

# Assessing Computer Science Teachers' Competence in Constructing Essay Test Items: A Comparative Study of Lower and Higher Order Thinking Skills in Junior Secondary Schools in Benue State

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**Abstract:** This study assessed the competence of junior secondary school Computer Science teachers in Benue State, Nigeria, in constructing essay test items based on Bloom's Taxonomy, comparing the LOTS and HOTS. Adopting a descriptive survey design, the study was guided by two research questions and a hypothesis. The scope targeted junior secondary school Computer Science teachers in the state, and stratified disproportionate random sampling was used to select 105 teachers. Data was collected using the Computer Science Teachers' Essay Test Item Construction Competency Test (CSTETICT), a validated 30-item instrument covering all six cognitive levels of Bloom's Taxonomy. Instrument reliability was confirmed through a pilot test involving 20 respondents, yielding a KR-20 coefficient of 0.85. Descriptive statistics (frequencies, percentages, means, and standard deviations) and visual aids (charts and graphs via Microsoft Excel) were used for data presentation. Inferential statistics, including t-test, ANOVA, and post hoc analysis, were conducted using SPSS Version 20. Findings, among others, revealed that teachers demonstrated high competence in constructing items for lower-order thinking skills (knowledge and comprehension), moderate ability at the application level, and low competence in higher-order thinking skills (analysis, synthesis, and evaluation), these different competency levels in constructing items that assess LOTS and HOTS were found to be significant. The study concludes that while teachers are proficient in evaluating lower-order cognitive skills, there is a notable gap in their ability to develop higher-order assessment items. It recommends continuous professional development, curriculum revision to include specialised Computer Science training, optional certification in assessment design, and mentorship programs to enhance teachers' assessment competencies across all cognitive levels.

**Keywords:** Assessment, Construction Competency, Essay Tests, Teachers' Characteristics.

## 1 INTRODUCTION

Education is a systematic process aimed at the holistic development of individuals through the acquisition of knowledge, skills, attitudes, and values necessary for personal growth and societal contribution. At the heart of effective education lies classroom assessment, a vital mechanism for monitoring and enhancing learning. Through evaluations, teachers gather evidence of students' understanding, progress, and achievement of established instructional objectives. One of the most integral aspects of classroom assessment is the construction of test items, which serve as tools for eliciting measurable responses from learners. These items, particularly essay-type questions, not only reflect the depth of a student's cognitive processing but also mirror the teacher's instructional clarity and competence. Thus, the quality of test item construction is closely linked to the effectiveness of teaching and the accuracy of learning evaluation, reinforcing the central role of assessment in educational practice.

Building on this understanding, classroom assessment emerges as a cornerstone in the teaching and learning process, offering a structured approach to evaluating both student learning and instructional effectiveness. According to Cania and Wamar [1], it involves collecting student performance data to diagnose learning problems, monitor progress, and provide feedback for improvement. Gichuru Francis Maina further explains that classroom assessment tools, particularly tests, are used to gather information on students' achievement, aptitude, or intelligence levels [2]. A key part of classroom assessment is the construction of test items, which teachers use to elicit relevant information that reflects the attainment of instructional objectives.

Test item construction plays a central role in practical classroom assessment. When done proficiently, it helps teachers gain insight into student learning and progress. For effective test construction, especially essay test items, educators must be grounded in the application of Bloom's taxonomy in the cognitive domain. Benjamin S. Bloom outlined six levels of cognitive learning: knowledge, comprehension, application, analysis, synthesis, and evaluation [3]. These levels are further grouped into Lower Order Thinking Skills (LOTS), comprising knowledge, comprehension, and application, and Higher Order Thinking Skills (HOTS), including analysis, synthesis, and evaluation.

Well-constructed essay tests are instrumental in measuring learning outcomes in the cognitive domain. Unlike objective tests, essay items enable a more in-depth assessment of students' critical thinking, reasoning, and analytical abilities. This is particularly important in Computer Science education, where learners are expected to develop problem-solving skills and cognitive flexibility to thrive in a rapidly evolving digital landscape. However, observations from internal assessments suggest that many Computer Science teachers may lack the required competence to design essay test items that thoroughly assess all cognitive levels.

At the junior secondary level, Computer Science education aims to cultivate critical and analytical thinking, laying a foundation for further study and equipping learners with skills essential for an excellent performance in specific fields of Computer Science, hence fostering national development. Given the significance of these outcomes, it becomes necessary that assessment, particularly through essay tests, is accurate and aligned with learning objectives. It is on this premise that this study aims to assess the proficiency of Computer Science teachers in constructing essay test items for junior secondary schools in Benue State, with a particular focus on their ability to address various cognitive levels in their assessments.

### 1.1. Problem Statement

The development of students' critical and analytical thinking skills is essential for preparing them to thrive in a technology-driven world. To evaluate these cognitive abilities effectively, teachers must construct well-structured essay test items that align with Bloom's taxonomy, particularly across both LOTS and HOTS. However, observations and preliminary reports from school inspections, curriculum reviews, and internal assessments suggest that many Computer Science teachers may lack the required competence to design essay test items that thoroughly assess these cognitive levels. Inadequate test construction not only undermines the accuracy of assessment outcomes but also jeopardizes the validity of instructional feedback and student learning progress. Despite the importance of essay tests in evaluating deep learning outcomes, there is limited empirical evidence on the extent to which junior secondary school teachers in Benue State possess and apply the necessary skills in constructing such test items. This gap necessitates systematic investigation. Hence, this study will assess the characteristics and competence of computer teachers in constructing essay test items using the cognitive domain of Bloom's Taxonomy of Educational Objectives in Junior Secondary Schools in Benue State, Nigeria. The Objectives of the study are the following.

1. To assess the competence of Computer Science teachers in constructing essay test items that assess LOTS in junior secondary schools in Benue State.
2. To assess the competence of Computer Science teachers in constructing essay test items that assess HOTS in junior secondary schools in Benue State.
3. To compare the competence of Computer Science teachers in constructing essay test items that assess LOTS and HOTS in junior secondary schools in Benue State.

The research has considered the following research questions.

1. What is the level of competence of Computer Science teachers in constructing essay test items that assess LOTS in junior secondary schools in Benue State?
2. What is the level of competence of Computer Science teachers in constructing essay test items that assess HOTS in junior secondary schools in Benue State?

The hypothesis considered is given below.

H<sub>0</sub>: There is no significant difference in Computer Science teachers' competence in constructing essay test items that assess LOTS and HOTS in junior secondary schools in Benue State

This study will provide insights into the competence of Computer Science teachers in constructing essay test items that assess different levels of thinking skills. The findings will be helpful for teacher training programs, curriculum development, and educational policymaking. The study focused on determining the competence of junior secondary school Computer Science teachers in constructing essay test items based on Bloom's Taxonomy, specifically comparing the competence of Computer Science teachers in constructing essay test items that assess LOTS and HOTS. The study was conducted in Benue State, Nigeria, targeting junior secondary school Computer Science teachers across the state's three senatorial zones.

## 2 LITERATURE REVIEW

### 2.1. Theoretical Framework

This study will be based on the Taxonomy of Educational Objectives, initially introduced by Bloom in 1956 [3] and later revised by Anderson and Krathwohl in 2001 [4]. This framework helps categorise different levels of thinking skills into two main categories: LOTS and HOTS. According to this taxonomy, thinking skills are divided into six levels: Remembering, Understanding, and Applying (which are considered LOTS) and Analysing, Evaluating, and Creating (which are classified as HOTS). About this study, Bloom's Taxonomy provides a framework for evaluating the cognitive levels targeted by essay test questions constructed by teachers.

The taxonomy underscores the importance of balanced assessments that should not only measure factual recall but also prompt students to think critically and creatively. This study aligns with Bloom's principles by examining the verbs used in essay questions and emphasising the importance of teacher proficiency in selecting verbs that stimulate both Lower and higher-level cognitive engagement, which is essential for meaningful learning and educational advancement.

## **2.2. Conceptual Framework**

### **2.2.1. Teacher Competence in Test Construction**

Teacher competence refers to the sum of knowledge, skills, attitudes, and values that empower educators to perform their professional responsibilities and meet the diverse learning needs of their students. This competence extends beyond content knowledge and encompasses the ability to develop valid, reliable, and pedagogically robust assessments [5]. Specifically, in essay-type assessments, teacher competence provides for the integration of assessment processes with instructional objectives. Three fundamental domains of teacher competence include content knowledge, pedagogical knowledge, and pedagogical content knowledge (PCK). Content knowledge refers to a deep understanding of the subject matter, pedagogical knowledge involves familiarity with effective teaching strategies, and PCK blends both to facilitate effective instruction [6]. In recent developments, assessment literacy has emerged as a crucial component of teacher competence. Assessment literacy refers to the teacher's ability to design, implement, interpret, and adapt assessment techniques to enhance student learning [7].

An assessment-literate teacher can construct test items aligned with learning objectives, use clear and precise language, and apply appropriate rubrics to ensure fairness and reliability. In essay test construction, competencies are especially critical due to the subjective nature of open-ended responses and the cognitive complexity involved. Validity is essential, as it requires items to measure the intended outcomes, notably higher order thinking skills [8]. Reliability, while more challenging, can be achieved through clear rubrics and, if possible, multiple raters to minimize subjectivity [9]. Clarity in question wording helps eliminate ambiguity and ensure equitable access for students of varying academic abilities [10]. Furthermore, alignment with cognitive objectives, such as those in Bloom's taxonomy and its revision by Anderson and Krathwohl [4], ensures balanced assessment across different cognitive levels.

Despite the importance of these competencies, many teachers—particularly in Computer Science—receive little formal training in test construction. This often results in reliance on questions targeting lower-order skills due to a lack of understanding of how to design assessments that evaluate analytical, evaluative, or creative responses [11]. This highlights the importance of professional development in assessment design, particularly in creating essay items that foster meaningful learning and accurately assess student understanding. Improving teacher competence in essay test construction is a vital step toward fair, effective, and instructionally aligned assessments. This not only enhances the quality of classroom evaluation but also promotes deeper student learning by fostering the development of complex cognitive skills.

### **2.2.2. Essay Test Items**

Essay test items require students to construct responses in their own words, allowing teachers to assess both knowledge and its organization, expression, and application. Unlike objective tests, essay questions are open-ended, facilitating deeper engagement with content and the assessment of higher-order thinking skills such as analysis, synthesis, and evaluation [12]. Essay questions generally fall into two categories. Restricted response questions limit the scope and structure of answers and are suitable for assessing specific knowledge or lower-order thinking skills. In contrast, extended-response questions offer more flexibility, allowing for in-depth exploration and assessment of higher-order thinking skills [13]. In Computer Science education, essay questions can evaluate algorithmic logic, problem-solving strategies, and ethical implications, tailored to learning objectives. Despite their benefits, essay items can be time-consuming to grade and require clear, consistent scoring rubrics. Their subjectivity highlights the importance of teacher competence in test construction. Effective essay assessments not only address curricular goals but also foster critical thinking and communication skills.

### **2.2.3. Cognitive Levels in Educational Objectives**

Cognitive levels represent the mental processes students engage in during learning, ranging from recall to complex critical thinking. Bloom's Taxonomy is a widely used framework for classifying these levels. Anderson and Krathwohl's revision introduced active verbs and a two-dimensional structure: cognitive processes and types of knowledge [4], making it a foundational reference in modern curriculum design and assessment [14]. The revised taxonomy categorizes six cognitive levels: remembering, understanding, applying, analyzing, evaluating, and creating. These are grouped into LOTS and HOTS.

While LOTS support foundational learning, HOTS promote analytical, evaluative, and creative abilities necessary for problem-solving and innovation [15]. There is growing emphasis on HOTS in education, especially in subjects like Computer Science. Educational assessments, particularly essay items, should therefore be intentionally designed to evaluate both LOTS and HOTS.

The teacher's competence in constructing such assessments is crucial in determining the depth of student cognition elicited [16]. Despite awareness of Bloom's Taxonomy, teachers often default to LOTS in evaluation due to limited training in assessment design [17]. This imbalance may hinder cognitive development. In the context of junior secondary schools in Benue State, teacher competence in distinguishing and assessing LOTS and HOTS through essay items is critical for fostering analytical and problem-solving skills.

#### 2.2.4. Alignment of Test Items with Cognitive Objectives

Aligning test items with cognitive objectives is essential for a valid and effective assessment. When assessments reflect instructional objectives and cognitive levels, they more accurately measure student understanding and encourage higher-order thinking. This alignment begins with clearly defined learning objectives, often guided by frameworks like the Revised Bloom's Taxonomy. These objectives inform both teaching strategies and the construction of test items across cognitive complexity levels. Misaligned assessments may misrepresent student learning and fail to challenge students appropriately [16]. In disciplines such as Computer Science, aligning test items with objectives ensures that assessments develop students' analytical and creative skills. For example, an objective focused on algorithm evaluation should involve critical comparison tasks, not simple recall. Key alignment criteria include:

1. Matching the cognitive level of objectives and assessment verbs (e.g., "define" vs. "analyze"),
2. Structuring tasks to elicit deeper thinking, and
3. Using scoring rubrics that recognize cognitive complexity [18].

Despite its importance, misalignment remains a common occurrence. A comparative assessment approach can highlight teacher strengths and weaknesses in constructing LOTS and HOTS items. Such analysis supports deeper learning goals and identifies gaps in assessment literacy. This is particularly relevant in Computer Science, where HOTS are crucial for understanding complex concepts [19]. Comparative assessment also supports evidence-based decisions and policy recommendations. Teachers can reflect on and improve their practices, and stakeholders can design better training programs. In this study, a comparative approach is employed to evaluate Computer Science teachers in Benue State, assessing their proficiency in designing LOTS versus HOTS questions and the impact on instructional quality [20].

#### 2.2.5. Review of Related Empirical Studies

Effective tests allow teachers to assess student understanding accurately. Conversely, poorly constructed tests may misrepresent both student learning and teaching effectiveness [21]. Gichuru [22] examined how well teacher-constructed tests reflected Bloom's Taxonomy in the Kikuyu District, Kenya. Using a cross-sectional survey of 42 teachers from 14 schools, the study found a lack of alignment with higher-order thinking skills. The descriptive analysis showed limited teacher competence in constructing effective assessments.

A related study by Aduloju and Agi [25] evaluated Basic Science teachers in Nasarawa State. Using a validated Teachers Competency Questionnaire with a Cronbach Alpha of 0.89, the study concluded that teachers lacked competence in item construction and analysis. This aligns with the current study's focus on improving assessment quality. Asnakew and Lake [26] assessed teachers in Amhara State using a revised Teacher Assessment Literacy Questionnaire. Despite some teachers having formal training, results indicated widespread incompetence in educational assessment, reaffirming the need for targeted training. Kissi et al. [27] studied 157 teachers in Ghana, revealing a gap between self-reported competence and the actual quality of test items. This suggests the need for professional development, particularly for assessing higher-order skills. While their focus was on multiple-choice items, the findings support this study's emphasis on essay assessments in Computer Science. These empirical studies collectively highlight the widespread need for improved teacher competence in assessment construction, particularly in terms of cognitive alignment and the effective measurement of higher-order skills.

### 3 METHODS

This research employed a descriptive design, utilizing a survey research methodology to assess the competence of Computer Science teachers in developing essay test items for both LOTS and HOTS, as outlined in Bloom's Taxonomy.

**Population and Sampling Technique:** The population for this study comprised all Computer Science teachers in junior secondary schools across the three senatorial zones of Benue State. As the population size in each zone was unknown, a stratified disproportionate random sampling technique was applied. The senatorial zones served as strata, and 35 teachers were randomly selected from each zone, resulting in a total sample size of 105 Computer Science teachers.

**Instrument:** Data were collected using a self-developed, structured, and validated instrument titled the Computer Science Teachers' Essay Test Item Construction Competency Test (CSTETICT). This instrument was designed to measure teachers' competence in developing essay test items aligned with the six cognitive domains of Bloom's Taxonomy.

The CSTETICCT consisted of 30 items—five items per domain. Each item presented a Computer Science-related essay question with an action verb, and respondents were required to identify the appropriate cognitive domain. Scoring was dichotomous: 1 point was awarded for each correct response (indicating competence), and 0 points were awarded for incorrect responses. Each domain had a maximum score of 5, allowing targeted measurement of domain-specific competence.

**Validity and Reliability of the Instrument:** To establish content validity, the instrument was reviewed by two experts in Measurement and Evaluation. These experts assessed the clarity, alignment with Bloom’s Taxonomy, and the relevance of items to cognitive domain assessment. Their feedback was incorporated to enhance the instrument’s quality. Reliability was tested through a pilot study involving 20 Computer Science teachers not included in the main study. Internal consistency was determined using the Kuder-Richardson Formula 20 (KR-20), suitable for dichotomous items. The KR-20 coefficient was 0.85, indicating high reliability and consistency in measuring the intended competencies.

**Data Collection Procedure:** The instrument was administered in person by the researcher and a co-researcher. Visits were made to the selected junior secondary schools, and the competency test was conducted on-site with the resident Computer Science teachers. Each teacher completed the test individually under minimal supervision, and the instrument was collected immediately after completion. This approach ensured a high return rate and allowed clarification of any ambiguities during administration.

**Data Analysis Technique:** The data were analyzed using descriptive and inferential statistics, with the aid of SPSS Version 20 and Microsoft Excel 2016. Descriptive statistics—frequency counts, percentages, means, and standard deviations—were used to summarize the data. Excel was used to create charts and graphs for the visual representation of data.

To evaluate competence in essay test item development, scores across cognitive domains were aggregated into LOTS (knowledge, understanding, and application) and HOTS (analysis, evaluation, and synthesis). The mean scores for the first three domains represented each teacher’s LOTS competence, while the mean of the last three domains represented HOTS competence. Overall competence was calculated by averaging the LOTS and HOTS scores for each respondent. For inferential analysis, independent samples t-tests, Analysis of Variance (ANOVA), and Post Hoc tests were employed to determine if there were statistically significant differences in competence based on demographic variables, such as gender, academic qualification, teaching experience, and course of study.

## 4 RESULTS

### Research Question 1

What is the level of competence of Computer Science teachers in constructing essay test items that assess LOTS in junior secondary schools in Benue State?

Table 1. Descriptive Statistics of Teachers’ Competence in Essay Test Construction across Bloom’s Taxonomy Levels

| Descriptive Statistics   |     |         |         |        |                |
|--------------------------|-----|---------|---------|--------|----------------|
|                          | N   | Minimum | Maximum | Mean   | Std. Deviation |
| Knowledge                | 105 | 1.00    | 5.00    | 3.8476 | 1.01698        |
| Understanding            | 105 | 1.00    | 5.00    | 3.4000 | 1.11459        |
| Application              | 105 | 0.00    | 5.00    | 2.8095 | 1.19370        |
| Analysis                 | 105 | 0.00    | 5.00    | 1.8286 | 1.54084        |
| Evaluation               | 105 | 0.00    | 5.00    | 1.3619 | 1.33102        |
| Synthesis                | 105 | 0.00    | 5.00    | 1.2571 | 1.24057        |
| LOTs                     | 105 | 1.33    | 5.00    | 3.3524 | .73209         |
| HOTs                     | 105 | 0.00    | 5.00    | 1.4825 | .99570         |
| Overall Competency Level | 105 | 1.00    | 5.00    | 2.4175 | .71579         |
| Valid N (listwise)       | 105 |         |         |        |                |

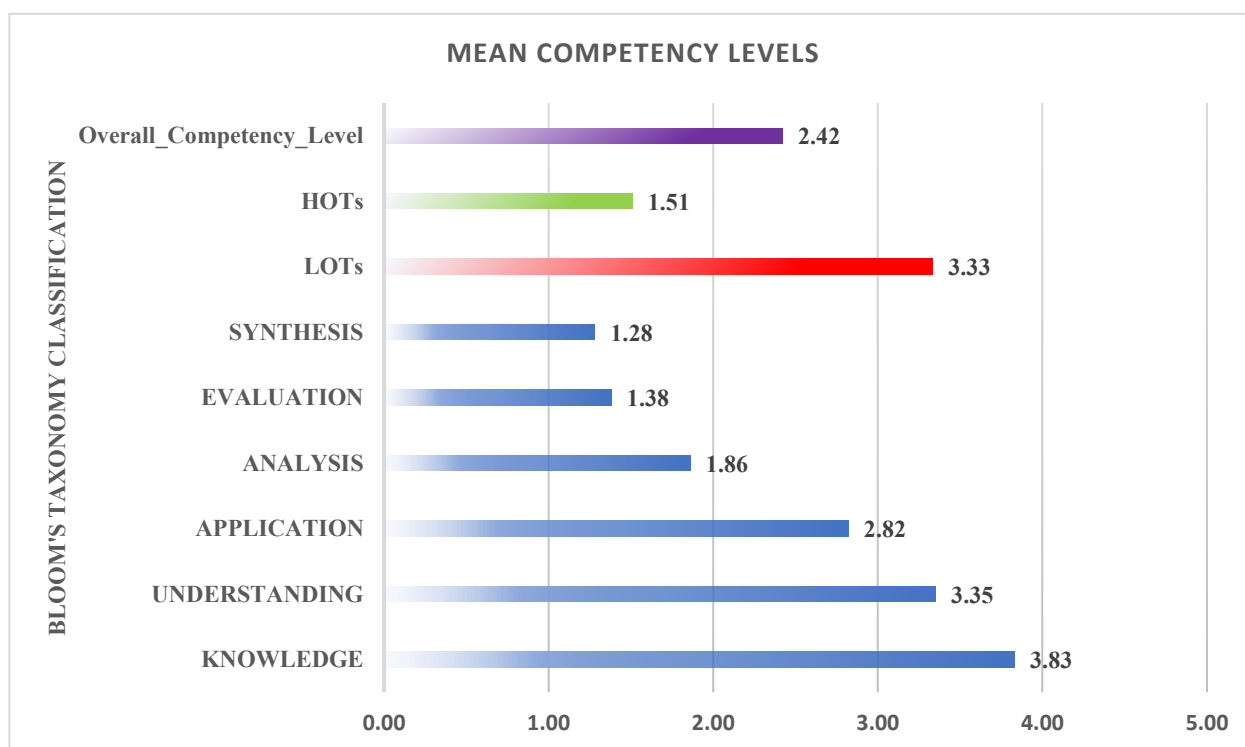


Fig. 1. Bar Chart Showing Teachers' Competence in Essay Test Construction across Bloom's Taxonomy Levels

Table 1 is visualized in Fig. 1. Above presents descriptive statistics for teachers' competencies across the six levels of Bloom's Taxonomy, categorized into LOTs (Knowledge, Understanding, Application) and HOTs (Analysis, Evaluation, Synthesis), along with aggregate scores for LOTs, HOTs, and overall competency level; The focus for Research questions one is the LOTs, Knowledge ( $M = 3.85$ ,  $SD = 1.02$ ) indicates that teachers are highly competent in constructing essay questions that assess knowledge-level objectives. The understanding score ( $M = 3.40$ ,  $SD = 1.11$ ) suggests that Teachers are moderately skilled in evaluating understanding. Application ( $M = 2.81$ ,  $SD = 1.19$ ) indicates that Competence in constructing items that assess application is fair to moderate. Overall LOTs Mean = 3.35 ( $SD = 1.11$ ) suggests a moderate to high level of competence among teachers in constructing essay items that assess lower-order thinking skills.

## Research Question 2

What is the level of competence of Computer Science teachers in constructing essay test items that assess HOTS in junior secondary schools in Benue State?

From Table 1, visualized in Fig. 1, we see the description of the level of competency of Computer Science teachers in constructing essay test items that assess Higher Order Thinking Skills (HOTS), amongst others. Analysis ( $M = 1.83$ ,  $SD = 1.52$ ) describes low competence in constructing analytical essay items. Evaluation ( $M = 1.36$ ,  $SD = 1.33$ ) indicates very low competence in constructing evaluation-level questions. Synthesis ( $M = 1.26$ ,  $SD = 1.24$ ) shows the lowest level of competence among the HOTS dimensions. Overall HOTS Mean = 1.48 ( $SD = 1.36$ ) reflects a generally low level of competence in constructing essay questions that assess higher-order thinking skills.

## Hypothesis:

$H_0$ : There is no significant difference in Computer Science teachers' competence in constructing essay test items that assess LOTs and HOTs in junior secondary schools in Benue State

The mean level of competence in constructing essay questions that assess LOTs versus HOTS was 3.35 for LOTs and 1.48 for HOTS, resulting in a mean difference of 1.87, with a standard deviation of 1.0. The Paired Samples Test was used to evaluate the hypothesis, and the results provided strong statistical evidence. The t-value was 19.109 with 104 degrees of freedom, and the significance level (p-value) was .000, which is much lower than the standard alpha level of .05. Given that the p-value (.000) is less than 0.05, we reject the null hypothesis. This indicates a statistically significant difference in the competence of Computer Science teachers in constructing essay tests, particularly in terms of assessing higher-order thinking skills. The T-test metrics are given in Table 2.

Table 2. T-test Comparing Mean Scores of Computer Teachers' Competence in Constructing Essay Tests that Assess LOTS and HOTS

|        |             | Paired Samples Test |                |                 |                                           |       |        |     |                 |  |
|--------|-------------|---------------------|----------------|-----------------|-------------------------------------------|-------|--------|-----|-----------------|--|
|        |             | Paired Differences  |                |                 |                                           |       |        |     |                 |  |
|        |             | Mean                | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference |       | t      | df  | Sig. (2-tailed) |  |
|        |             |                     |                |                 | Lower                                     | Upper |        |     |                 |  |
| Pair 1 | LOTs - HQTs | 1.87                | 1.00           | 0.10            | 1.68                                      | 2.06  | 19.109 | 104 | .000            |  |

### Summary of Findings

1. Computer Science Teachers in Benue State demonstrated high competence in constructing essay test items for assessing knowledge ( $M = 3.85$ ,  $SD = 1.02$ ), moderate competence in assessing understanding ( $M = 3.40$ ,  $SD = 1.11$ ), and fair to moderate competence in assessing application ( $M = 2.81$ ,  $SD = 1.19$ ). Overall, the teachers exhibited a moderate to high level of competence in constructing essay test items for LOTS, with an overall mean of 3.35 ( $SD = 1.11$ ).
2. Computer Science teachers in Benue State showed low competence in constructing essay test items for higher-order thinking skills (HOTS), with analysis having a mean of 1.83 ( $SD = 1.52$ ), evaluation at a very low level ( $M = 1.36$ ,  $SD = 1.33$ ), and synthesis being the least assessed, with a mean of 1.26 ( $SD = 1.24$ ). The overall mean for HOTS was 1.48 ( $SD = 1.36$ ), suggesting a generally low level of competence in constructing essay items that assess higher-order thinking skills.
3. The findings indicate a statistically significant difference in Computer Science teachers' competence in constructing test items for LOTS and HOTS ( $p$ -value = .000), with teachers being significantly more competent in assessing LOTS than HOTS.

### Discussion of Findings

The remarkable ability of teachers to formulate essay test items capable of assessing knowledge and understanding (presented in the findings) shows that educators are prepared to assess basic cognitive functions of recall and recognition. This is essential as these are foundational skills for students, and having teachers who are competent in this domain will ensure that the foundational knowledge base is well tested. However, sufficient competency in assessing applications suggests that there is a possibility for improvement. The implications are that teachers may need additional professional development to enhance their ability to evaluate this area and provide more comprehensive support for students' cognitive skills at all levels of Bloom's Taxonomy.

Secondly, the low competence in developing essay test items for HOTS, such as analysis, evaluation, and synthesis, indicates that teachers may find it challenging to evaluate complex cognitive processes. Since HOTS helps build critical thinking and problem-solving skills among students, the findings suggest that teachers may not be adequately prepared to challenge students at these higher levels of cognition. This finding aligns with the findings of Kissi et al. (2023), who reported that, despite teachers' self-perception of competence in test construction and analysis, their test items were problematic. This difference highlights the need for professional development in enhancing teachers' capacity to assess higher-order cognitive skills, such as application, as your perception of fair-to-moderate competence in this area concurs. The limitation can leave students poorly prepared to perform activities that require deep thinking and the application of knowledge. The need for specific PD and training on how to develop HOTS-based assessments becomes obvious, as the improvement of the teachers' competence in this area is crucial to the development of high-order thinking skills in the students.

The significant difference in the ability of LOTS and HOTS demonstrates that teachers in Benue State are more comfortable with evaluating lower-order thinking skills but struggle with assessing higher-order thinking skills. This result has significance for curriculum design and teacher training. There is a need to equip teachers with the tools, methodologies, and understanding of how to generate and measure HOTS. Lacking such skills, students will miss out on opportunities to acquire critical thinking and problem-solving skills, which are essential in higher learning institutions and workplaces.

## 5 CONCLUSIONS

The study concludes that teachers in Benue State are moderately or highly competent in constructing essay test items that assess LOTS but are severely lacking in constructing test items that assess HOTS. This gap represents the urgent need for a specific intervention to enhance teachers' ability to assess analytical, evaluative, and synthetic thinking, particularly in cultivating deeper competencies in learning and problem-solving among students. Therefore, these results reflect systemic shifts in teacher training, lifelong professional development, and inclusive educational policy, aiming to enhance competence in all cognitive domains and across the entire teacher population.

## Recommendations

1. Initiate Continuous Professional Development (CPD) Programs: Conduct regular workshops and training courses dedicated to developing assessment tasks that span the mixed levels of LOTS and HOTS. These should be compulsory for both beginner and experienced teachers to promote competency in creating HOTS-based assessments. Saleem et al. noted that CPD is fundamental in developing teachers with the latest assessment approaches and enhancing classroom performance [28].
2. Strengthen Pre-Service Teacher Education in Computer Science: Revise and expand teacher education curricula to include specialized training in Computer Science Education. This will ensure that future teachers possess both content knowledge and pedagogical skills specific to the subject. A study by Karlin et al. noted that embedding computer science into preservice education is crucial for preparing future teachers with both content knowledge and instructional strategies [29].
3. Introduce In-Service Certification in Assessment Design: Provide optional but incentivized certification programs for in-service teachers to improve their competence in test construction, particularly in applying Bloom's Taxonomy comprehensively.
4. Promote Subject-Specific Pedagogical Knowledge: Encourage teachers from non-computer science backgrounds to undertake conversion or refresher courses in computer science pedagogy to build competency in both subject matter and assessment techniques.
5. Monitor and Evaluate Assessment Practices in Schools: Introduce regular audits and evaluations of teachers' test items to ensure alignment with national learning standards and to identify areas needing further intervention or support.
6. Incentivize Excellence in Assessment Design: Recognize and reward teachers who demonstrate outstanding competence in constructing high-quality assessments. This could serve as motivation and encourage peer learning.
7. Intentionality in using associated verbs: Educators should make intentional use of action verbs from Bloom's Taxonomy to develop balanced assessments that support national education goals and improve learning outcomes.

## Limitations of the Study

In terms of sample size and scope, a significant limitation of this study is evident. The research was conducted with a sample of 105 Computer Science teachers in junior secondary schools in Benue State, rather than the entire population. This has resulted in the findings being limited in generalisability to all Computer Science teachers in the state or on a broader scale. The limited sample size can also compromise the representation of different demographic variables, such as teaching experience and academic qualifications, as well as institutional setting, which can significantly contribute to the overall interpretation of teachers' competence in constructing essay test items. Additionally, a competency test was independently administered to each respondent. The teachers took the test at different times, not simultaneously; this could lead to variations in the conditions of responses, such as exposure to environmental distractions, levels of focus, or availability of external aid. Thus, although the study presents valuable insights, care should be taken when applying the findings in a broader context.

## FUNDING INFORMATION

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

## ETHICS STATEMENT

This study did not involve human or animal subjects and, therefore, did not require ethical approval.

## STATEMENT OF CONFLICT OF INTERESTS

The authors declare that they have no conflicts of interest related to this study.

## LICENSING

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