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COMPARISON OF ASSESSMENT ALIGNMENT OF WEST AFRICAN SENIOR SCHOOL CERTIFICATE EXAMINATION AND NATIONAL EXAMINATION COUNCIL CHEMISTRY QUESTIONS

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Abstract

The objective of this study was to compare alignment with the content of senior secondary school chemistry examination questions set by the West African Examinations Council (WAEC) and the National Examinations Council (NECO) to ascertain how evenly the questions were distributed across the cognitive domains and the themes and topics in their syllabi. Although both examination bodies operate under the same national Chemistry curriculum, concerns have been raised about differences in examination standards, reliability, and the extent to which each body adheres strictly to the prescribed curriculum. Empirical studies directly comparing the curriculum compliance and cognitive distribution patterns of WAEC and NECO examinations are limited, thereby necessitating this comparative investigation. The multiple-choice question papers in Chemistry set by WAEC and NECO in 2023 were obtained for analysis. A total of 90 Chemistry multiple-choice questions (45 from WAEC and 45 from NECO) were used for the study. These questions were administered to 1,000 senior secondary school students who were purposively selected to participate in the study. The items were classified according to curriculum topics and levels of the cognitive domain. Inter-rater reliability was established to ensure consistency in classification, while the internal consistency of the re-administered test was confirmed using Cronbach's alpha ($\alpha = 0.83$). (3) Research questions guided the study. The questions were answered using t-test analyses, frequencies, and percentages. Findings showed significant differences in the coverage of higher-order thinking skills, with WAEC demonstrating a more balanced

distribution of questions across cognitive levels, whereas NECO was skewed towards knowledge and comprehension. In 2023, lower-order cognitive levels accounted for 58.0% of WAEC and 59.18% of NECO multiple-choice Chemistry questions, indicating a predominance of lower-level cognitive demand in both examinations. It was recommended that teachers should ensure adequate coverage of all syllabus topics during instruction, and that examination bodies should maintain balanced cognitive and topic distribution of items to enhance assessment credibility
Keywords: WAEC, NECO, Chemistry Syllabus, Assessment Alignment Content Validity

Introduction

Assessment alignment in the educational system typically refers to the coherence or compatibility among its components, including standards, teaching practices, and assessment methods. Assessment alignment in chemistry refers to the degree to which chemistry test items reflect the content, skills, and cognitive levels prescribed in the senior secondary school chemistry curriculum. In Nigeria, WAEC and NECO are two major examination bodies conducting nationwide secondary school assessments. Both bodies are tasked with ensuring that their examinations align with the senior secondary school curriculum, as specified by the Nigerian Educational Research and Development Council (NERDC). The scores students achieve on these assessments are intended to accurately reflect how well the subject matter being evaluated is understood by the test-takers. Test scores are significant and relevant only if they genuinely indicate the test-takers' grasp of the concept that the test items are designed to measure.

According to Cizek, Kosh, and Toutkoushian (2012), Assessments intended to make inferences about competence or proficiency with respect to learning targets should closely align with the prescribed content standards. Content validity is a key factor in assessment alignment, indicating how well an assessment captures all dimensions of the intended construct it aims to measure. Student learning, learning objectives, and assessment are vital elements in assessment alignment processes. Their role is to ensure the validity, reliability, and fairness of assessments within the alignment process.

Research on educational assessment in Nigeria consistently reports gaps between intended curriculum objectives and what is emphasized in high-stakes external examinations. Studies on curriculum coverage and cognitive demand show that national examinations sometimes privilege "what is easiest to test" (recall and comprehension) rather than the broader competencies expected in the curriculum (Adeniyi & Ogunsola, 2021; Ibrahim, 2019). This pattern is important because persistent emphasis on lower-order cognitive skills can influence teaching practices, narrowing classroom instruction toward memorization and reducing opportunities for learners to develop higher-order reasoning and problem-solving

competencies. Evidence also suggests that multiple-choice formats, commonly used by both WAEC and NECO, often emphasize recall-based tasks, with limited representation of analysis and evaluation, which may affect students' preparedness for higher education and the demands of scientific reasoning (Bandele & Udeh, 2022). Earlier studies by Amajuoyi, Joseph, and Udoh (2013) reported uneven topic coverage and a strong tilt toward lower-order cognitive levels in WASSCE Chemistry questions, concluding that such an imbalance can weaken content validity when curriculum themes and cognitive expectations are not proportionately represented. However, this "low validity" conclusion is not consistent across subjects and time frames, as seen in Ahmadu and Amuda (2021), who examined WAEC Physics (2015–2019) and reported relatively high content validity and improved test-construction quality. Taken together, these findings suggest that alignment and validity are not uniform across examination bodies, subjects, or years; rather, they appear sensitive to the rigor of test development practices (e.g., blueprinting and weighting of objectives) and to the specific construct being assessed. (Nweze and Obu, 2022).

The West African Senior School Certificate Examination is a multiple-choice, standardized examination designed to evaluate students, and it has significant implications for schools, administrators, teachers, and students (Nichols, Glass, and Berliner, 2012). They are criterion-referenced. Criterion referencing was introduced by Glaser (1963) to increase the content validity of the test. It also became helpful by linking test items to a well-prescribed criterion. Criterion-referenced tests and assessments are structured to evaluate student performance against established, predetermined criteria or learning standards. (Popham, 2005; Ibrahim, 2015). Studies by Nweze and Obu on comparative analysis of WAEC and NECO Chemistry multiple-choice questions (2021–2022) found that both examinations concentrated heavily on lower-level cognitive processes, especially knowledge/remembering, with limited representation of higher-order cognitive processes, and with NECO showing weaker representation in some higher-level categories, including little or no evaluation in certain instances. This supports the concern that cognitive imbalance remains a recurring feature in Chemistry objective tests and strengthens the recommendation made for future research.

These examination items are intended to represent all the content and behavioral goals students should be able to cover in a given course. Stated differently, an examination item should cover the range of topics in the core curriculum and examination syllabus as well as the behavioral goals it purports to measure. This is made possible mostly at the test development stage through the use of a test blueprint (Abayomi, 1999). Any test or examination with this characteristic is considered content validity. According to this study, questions in Chemistry on the WASSCE are considered valid for measuring students' performance only if they fairly cover the subjects and performance goals highlighted in the examination syllabi or the Chemistry Curriculum to which the students were exposed.

Through this, we can ascertain that the students' chemistry scores are a true representation of their abilities (Amajuoyi, Joseph, and Udoh 2013).

Validity, therefore, is not merely a technical property of a test but a reflection of its relevance and fairness. Ibe (2004) argued that an examination becomes invalid if its items fail to cover the full range of instructional content. Representativeness must include not only topical coverage but also balanced assessment across cognitive domains. Test fairness requires that items reflect the full scope of curriculum goals and avoid linguistic ambiguity and cognitive bias, enabling students to demonstrate their actual level of learning (Tierney, 2016). When examinations overemphasize recall at the expense of analysis and evaluation, they may fail to support the curriculum's broader goals of developing critical thinking and problem-solving skills. Oguguo, Agah, Catherine, Acholonu, Azubuike, Okeke, and Agbo (2022) sought to ascertain the content validity of West African Examination Council Multiple-Choice Test Items in Financial Accounting from 2016 to 2018. The findings showed that, at the expense of the higher cognitive domain levels, the items for each year focused mostly on comprehension and knowledge questions, which were of lower cognition. A perusal of the literature shows a gap in the comparison of assessment alignment with a focus on the content validity of WAEC and NECO chemistry 2023 multiple-choice questions**.** This gap justifies the present study's comparative analysis of the 2023 WAEC and NECO Chemistry multiple-choice examinations.

Despite studies examining curriculum coverage and cognitive demand in subjects such as Mathematics and English, a limited empirical comparison of Chemistry exists across WAEC and NECO. Given the conceptual and analytical nature of Chemistry as a science discipline, balanced cognitive representation is particularly important. The absence of recent comparative evidence on the alignment of WAEC and NECO Chemistry examinations creates a gap in understanding whether both bodies adhere consistently to the prescribed curriculum standards. It is against this background that the present study examines the content validity and cognitive distribution of WAEC and NECO Chemistry objective questions to determine the extent to which they align with the senior secondary school curriculum and their implications for student performance outcomes.

Statement of Problem

Alignment is not a simple binary condition; rather, it involves the degree to which curriculum objectives, instructional practices, and assessment measures align with respect to content coverage and cognitive demand. In the Nigerian secondary school system, educators and stakeholders have raised concerns about discrepancies between what is taught in classrooms and what is assessed in external examinations. When examination questions do not adequately reflect curriculum expectations, student performance outcomes may not accurately represent true learning attainment.

Empirical studies in Nigeria have documented variations in cognitive demand and content representation across WAEC and NECO examinations, particularly in subjects such as Mathematics, English, and Accounting. For instance, prior research has shown that examination items often emphasize lower-order cognitive skills at the expense of higher-order thinking abilities. These imbalances suggest potential weaknesses in blueprint adherence and cognitive spread across domains. However, despite the conceptual and analytical nature of Chemistry as a science subject, empirical attention to comparing the alignment of WAEC and NECO Chemistry examinations has been limited. The absence of such comparative evidence makes it difficult to determine whether both examination bodies consistently adhere to curriculum specifications, particularly regarding balanced cognitive representation.

The problem, therefore, lies in the possible lack of cognitive balance and uneven topic distribution in WAEC and NECO Chemistry examinations, which may undermine content validity and affect student performance. Therefore, this study addresses the gap by empirically examining the distribution of Chemistry objective questions across curriculum topics and cognitive domain levels in the 2023 WAEC and NECO examinations.

Research Questions

The research questions listed below guided the study:

1. What percentage of the topics in the chemistry core curriculum were found in the 2023 WAEC and NECO Chemistry questions?
2. What is the percentage spread of the various levels of the cognitive domain in the 2023 WAEC and NECO Chemistry questions?
3. What percentage of the multiple-choice questions of the 2023 WAEC and NECO reflect the lower-order cognitive level?

Methodology

Research Design*:* This study adopted a descriptive research design employing content analysis and comparative item analysis. The design was appropriate because the study involved a systematic examination and classification of examination questions to determine their distribution across curriculum topics and levels of the cognitive domain. Content analysis enabled objective evaluation of item characteristics without manipulation of variables. The population for this study comprises the objective questions from the WAEC and NECO May/June Senior School Certificates Examination in Chemistry. The 2023 question papers were purposively selected because they were recent and relevant to reflecting the current assessment practices of both examination bodies. The choice of 2023 ensured that the findings provide up-to-date evidence of the extent to which WAEC and NECO presently adhere to curriculum specifications.

***Data**:* The study data were sourced from the Chemistry Core Curriculum designed for Senior Secondary Schools, along with the Chemistry question papers from the May/June West African Examination Council (WAEC) and National Examination Council (NECO) for 2023. An assessment framework derived from the NERDC Chemistry curriculum and Bloom's revised taxonomy was developed to classify examination items by content themes and cognitive levels. Copies of the classification framework were given to experts in educational evaluation for independent coding of the items. Inter-rater reliability was established to ensure consistency in classification decisions. Frequencies and percentages were used to analyze the distribution of items across curriculum topics and cognitive domain levels to answer the research questions

Results and Discussion

Research Question One: What percentage of the topics in the chemistry core curriculum were found in the 2023 WAEC and NECO Chemistry questions?

Table 1: Frequency and percentage spread of topics in the Core Curriculum from WAEC and NECO 2023.

SN	Topics	WAEC	NECO	% spread for WAEC	% spread for NECO
1	Separation technique of mixtures	2	4	4.0%	8.0%
2	Wave/particulate nature of matter	1	3	2.0%	6.0%
3	Chemical combination	5	6	10.0%	12.0%
4	Gaseous state and gas laws	8	5	16.0%	10.0%
5	Acids, bases and salts	4	4	8.0%	8.0%
6	Carbon and its compounds	3	5	6.0%	10.0%
7	Quantitative aspect of chemical reaction	5	3	10.0%	6.0%
8	Rates, energy and chemical equilibrium	4	5	8.0%	10.0%
9	Non-metals and their compounds	3	2	6.0%	4.0%
10	Organic chemistry	7	4	14.0%	8.0%
11	Metals and their compounds	3	3	6.0%	6.0%
12	Chemistry, industry and environment	5	6	10.0%	12.0%
	Total	50	50	100%	100%

The results show a balanced spread across most topics, with "Gaseous state and gas laws" (16.0%) and "Organic chemistry" (14.0%) highly represented in WAEC. NECO, in contrast, placed more weight on topics like "Chemical combination" and "Chemistry, industry and environment" at 12% each. Both exams show similar distributions for specific topics, such as "Acids, Bases, and Salts" (8.0% in both) and "Metals and Their Compounds" (6.0% in both), while Separation Techniques of Mixtures" is slightly more represented in NECO (8.0%) compared to WAEC (4.0%)

Alignment with the core curriculum is essential to ensure a fair assessment of students' knowledge across all areas. The researcher suggests that a balanced distribution across topics helps evaluate comprehensive understanding and promotes alignment with curriculum content. Additionally, focusing too much on specific topics may leave students underprepared in less-covered areas, which may not reflect their actual knowledge or competence.

Research Question Two: What is the percentage spread of the various levels of the cognitive domain in the 2023 WAEC and NECO Chemistry questions?

Table 2: Frequency and percentage spread of the various levels of the cognitive domain

SN	Cognitive levels	WAEC 2023	NECO 2023	% spread of WAEC	% spread of NECO
1	Remember	13	15	26.0%	30.61%
2	Understand	16	7	32.0%	28.57%
3	Apply	13	13	26.0%	20.41%
4	Analyze	4	10	8.0%	18.37%
5	Evaluate	2	3	4.0%	0.0%
6	Create	2	1	4.0%	2.04%

The result for research question two in Table 2 shows that WAEC and NECO emphasize lower-order cognitive levels, specifically "Remember" and "Understand." The "Understand" level has the highest percentage in WAEC at 32.0%, while "Remember" is most prominent in NECO at 30.61%. Higher-order cognitive skills (HOCS), such as "Evaluate" and "Create," were less emphasized in both examinations. This aligns with the findings of Bloom (1956) and Anderson and Krathwohl (2001), which highlight that educational assessments may focus more on foundational recall and comprehension, as these are perceived as more straightforward to measure. Nevertheless, the senior secondary age is of a higher cognitive stage of development and, as such, should test higher cognitive levels. Studies by Amajuoyi et al. (2013) also revealed that the WASSCE measures lower cognitive levels against higher cognitive levels. This (lower cognitive levels) may result from misalignment with content

standards and non-use of the table of specifications while developing their questions. As a result, the WASSCE Chemistry questions from 2023 have low content validity. Onunkwo (1990) and Joseph (2000) confirmed, in their studies, that the Junior School Certificate Examination (JSCE) and the Senior School Certificate Examination (SSCE), respectively, have a low degree of content validity. Odiagbe (2022) also added that the Construction of valid and reliable tests across various subject areas has not received enough attention in senior secondary schools in Nigeria. The schools are expected to have enough valid and reliable tests to assess their students when they have covered the curriculum content areas and to prepare them for external examinations.

Research Question Three: What percentage of private school students passed the 2023 WAEC and NECO chemistry objective tests compared to public school students in Akwa Ibom State?

The researcher re-administered the 2023 WAEC and NECO chemistry examinations to a sample of 120 students in private schools and another 120 students from public schools. By examining the data gathered from the first instrument, the researcher used frequency counts and basic percentages to analyze it. After assessing the students' tests, determining their average scores, and using the mean percentage scores, the researcher classified the students' performances into ability groups of:

i) Above-average
ii) Average
iii) Below-average

Table 3: *What percentage of the multiple-choice questions of the 2023 WAEC and NECO reflect the lower-order cognitive level?*

Examination /Year	**Remember (%)**	**Understand (%)**	**Total (%)**
WAEC /2023	26.0%	32.0%	58.0%
NECO /2023	30.61%	28.57%	59.18%

The findings revealed that 58.0% of the multiple-choice questions in the 2023 WAEC Chemistry examination reflected lower-order cognitive levels (Remember 26.0% and Understand 32.0% categories). While 59.18% of the NECO questions reflected lower-order cognitive levels (Remember: 26.0%; Understand: 32.0%). This indicates that more than half of the items emphasized foundational knowledge and comprehension rather than higher-order thinking skills such as analysis, evaluation, and creation. Although both WAEC and

NECO demonstrate substantial coverage of lower-order cognitive skills, the findings indicate that neither examination body achieved a strong cognitive balance. The marginal difference between WAEC (58.0%) and NECO (59.18%) suggests that the issue is systemic rather than body-specific. While topic coverage may appear adequate, cognitive depth remains a critical area requiring improvement. Thus, the problem is not necessarily one of topic omission but of insufficient cognitive diversification. Balanced assessment requires not only representation across curriculum themes but also equitable distribution across cognitive domains to ensure content validity and promote higher-order learning outcomes.

Conclusion and Recommendations

This study examined the alignment of the 2023 WAEC and NECO Chemistry multiple-choice examinations with curriculum topics and cognitive domain distribution. The findings revealed that both examination bodies demonstrated reasonable coverage of the prescribed Chemistry curriculum themes, indicating alignment at the topical level. However, differences emerged in the cognitive depth of assessment, with both WAEC and NECO showing a predominance of lower-order cognitive items.

Although WAEC exhibited a slightly more balanced cognitive spread compared to NECO, both examinations placed greater emphasis on recall and comprehension than on higher-order thinking skills such as analysis, evaluation, and creation. This imbalance suggests that while curriculum topics are generally represented, the cognitive rigor expected at the senior secondary level is not fully realized in the assessment structure. Overall, the study concludes that alignment between curriculum and assessment exists at the level of topic coverage but remains limited in terms of cognitive balance. To ensure that examination outcomes accurately reflect students' conceptual understanding and scientific reasoning abilities, greater attention must be paid to developing standardized test blueprints that promote equitable representation across cognitive domains. Strengthening cognitive alignment will enhance the validity, reliability, and fairness of national Chemistry assessments and contribute to improved educational standards.

Based on the findings of this study and the importance of assessment alignment in any examination, the researchers offer the following recommendations:

- NERDC to update the Chemistry curriculum to explicitly encourage the assessment of higher-order cognitive skills across all exam bodies.
- The two examining bodies should consider incorporating higher-order questions to enhance students' analytical skills and prepare them for real-world applications.
- Teachers should be trained to emphasize higher-order thinking skills in classroom instruction, particularly in senior secondary schools, to ensure alignment with the curriculum's objectives.

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