of this study is the limited empirical evidence on whether the use of tests as an instructional strategy improves students' achievement in Theory of Cost and whether male and female students benefit differently from this approach. The study therefore sought to determine the effect of formative using tests on senior secondary school students' achievement in Theory of Cost and examine the moderating influence of gender in Nasarawa Local Government Area of Nasarawa State, Nigeria.

Research Questions

- i. What are the mean achievement scores of secondary school students taught Theory of Cost using test and those taught using the conventional teaching method in in Nasarawa Local Government Area of Nasarawa State, Nigeria?
- ii. What are the difference in the mean achievement scores of male and female secondary school students taught Theory of Cost using test senior secondary schools in Nasarawa Local Government Area of Nasarawa State, Nigeria?

Objectives

- i. To determine the mean achievement scores of secondary schools students

- taught Theory of Cost using test and those taught using the conventional teaching method in in Nasarawa Local Government Area of Nasarawa State, Nigeria
- ii. To examine the difference in the mean achievement scores of male and female secondary school students taught Theory of Cost using test in in Nasarawa Local Government Area of Nasarawa State, Nigeria

Hypotheses

H₀₁: There is no significant difference in the mean achievement scores of secondary school students taught the Theory of Cost using test and those taught using the conventional teaching method in Nasarawa Local Government Area of Nasarawa State, Nigeria.

H₀₂: There is no significant difference in mean achievement scores of male and female secondary school students taught Theory of Cost using test in Nasarawa Local Government Area of Nasarawa State, Nigeria.

Methodology

The study employed a quasi-experimental research design involving a non-randomized pretest–posttest control group design. This design was considered appropriate because random assignment of participants was not feasible, as intact classes were used as the experimental and control groups. The selection of intact classes was based on the existing school organizational structure, where altering class composition could disrupt the normal academic activities and instructional arrangements.

To address potential threats to internal validity associated with the use of intact groups, a pretest was administered to both groups before the intervention to determine their initial equivalence. The groups were exposed to similar learning conditions, curriculum content, instructional duration, and assessment procedures, with the instructional method being the primary difference between the experimental and control groups. Furthermore, the intervention was implemented within the same period to reduce the influence of maturation and historical events on the outcomes. These measures helped to minimize possible selection bias and other validity threats while maintaining the natural classroom setting of the study.

Table 1: Illustration of the Research Design of the Study

Group	Achievement			Interest		
Experimental Group A:	0 ₁	X ₁	0 ₂	0 ₃	X ₁	0 ₄
Control Group B:	0 ₁	-	0 ₂	0 ₃	-	0 ₄

Where:

0₁ = Pretest with SEAT

0₂ = Post-test with SEAT

X₁ = Treatment (use of formative assessment technique)

- = No treatment (use of conventional technique)

The population of the study comprised 5,550 Senior Secondary School II (SS II) Economics students

(3,752 males and 1,798 females) from 15 public secondary schools in Nasarawa Local Government Area of Nasarawa State, Nigeria. A sample of 195 SS II Economics students was selected from two public secondary schools in the study area. The two schools were selected using a purposive sampling technique based on the availability of SS II Economics classes, comparable academic facilities and willingness of the schools to participate in the study. The two intact classes were assigned as experimental and control groups through a simple balloting procedure to minimize researcher bias. The experimental group

consisted of 125 students (72 males and 53 females), while the control group consisted of 70 students (39 males and 31 females). The experimental group was exposed to the formative assessment instructional method, while the control group was taught using the conventional assessment method. Gender was considered as a moderator variable to determine whether students' gender influenced the effect of the instructional method on achievement.

The intervention lasted for two weeks and consisted of four lessons delivered at two periods per week. During the intervention, students in the experimental group received formative assessment activities integrated into regular Economics lessons. These activities included periodic classroom assessments, quizzes, questioning sessions and learning tasks designed to monitor students' understanding. Immediate and constructive feedback was provided to students based on their responses, enabling them to identify learning difficulties and improve their performance.

The control group was taught using the conventional assessment method, where instruction was delivered through the usual teaching approach involving explanation of concepts, classroom exercises and assessment activities conducted at the teacher's discretion without the systematic use of formative assessment feedback strategies. To minimize teacher-related effects, the same teacher taught both the experimental and control groups using the same instructional content and lesson objectives. Where different teachers were involved, their qualifications, teaching experience, and instructional procedures were considered to ensure comparability between groups.

The instrument used for data collection was the Theory of Cost Achievement Test (TCAT), which was administered as both pretest and posttest. The TCAT consisted of two sections: Section A contained students' demographic information, while Section B consisted of 30 multiple-choice Economics items

based on the Theory of Cost. Each item had four options (A–D), from which students selected the correct answer.

The construction of the TCAT was guided by the Economics curriculum and the specific learning objectives of the Theory of Cost. The instrument was subjected to validation by two experts in Educational Measurement and Evaluation and Economics Education from the Faculty of Education, Nasarawa State University, Keffi, Nigeria. The experts assessed the items based on clarity, relevance, content coverage, alignment with instructional objectives, and appropriateness of difficulty level. Their suggestions regarding ambiguous items, content coverage and item construction were incorporated into the final version of the instrument, thereby improving its content validity of 0.87 index using content validity.

The validated instrument was pilot-tested among 20 SS II Economics students from Government Secondary School Nasarawa Local Government of Nasarawa State, Nigeria, who were not part of the main study sample. The pilot testing was conducted to determine the reliability of the instrument and identify items requiring modification. The reliability coefficient of the TCAT was established using the Kuder–Richardson Formula 20 (KR-20), which yielded a coefficient of 0.78, indicating that the instrument had acceptable internal consistency.

Permission to conduct the study was obtained from the relevant school authorities. The purpose and procedures of the study were explained to the participants and participation was conducted in accordance with ethical research principles. Students' participation was voluntary, and confidentiality of participants' information was maintained throughout the study. Data collected were used strictly for research purposes and students' identities were protected through the use of codes rather than personal identifiers.

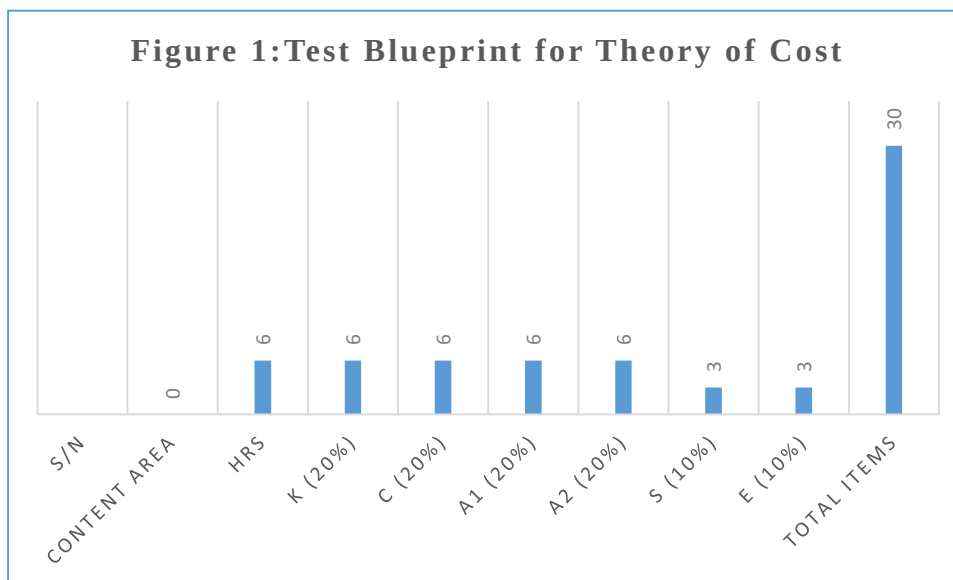
Table 2: Test Blueprint for Theory of Cost

S/N	Content Area	Hrs	K (20%)	C (20%)	A1 (20%)	A2 (20%)	S (10%)	E (10%)	Total Items
1	Meaning of Cost (33%)	2	2 (1–2)	2 (3–4)	2 (5–6)	2 (7–8)	1 (9)	1 (10)	10
2	Classifications of Cost (33%)	2	2 (11–12)	2 (13–14)	2 (15–16)	2 (17–18)	1 (19)	1 (20)	10
3	Application of Cost Theory (34%)	2	2 (21–22)	2 (23–24)	2 (25–26)	2 (27–28)	1 (29)	1 (30)	10
	Total Items	6	6	6	6	6	3	3	30

Key: K=Knowledge, C= Comprehension, A1=Application, A2=Analysis, S=Synthesis and E=Evaluation.

Table 2 presents the test blueprint for the “Theory of Cost” in Economics, showing how instructional time, content areas, and test items are distributed across different cognitive levels. The topic is divided into three main content areas: Meaning of Cost, Classifications of Cost and Application of Cost Theory. Each content area carries a similar weight (about 33%–34%) and is allocated 2 instructional hours, giving a total of 6 hours for the entire topic. In terms of assessment, a total of 30 test items were constructed and distributed evenly across the three content areas, with each section containing 10 items. These items are further spread across six cognitive levels: Knowledge (K), Comprehension (C),

Application A1, Application A2, Synthesis (S), and Evaluation (E). The Knowledge, Comprehension, Application A1, and Application A2 levels each contain 6 items in total (2 items per content area per level). The Synthesis and Evaluation levels contain 3 items each in total, reflecting fewer but higher-order thinking tasks. The table shows a balanced assessment structure that ensures students are evaluated across both lower-order and higher-order cognitive skills, while maintaining equal emphasis on all sections of the Theory of Cost. The mean and standard deviation was used to answer research questions. The null hypotheses was tested using ANCOVA at alpha 0.05 level of significance.



Results and Discussion

The results are presented in tables below:

Research Question 1: What are the mean achievement scores of secondary school students taught Theory of Cost using test and those taught using the conventional teaching method in in

Nasarawa Local Government Area of Nasarawa State, Nigeria?

Table1 3: The Means and Standard Deviation for students Achievement Scores

Group	No. of Students	Pretest		Posttest		Achievement Gain
		Mean	SD	Mean	SD	
Experimental Group	125	23.43	10.01	41.18	13.51	17.75
Control Group	70	22.64	11.07	35.26	15.45	12.62

Table 3 presents the pre-test and post-test mean scores, standard deviations and achievement gains of students taught Theory of Cost using two different instructional methods: the test-based (experimental) method and the conventional teaching method. At the pre-test stage, the experimental group had a mean score of 23.43 with a standard deviation of 10.01, while the control group had a mean score of 22.64 with a standard deviation of 11.07. This indicates that both groups had almost similar levels of prior knowledge before the treatment, as their mean scores were closely matched. After the instructional period, there was a noticeable improvement in the post-test mean scores of both groups. The experimental group recorded a higher post-test mean score of 41.18 with a standard deviation of 13.51, while the control group recorded a lower post-test mean score of 35.26 with a standard deviation of 15.45. This shows that both teaching methods improved students' achievement, but the experimental

group performed better. In terms of achievement gain, the experimental group recorded a mean gain score of 17.75, whereas the control group recorded a mean gain score of 12.62. This indicates that students taught using the test-based method achieved greater improvement in their performance compared to those taught using the conventional method. The result suggests that the use of test as a teaching and assessment strategy had a more positive effect on students' achievement in Theory of Cost than the conventional teaching method in Nasarawa Local Government Area of Nasarawa State, Nigeria.

Research Question 2: What are the difference in the mean achievement scores of male and female secondary school students taught Theory of Cost using test in Nasarawa Local Government Area of Nasarawa State, Nigeria.

Table 4: The Mean and Standard Deviation Scores of Male and Female Students

Group	No. of Students	Pretest		Posttest		Mean Achievement Gain
		Mean	SD	Mean	SD	
Male	125	21.13	4.70	41.84	6.46	19.71
Female	70	20.56	4.53	32.15	5.67	11.59

Table 4 presents the pre-test and post-test mean scores, standard deviations, and mean gain scores of male and female secondary school students taught Theory of Cost using the test-based instructional method. At the pre-test stage, male students recorded

a mean score of 21.13 with a standard deviation of 4.70, while female students recorded a mean score of 20.56 with a standard deviation of 4.53. This indicates that both groups had similar entry-level knowledge before the treatment, with only a slight difference in

favour of male students. After the instructional period, both groups showed improvement in their post-test scores. Male students recorded a higher post-test mean score of 41.84 with a standard deviation of 6.46, while female students recorded a post-test mean score of 32.15 with a standard deviation of 5.67. This suggests that the test-based instructional method improved achievement for both male and female students, although the improvement was more pronounced among male students. In terms of mean gain scores, male students achieved a gain of 19.71, whereas female students recorded a gain of 11.59. This indicates a notable difference in achievement improvement in favour of male students. The result shows that while both male and female students

benefited from the use of test-based instruction in learning Theory of Cost, male students demonstrated a higher level of achievement gain compared to female students in Nasarawa Local Government Area of Nasarawa State, Nigeria.

Testing of the Hypotheses

Ho₁: There is no significant difference in the mean achievement scores of secondary school students taught Theory of Cost using test and those taught using the conventional teaching method in senior secondary schools in Nasarawa Local Government Area of Nasarawa State, Nigeria.

Table 5: Summary of ANCOVA for Students Achievement Scores

Source of Variation	Type III Sum of Squares	DF	Mean Squares	F	Sig.
Corrected Model	44304.51	2	22152.27	0.499	0.002
Intercept	620.98	1	253.17	0.486	0.002
Pretest	6462.21	1	2594.72	0.426	0.002
Group	41308.83	1	168.23	21.243	0.002
Error	5953.28	193	46.26		
Total	344586.01	195			
Corrected Total	50257.81	194			

Table 5 presents the Analysis of Covariance (ANCOVA) used to test whether there is a significant difference in the achievement mean scores of students taught Theory of Cost using the test-based instructional method and those taught using the conventional method, while controlling for pre-test scores. The results show that the group (instructional method) had a significant effect on students' achievement. This is indicated by an F-value of 21.243 with a significance value ($p = 0.002$), which is less than the 0.05 alpha level. Therefore, the null hypothesis (H_{01}), which states that there is no significant difference in the achievement mean scores of students taught using test and those taught using the conventional method, is rejected. This finding implies that there is a statistically significant difference in achievement between the two groups, and the difference is in favour of the experimental group taught using the test-based instructional method. The

table also shows that the pre-test score was controlled in the analysis ($F = 0.426$, $p = 0.002$), indicating that students' initial ability levels were adjusted for in determining the effect of the treatment. The corrected model is statistically significant, suggesting that the overall model adequately explains variations in students' achievement scores. The result demonstrates that the use of test as an instructional strategy has a significant positive effect on students' achievement in Theory of Cost compared to the conventional teaching method in Nasarawa Local Government Area of Nasarawa State, Nigeria.

Ho₂: There is no significant difference in the mean achievement scores of male and female secondary school students taught Theory of Cost using test in Nasarawa Local Government Area of Nasarawa State, Nigeria.

Table 6: Summary of ANCOVA for Student Interest Scores of Male and Female Students

Source of Variation	Type III Sum of Squares	DF	Mean Squares	F	Sig.
Corrected Model	14304.53	2	276.28	189.028	0.002
Intercept	420.99	1	569.599	44.716	0.002
Pretest	5462.22	1	2494.72	116.15	0.002
Gender	21308.84	1	268.24	346.894	0.002
Error	4953.29	193	5.260		
Total	144586.00	195			
Corrected Total	30257.82	194			

Table 6 presents the Analysis of Covariance (ANCOVA) used to determine whether there is a significant difference in the achievement mean scores of male and female secondary school students taught Theory of Cost using the test-based instructional method, while controlling for pre-test scores. The result shows that gender has a statistically significant effect on students' achievement. This is indicated by an F-value of 346.894 with a significance value ($p = 0.002$), which is less than the 0.05 level of significance. Therefore, the null hypothesis (H_{02}), which states that there is no significant difference in the achievement mean scores of male and female students taught Theory of Cost using test, is rejected. This finding implies that a significant difference exists in the achievement of male and female students exposed to the test-based instructional method, with gender influencing students' performance in Theory of Cost. The table also shows that the pre-test scores were controlled in the analysis ($F = 116.15$, $p = 0.002$), indicating that prior knowledge was accounted for in determining the effect of gender on achievement. The corrected model is also statistically significant, suggesting that the model is appropriate for explaining variations in students' achievement scores. The result reveals that gender significantly influences students' achievement in Theory of Cost when taught using test in Nasarawa Local Government Area of Nasarawa State, Nigeria.

Discussion of the Results

The findings of this study revealed that the instructional method (test-based teaching) had a significant effect on students' achievement in Theory

of Cost. The result of Hypothesis one showed that students taught using the test-based method performed significantly better than those taught using the conventional teaching method. This finding agrees with the view that formative and test-based assessment strategies enhance learning by providing continuous feedback, identifying learning gaps, and improving students' understanding of concepts. It is also consistent with earlier studies that reported the effectiveness of formative assessment in improving students' academic achievement across different subjects. For example, Ejembi et al. (2024) found that formative classroom assessment techniques, such as the "muddiest point" strategy, significantly improved students' academic performance in Mathematics. Similarly, Moyosore (2015) concluded that consistent exposure to formative assessment reduces performance gaps and enhances students' achievement. These findings support the present study, which demonstrates that integrating test-based instructional strategies into classroom teaching improves students' performance in Economics, particularly in the Theory of Cost.

However, the result of Hypothesis Two revealed a significant difference in the mean achievement scores of male and female students taught using the test-based method, with gender influencing students' achievement. This finding is in contrast with some previous studies. For instance, Oluwatayo and James (2011) and Ajai and Imoko (2015) reported no significant gender difference in Mathematics achievement, suggesting that both male and female students perform equally when given similar learning conditions. In the same line, Moyosore (2015) also

found that when students are consistently exposed to formative assessment, gender has no significant influence on academic achievement. Likewise, Ejembi et al. (2024) reported no statistically significant difference between male and female students' achievement in Mathematics when effective instructional strategies were used. On the other hand, the present finding aligns with studies that reported gender differences in academic achievement. Augustinah and Bolajoko (2014) and Allahnana et al. (2018) found that male students performed better in some academic contexts, while Owodunni and Ogundola (2013), Kwame et al. (2015), and Amalu (2017) reported findings favouring female students in certain subjects. This inconsistency in research findings suggests that gender influence on academic achievement may depend on factors such as teaching strategy, subject matter, learning environment, and student characteristics. Furthermore, the findings of Nwanne (2026) support the idea that while gender differences may exist in some cases, they are often marginal and not always statistically significant. The study reported only slight differences in performance between male and female students in Economics at WASSCE, indicating that gender gaps may not be substantial when appropriate instructional conditions are provided. Findings of this study suggest that the test-based instructional method is effective in improving students' achievement in Theory of Cost. However, gender appears to influence achievement under this instructional approach, although existing literature presents mixed results. This implies that while instructional strategies such as formative testing are beneficial, other contextual factors may also interact with gender to influence students' academic performance.

Conclusion

Based on the findings of the study, it was concluded that formative assessment had a significant positive effect on secondary school students' understanding and achievement in the Theory of Cost in Nasarawa

State, Nigeria. Students who were exposed to formative assessment in terms of test achieved higher mean achievement scores compared with those taught using the conventional assessment method. This indicates that the use of continuous assessment activities, timely feedback and opportunities for students to identify and correct learning difficulties enhanced students' understanding of economics concepts and improved their academic performance.

The study also concluded that gender influenced students' achievement in the Theory of Cost. Although both male and female students benefited from formative assessment in terms of test, differences existed in their achievement levels. The findings implies that formative assessment provides opportunities for both male and female students to participate actively in the learning process; however, attention should be given to ensuring that assessment activities are inclusive and support the learning needs of all students regardless of gender.

Recommendations

- i. Economics teachers in secondary schools should adopt formative assessment strategies in teaching the Theory of Cost and other difficult Economics concepts. Regular classroom assessments, constructive feedback and correction of students' misconceptions should be integrated into teaching practices to improve students' understanding and achievement.
- ii. Teachers and school administrators should ensure that formative assessment practices are gender-responsive by providing equal learning opportunities and encouraging active participation of both male and female students. Special attention should be given to identifying and addressing factors that may contribute to achievement differences between male and female students.

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