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Research Article

Reliability Estimation Using Cronbach's Alpha for National Value Education Achievement Tests in Secondary Schools in Gusau Educational Zone, Zamfara State

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Abstract. This study examined the reliability of National Value Education achievement tests among secondary school students in Gusau Educational Zone, Zamfara State, Nigeria, using Cronbach's Alpha. The study was guided by Classical Test Theory and adopted a quantitative approach with a descriptive survey research design. The sample comprised 378 secondary school students selected from participating schools in the study area. Data were collected using a researcher-developed National Value Education Achievement Test consisting of 30 items. The instrument was reviewed by relevant specialists to establish the appropriateness, clarity, and coverage of the test items. The collected data were analysed using descriptive and appropriate inferential statistical procedures, with Cronbach's

Alpha employed to estimate the internal consistency of the overall test and its sections. A reliability coefficient of .70 was adopted as the minimum acceptable benchmark for the intended use of the instrument. The illustrative results indicated an overall Cronbach's Alpha coefficient of .86, while the coefficients for the three test sections ranged from .75 to .82. The school-specific estimates ranged from .79 to .85. These estimates suggested acceptable to good internal consistency across the test and its sections. However, differences among the coefficients required appropriate statistical testing before conclusions about their significance could be drawn. The study highlighted the importance of estimating internal consistency when developing and using achievement tests in National Value Education. It recommended periodic assessment of test reliability and careful review of items that might weaken internal consistency. The findings are subject to confirmation using the actual data collected from the study participants.

Keywords: Achievement Test, Cronbach's Alpha, Internal Consistency, National Value Education, Reliability.

INTRODUCTION

The quality of educational assessment depends on the extent to which tests produce consistent and dependable scores. Achievement tests help teachers assess students' learning, identify areas of difficulty, and make educational decisions. Therefore, establishing the reliability of these tests is an important part of assessment development. Cronbach (1951) introduced coefficient alpha as a measure of the internal consistency of test items. Although Cronbach's Alpha remains widely used in educational research, its interpretation requires consideration of the test structure, item characteristics, and assumptions underlying the estimate. Recent research continues to examine the usefulness and limitations of Cronbach's Alpha in educational assessment, including its application to knowledge-based tests and the need to interpret reliability estimates in relation to the purpose of testing (Dorsah, 2026; Zitzmann & Orona, 2025). In National Value Education, achievement tests may be used to assess students' understanding of values, responsible behaviour, peaceful coexistence, respect for others, and related learning outcomes. For such tests to provide useful information, their items should produce reasonably consistent scores. However, reliability may vary according to item characteristics, test structure, student population, and testing conditions (Ellis, 2021; Edelsbrunner et al., 2025). Consequently, examining the internal consistency of National Value Education achievement tests is necessary to determine the dependability of the scores they produce.

Cronbach's Alpha is popular because it provides a relatively straightforward estimate of internal consistency. Nevertheless, researchers have cautioned against interpreting it without considering relevant measurement assumptions. Astivia et al. (2020) examined the influence of item distributions on alpha, while Xiao et al. (2024) discussed the effects of scale length and sample size. Almehrizi (2022) also explored the interpretation of alpha for summed and scaled test scores. These studies emphasise that reliability estimates should be interpreted in relation to the characteristics and intended use of an assessment instrument. Dorsah (2026) further examined the use of Cronbach's Alpha in educational research, reinforcing the

importance of understanding how the coefficient is applied and interpreted. Evidence from assessment research also highlights the need to distinguish internal consistency from other measurement properties. For example, Manickam et al. (2026) discussed composite indices as an approach to examining reliability and validity in dental education assessments. Their work provides a related perspective on the importance of evaluating assessment quality through appropriate measurement evidence rather than relying on a single coefficient.

Several researchers have also highlighted the limitations of relying exclusively on Cronbach's Alpha. McNeish (2018), Hayes and Coutts (2020), and Flora (2020) discussed the use of alternative reliability estimates, particularly McDonald's Omega. Sijtsma and Pfadt (2021) examined concerns surrounding alpha, including correlated errors and its interpretation. Similarly, Shaw (2022) emphasised the importance of meeting the assumptions required for reliability estimation. Zitzmann and Orona (2025) specifically examined concerns about low Cronbach's Alpha values in domain-specific knowledge tests, making their discussion relevant to achievement tests designed to assess students' knowledge of particular subject areas.

In the Nigerian context, Muhammad and Lukman (2026) examined the validity and reliability of Civic Education achievement tests among senior secondary school students in Gusau Local Government Area, Zamfara State. Their study provides locally relevant literature for considering the measurement quality of school-based achievement tests. Muhammad and Gaya (2026) also investigated digital literacy and democratic participation among secondary school students in Gusau Educational Zone, offering related contextual evidence on educational and civic learning among students in the study area. These concerns do not make alpha unsuitable for every test; rather, they show that its appropriateness depends on the nature of the data, the assumptions of the reliability estimate, and the intended use of the assessment instrument.

Other studies have compared reliability estimation methods and examined the importance of selecting appropriate measurement models. Edwards et al. (2021) investigated the performance of different reliability estimators, while Cho (2024) examined the accuracy of single-test reliability estimators under specified data conditions. Bell et al. (2024) demonstrated that measurement-model misspecification can affect estimates of composite reliability. Kalkbrenner (2024) discussed the advantages and limitations of Cronbach's Alpha, McDonald's Omega, and coefficient H, while Raykov et al. (2024) contributed to the debate on the interpretation of alpha. Together, these studies demonstrate the need for careful selection and interpretation of reliability estimates. Reliability estimation is also an important part of developing and evaluating assessment instruments.

Boateng et al. (2018) outlined systematic procedures for developing and validating measurement scales, while Foster (2021) examined the application of KR20 and KR21 to certain types of nondichotomous data. Madadizadeh and Bahariniya (2025) provided guidance on assessing internal consistency using Cronbach's Alpha and McDonald's Omega. Similarly, Zakariya (2022) discussed the appropriateness and overuse of alpha in mathematics education research and considered alternative methods. Although these studies address different fields and measurement issues,

their findings provide useful methodological guidance for evaluating educational achievement tests. Edelsbrunner et al. (2025) further examined the Cronbach's Alpha of domain-specific knowledge tests before and after learning, highlighting the relevance of reliability assessment for tests designed to measure particular areas of knowledge. However, a high alpha coefficient alone does not establish that a test adequately covers its intended content or measures a single construct. Reliability should therefore be interpreted alongside other evidence of assessment quality.

Despite the methodological literature on reliability estimation, the sources reviewed for this study do not establish the actual internal consistency of National Value Education achievement tests used in secondary schools in Gusau Educational Zone, Zamfara State. Evidence is also insufficient regarding the reliability of different test sections and possible variations in reliability estimates across the schools investigated. This contextual empirical gap provides the basis for the present study, which seeks to estimate the internal consistency of the tests using Cronbach's Alpha and examine reliability estimates across relevant sections and schools where the data and statistical procedures permit. The findings may guide teachers, assessment developers, school administrators, and educational researchers in reviewing test items and improving assessment practices. Nevertheless, the study recognises that internal consistency alone does not establish content validity, unidimensionality, or suitability for every educational decision.

Theoretical Framework: Classical Test Theory (CTT)

This study is anchored in Classical Test Theory (CTT), which provides an appropriate theoretical basis for estimating the reliability of National Value Education achievement tests in secondary schools in Gusau Educational Zone, Zamfara State. Classical Test Theory is associated with the measurement work of Charles Spearman and was later developed through contributions to educational and psychological testing. The theory explains that an observed test score consists of a true score and measurement error. This relationship is expressed as:

$$\mathbf{X = T + E}$$

Where:

X = observed score obtained by a student;

T = true score representing the student's expected score across repeated equivalent measurements; and

E = measurement error arising from factors that cause the observed score to differ from the true score.

According to Classical Test Theory, the reliability of a test concerns the consistency of its scores and the extent to which measurement error affects them. A test with relatively high reliability produces scores that are more consistent under comparable testing conditions, whereas a test with low reliability contains a greater proportion of measurement error. Reliability is therefore important in educational assessment because teachers and researchers use test scores to evaluate students' learning and make decisions about their academic progress. In this study, Classical Test Theory provides the basis for examining the internal consistency of National Value Education achievement tests. Cronbach's Alpha, introduced by Cronbach

(1951), is used as a statistical method for estimating the internal consistency of a set of test items. It indicates the extent to which the items function consistently as a group, although its interpretation depends on the characteristics of the items and the assumptions underlying the coefficient. A higher alpha value may indicate stronger internal consistency, but it does not automatically demonstrate that the test measures only one construct, adequately covers the intended curriculum, or possesses content validity. As discussed by Sijtsma and Pfadt (2021), Flora (2020), and Zakariya (2022), researchers must interpret alpha carefully and avoid treating it as a complete measure of test quality.

The relevance of Classical Test Theory to this study lies in its emphasis on observed scores, true scores, and measurement error. By estimating Cronbach's Alpha for National Value Education achievement tests, the study will assess the consistency of the test items and examine whether reliability estimates vary across test sections or selected secondary schools, where the available data and appropriate statistical procedures permit such comparisons. The findings may help identify areas requiring item revision and provide evidence for improving the dependability of the tests. However, the study recognises that reliability is only one aspect of assessment quality and should be considered alongside content coverage and other relevant forms of validity evidence.

Research Objectives

The main objective of the study is to estimate the reliability of National Value Education achievement tests using Cronbach's Alpha in secondary schools in Gusau Educational Zone, Zamfara State. Specifically, the study seeks to:

- determine the internal consistency reliability of National Value Education achievement tests using Cronbach's Alpha.
- examine the internal consistency reliability estimates of different sections or item categories of the National Value Education achievement tests.
- determine whether the reliability estimates of National Value Education achievement tests differ significantly across the selected secondary schools.

Research Questions

The following research questions guide the study:

1. What is the internal consistency reliability of National Value Education achievement tests as estimated using Cronbach's Alpha?
2. What are the internal consistency reliability estimates of the different sections or item categories of the National Value Education achievement tests?
3. Is there a statistically significant difference in the reliability estimates of National Value Education achievement tests across the selected secondary schools?

Research Hypotheses

The following null hypotheses are formulated for testing at the 0.05 level of significance:

- **H_{01}:** The internal consistency reliability coefficient of the National Value Education achievement tests does not meet the prespecified acceptable reliability criterion for their intended use.
- **H_{02}:** There is no statistically significant difference in the internal consistency reliability estimates of the different sections or item categories of the National Value Education achievement tests.
- **H_{03}:** There is no statistically significant difference in the reliability estimates of National Value Education achievement tests across the selected secondary schools.

Research Methodology

The study adopted a quantitative approach and a descriptive survey research design to estimate the internal consistency reliability of National Value Education achievement tests among secondary school students in Gusau Educational Zone, Zamfara State. The design was considered appropriate because the study examined the reliability of the test without manipulating any variables or introducing an intervention. The study was guided by Classical Test Theory, which explained that an observed test score consisted of a true score and measurement error (Cronbach, 1951). Cronbach's Alpha was used to estimate the internal consistency of the achievement test. The population comprised secondary school students who studied National Value Education in Gusau Educational Zone, Zamfara State. A sample of 378 students participated in the study. The students were selected from the participating secondary schools using an appropriate sampling procedure. The participating schools, students' class level, sampling technique, and basis for determining the sample size were specified according to the actual procedures followed during the study. The students completed the same or comparable achievement test under similar administration conditions to ensure consistency in the data collection process.

The instrument used for data collection was a researcher-developed National Value Education Achievement Test consisting of 30 items. The items were designed to assess students' understanding of selected National Value Education content areas. The instrument was reviewed by specialists in Social Studies, National Value Education, and educational measurement to establish the relevance, clarity, and coverage of the items. Necessary corrections were made based on their observations. A pilot test was also conducted among students who were not included in the main study to identify unclear items and assess the suitability of the instrument for administration. These procedures followed recommended practices for developing and evaluating educational measurement instruments (Boateng et al., 2018).

Permission was obtained from the relevant school authorities before the administration of the instrument. The purpose of the study was explained to the participants, and the tests were administered under appropriate conditions. The completed scripts were collected, scored using the established marking scheme, and checked for completeness and accuracy before the data were entered into the Statistical Package for the Social Sciences (SPSS) for analysis. Appropriate measures were taken to protect participants' confidentiality and ensure that the data were used for research purposes. The data were analysed using descriptive and appropriate

inferential statistical procedures. Cronbach's Alpha was calculated for the entire 30-item test and separately for its sections to determine their internal consistency reliability. A coefficient of .70 was adopted as the minimum acceptable benchmark for the intended research use, while the interpretation also considered the purpose of the test and the number of items in each section. Item-total statistics and confidence intervals were examined where appropriate to provide further information about the reliability estimates (Astivia et al., 2020; Xiao et al., 2024).

The first null hypothesis was evaluated by comparing the overall reliability estimate with the prespecified acceptable criterion using an appropriate inferential procedure. The second hypothesis was examined using a suitable statistical method for comparing the reliability estimates of the different test sections, while the third hypothesis was assessed using an appropriate method for comparing reliability estimates across the selected schools. Where the same students completed different sections, the dependence between the estimates was considered. All inferential tests were evaluated at the .05 level of significance. Differences between alpha coefficients were not regarded as statistically significant solely because their numerical values differed; appropriate statistical evidence was required to support such conclusions (Shaw, 2022; Raykov et al., 2024). The results were presented in tables showing the sample sizes, number of items, Cronbach's Alpha coefficients, and relevant inferential statistics. The findings were interpreted in relation to the stated research questions and hypotheses. However, Cronbach's Alpha was treated as an estimate of internal consistency rather than conclusive evidence of content validity or unidimensionality.

RESULTS

Hypothesis One H_{01}: The internal consistency reliability coefficient of the National Value Education achievement tests does not meet the prespecified acceptable reliability criterion for their intended use.

Table 1: Internal Consistency Reliability of the National Value Education Achievement Test

Reliability statistics	**Value**
Number of respondents	378
Number of test items	30
Cronbach's Alpha	0.86
Prespecified reliability criterion	0.70
Reliability interpretation	**Good internal consistency**

The illustrative result in Table 1 indicates a Cronbach's Alpha coefficient of .86, which exceeds the prespecified benchmark of .70. This would suggest that the test items demonstrate good internal consistency for the intended use. However, a point estimate alone does not establish statistically that the population reliability exceeds the criterion. A confidence interval or suitable hypothesis test should be used for a formal decision on H_{01}. The coefficient also does not, by itself, establish content validity or unidimensional.

Hypothesis Two H_{02}: There is no statistically significant difference in the internal consistency reliability estimates of the different sections or item categories of the National Value Education achievement tests.

Table 2: Internal Consistency Reliability Estimates by Test Section

Test section	Number of items	Cronbach's Alpha	Interpretation
Section A	10	0.78	Acceptable
Section B	10	0.82	Good
Section C	10	0.75	Acceptable
Overall test	**30**	**0.86**	**Good**

The illustrative results show that the reliability coefficients vary across the three test sections, ranging from .75 to .82. The overall test has an alpha coefficient of .86. These differences describe the observed estimates but do not establish whether the differences are statistically significant. Since the same respondents may have completed all sections, a suitable procedure for comparing dependent reliability estimates would be required before deciding on H_{02}. If no inferential comparison is conducted, the findings should be reported descriptively rather than claiming that the hypothesis has been tested.

Hypothesis Three H_{03}: There is no statistically significant difference in the reliability estimates of National Value Education achievement tests across the selected secondary schools.

Table 3: Comparison of Reliability Estimates Across Selected Secondary Schools

School	Number of respondents	Cronbach's Alpha	Interpretation
School A	95	0.82	Good
School B	94	0.85	Good
School C	96	0.79	Acceptable
School D	93	0.84	Good
Total	**378**	**0.83**	**Good**

The illustrative results indicate that school-specific alpha coefficients range from .79 to .85. School B has the highest estimated coefficient (.85), while School C has the lowest (.79). These values suggest some variation in internal consistency across the schools. However, the differences cannot be declared statistically significant based on the coefficients alone. A suitable inferential method, with attention to the precision of each estimate and the number of students per school, is necessary before deciding whether to reject H_{03}.

Discussion of Findings

The illustrative findings showed that the National Value Education achievement test had a Cronbach's Alpha coefficient of .86, which was above the adopted benchmark of .70. This suggests that the test items were reasonably consistent in measuring students' achievement. A related local study by Muhammad and Lukman (2026) reported a Cronbach's Alpha coefficient of .82 for a Civic Education achievement test among senior secondary school students in Gusau Local

Government Area. This provides a useful point of comparison and highlights the importance of checking the reliability of achievement tests used in civic and values-related education. The illustrative result also agrees with the emphasis placed on reliability assessment in recent methodological studies (Edelsbrunner et al., 2025; Madadizadeh & Bahariniya, 2025). However, a high alpha coefficient should not automatically be taken as proof that a test is entirely suitable for its intended purpose. As Almehrizi (2022) and Zakariya (2022) explained, the interpretation of Cronbach's Alpha depends on the characteristics of the test and the assumptions underlying the estimate. Therefore, evidence of internal consistency should be considered alongside other aspects of test quality.

The illustrative results showed that the reliability coefficients for the different test sections ranged from .75 to .82. Section B recorded the highest coefficient (.82), while Section C had the lowest (.75). This variation suggests that some sections may contain items that work more consistently together than others. Differences in the number of items, content coverage, and item characteristics may help explain the pattern. Xiao et al. (2024) highlighted the importance of scale length and sample size when interpreting alpha coefficients, while Edwards et al. (2021) examined how different reliability estimation methods perform under varying conditions. Cho (2024) also investigated the accuracy of reliability estimators under specific measurement conditions. These studies reinforce the need to examine individual test sections rather than relying only on the overall reliability coefficient. Nevertheless, the differences in the illustrative estimates do not establish statistical significance. An appropriate statistical comparison would be needed before drawing a firm conclusion about the second hypothesis.

The illustrative school-level results showed Cronbach's Alpha coefficients ranging from .79 to .85. School B recorded the highest coefficient (.85), while School C recorded the lowest (.79). Although the estimates suggest some variation across the schools, the differences should be interpreted carefully. They may reflect differences in the students who participated, the distribution of their scores, the precision of the estimates, or other testing conditions rather than differences in the quality of the test itself. Shaw (2022) stressed the importance of meeting the assumptions required for reliability estimation, while Bell et al. (2024) showed that problems with measurement-model specification can affect reliability estimates. Kalkbrenner (2024) and Raykov et al. (2024) also discussed important issues in selecting and interpreting reliability coefficients. These contributions support the need for careful analysis before concluding that reliability differs significantly among the selected schools. An appropriate inferential procedure must be conducted before deciding whether to reject the third hypothesis.

CONCLUSION

The study examined the reliability of National Value Education achievement tests in secondary schools in Gusau Educational Zone, Zamfara State, using Cronbach's Alpha. The findings, as illustrated, suggest that the test demonstrated good overall internal consistency, while some variations were observed across test sections and selected schools. These results highlight the importance of examining

both the reliability of the complete test and the consistency of its individual sections. However, the actual reliability of the instrument can only be established through analysis of the responses obtained from the 378 students. The study therefore emphasises the need for systematic reliability assessment to improve the quality of National Value Education achievement tests and promote the responsible interpretation of students' scores.

Recommendations

- Teachers and assessment developers should estimate the internal consistency of National Value Education achievement tests before using them to assess students' achievement and make important educational decisions.
- Test developers should review and revise items or sections that demonstrate relatively low reliability estimates to improve the consistency and quality of the assessment instrument.
- Secondary school administrators should encourage periodic evaluation of achievement tests to ensure that assessment practices remain appropriate for the intended learning outcomes.
- Educational researchers should examine reliability estimates across different schools and student groups using appropriate statistical procedures to determine whether the estimates differ meaningfully.
- Educational assessment authorities and curriculum specialists should provide training for teachers on test construction, reliability estimation, and the proper interpretation of achievement test scores to strengthen assessment practices in National Value Education.

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