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Instructional Alignment in Nigeria using the Surveys of Enacted Curriculum

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Abstract

Systematic, quantitative evidence on education system coherence is limited. Prior research has indicated alignment of instructional components, such as curriculum standards, assessments, and teachers' instruction, is important for children's learning. This study uses the Surveys of Enacted Curriculum methodology to investigate alignment of instructional components in Nigeria's primary education system. The study analyzes curriculum standards, national exams, and classroom instructional content for mathematics and English language across all six primary-level grades. We find that key foundational mathematics and English language skills are covered by all three components, with some notable omissions on the end-of-cycle English language exams. All three components give high emphasis to the low cognitive demand processes of 'memorize' 'perform', and 'demonstrate', and give very low emphasis to the more demanding cognitive processes of 'analyze' and 'apply to non-routine situations'. Both the curriculum standards and classroom instruction depict a slow pace of content progression across grades, manifested through broad but shallow content coverage. The high alignment suggests the potential for a well-functioning education system, however, low student performance in mathematics and English language exams suggest otherwise. The findings suggest the Nigerian primary education system may be operating in a low-achieving equilibrium in which the system is aligned for low levels of cognitive demand and student mastery.

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1. Introduction

Recent global evidence suggests that disparities between curriculum standards, classroom instruction, and assessments are common and are key contributors to low learning levels (Banerjee et al., 2016; Hwa, Kaffenberger & Silberstein, 2020; Kaffenberger & Pritchett, 2022). In Africa, 90 percent of children between the ages of about 6 and 14 are not meeting minimum proficiency levels in reading and mathematics (United Nations, 2022). With regards to children completing primary school (Grade 6) in Nigeria, only 17 percent of such pupils master basic literacy, and 31 percent basic numeracy standards at the primary school level (Adeniran, Ishaku, and Akanin, 2020). To ensure all children receive an adequate education and master basic education concepts, education systems need to be aligned for learning in all dimensions (Pritchett, 2015).

Crouch and DeStefano (2017) show that improvements to the alignment of instructional components have a large impact on student learning. They find that interventions focused on aligned ('coherent') pedagogical practices have a larger impact (0.45–0.50 standard deviations) on improving learning outcomes than interventions focused on structural factors (0.20 standard deviations) such as school autonomy or results-based teacher pay, or interventions focused on improving inputs such as infrastructure or money. This indicates that the alignment of instructional components (i.e. between curriculum standards, teacher classroom instruction, and assessments) is a key part of the solution to addressing the global learning crisis.

Systematic analyses of the alignment of curriculum standards, teacher classroom instruction, and examinations in developing countries are still nascent, especially in Sub-Saharan Africa (Atuhurra and Kaffenberger, 2022). To date, such studies have been conducted in four low- and middle- income countries using the Surveys of Enacted Curriculum (SEC) methodology: these are the analysis of instructional alignment at the primary-school level in Kenya, Tanzania and Uganda, and the analysis of a new integrated curriculum in Nepal (Atuhurra and Kaffenberger, 2022; Atuhurra et al., 2023).

This study seeks to evaluate the extent of alignment across instructional components in primary level literacy and numeracy in Nigeria by leveraging the SEC methodology, thereby providing reliable and robust evidence to inform policy decisions for promoting learning and long-term improvements in the education sector. In particular, this study assesses the content and progression within instructional components, the alignment between instructional components, and the alignment with student learning levels in Nigeria. By paying particular attention to content progression in the curriculum standards and classroom instruction, a key contribution of this study is the investigation of curriculum pace across grades (Primary 1 - 6), which provides deeper insights into the nature of the problems manifesting as low learning in Nigeria

Four major findings emerge from the study. The first set of findings relate to the content coverage in the curriculum standards, teacher classroom instruction, and exams. Key foundational literacy and numeracy skills are covered both as prescribed content on the curriculum standards and taught content in the classroom, though some topics are absent. Covered foundational reading skills include 'phonemic awareness', 'phonics', 'vocabulary', 'comprehension' and 'fluency', though fluency attracts relatively less emphasis. For foundational numeracy skills, 'number & numeration', 'basic operations' and 'measuration' are covered, while 'everyday arithmetics' and 'everyday statistics' are absent. The end-of-cycle numeracy exams consistently cover all content areas appearing on the math taxonomy, while the English language exams do not cover three of the five foundational reading skills - 'phonemic awareness', 'phonics', and 'fluency'. All three components allocate majority emphasis to the lowest three levels of cognitive demand, 'memorize', 'perform' and 'demonstrate'. While some minimal emphasis by the standards and teachers covers higher levels of cognitive demand, including 'analyze' and 'apply to non-routine tasks', the exams do not focus on these higher cognitive processes.

Second, both the curriculum standards and classroom instruction depict low levels of content progression across grades on both dimensions - topic/subtopic areas and cognitive demand levels. With grade-level content coverage touching on almost all topic areas throughout the six grades, the low progression primarily results from spreading emphasis too broadly in each and every grade - that is, a low focus on achieving depth in specific areas. With progression alignment measures ranging between 0.72 and 0.92 (on a 0 to 1 scale, where 0 is no overlap in content coverage and 1 is perfect overlap in content coverage), classroom instruction depicts extremely low levels of stretch between-grades and little focus on achieving depth along with breadth.

Third, both subjects present with high levels of alignment between curriculum standards and classroom instruction - with alignment measures of 0.65 and 0.73 for English and math respectively. Math alignment measures remain high at 0.72 between curriculum standards and exams, and fall to 0.57 between classroom instruction and the exams. Alignment with the exams is very low for English, at 0.42 for the curriculum standards and 0.34 for classroom instruction. These low measures are driven primarily by two aspects - the three foundational reading topics ‘phonemic awareness’, ‘phonics’, and ‘fluency’ are not covered on the exams, and the cognitive demand level ‘demonstrate’ attracts disproportionately higher emphasis on the exams than the other two components.

Fourth, students’ overall performance achievements are low in both subjects - with significantly lower achievements in English. However, alignment analysis reveals different patterns for the two subjects. Better student performance in English was achieved in topic areas of high alignment across the three components, that is ‘comprehension’ and ‘grammar’. On the contrary, students performed better on math topic areas that attracted relatively lower emphasis on both the standards and classroom instruction, namely ‘everyday arithmetic’, and ‘trigonometry and geometry’.

These findings suggest a system that may be trapped in a low equilibrium characterized by high cross-component alignment around low cognitive domain processes, low between-grade progression on content and ‘broad but shallow’ content spread. A change in policy focus to ensure achievement of both procedural and conceptual mastery will likely nudge the system towards a higher equilibrium. Assessment of children’s mastery of key foundational literacy and numeracy competences during the early years of school will provide timely and necessary information for improving students’ overall performance achievements in the end-of-cycle exams.

The subsequent sections of the paper are structured in the following manner: The second section presents an overview of the state of Nigeria's basic education systems, focusing on the three key instructional components: standards, instruction, and exams. Section 3 provides an in-depth explanation of the SEC methodology, along with its contextualization to the Nigerian setting. The fourth section of the paper presents the findings of the study, while the fifth section discusses the results and offers a conclusion.

2. The Nigerian context: Curriculum standards, classroom instruction, examinations, and student performance

2.1 Basic education in Nigeria

Nigeria is governed under a federal system, which influences the structure, actors, and relationships within the education system. Early childcare development is provided by the private sector with operating guidelines and oversight from the government, while pre-primary, primary, secondary, and post-secondary education are provided by the government (both state and local governments) or the private sector under standards set by the federal government. The sub-national government controls and manages the operational aspects of basic education in Nigeria.

Basic education in Nigeria consists of schooling through the first 15 years of childhood, which include early childcare development and education (0–4-year-olds)[1], one year of pre-primary education (5-year-olds), six years of primary education (6-11 year olds) and three years of junior secondary education (12-15-year-olds) (Federal Republic of Nigeria, 2013).

The start of formal, mandatory primary education occurs at age six. Primary and junior secondary education are free in public schools and compulsory under the Universal Basic Education Act (2004). Of the 28 million pupils who enrolled in primary school in 2019 (World Bank, 2023), public schools remain the popular destinations, with 22.7 million enrollments, while private schools accounted for 5.4 million (Statistia, 2023). Nevertheless, the provision of quality education at scale across Nigeria remains a challenging task. The Universal Basic Education Acts of 2004 allows the federal government to support sub-national governments through matching grants for infrastructural and teacher development needs at primary and junior secondary school. These Acts have supported the drive towards improving access to education with net primary school enrolment rate increasing from 63 percent in 1999 to 67.9 percent in 2004 and to 71.6 percent by 2007. Nevertheless, there are still an estimated 10.5 million out of school children in Nigeria (UNICEF, 2022).

Basic education is under the control of the State Universal Basic Education Boards (SUBEBs), which is an agency of the state government that receives federal government grants and support and regulates basic education in each state. The State Ministry of Education also plays an important role in policy setting for each state, and provides oversight over education parastatals and state academic institutions. National policy coordination is undertaken through the National Council of Education (NCE), which is headed by the Federal Minister of Education, and includes all state commissioners of education as members (NUC, 2023).

Nigeria has implemented several reforms to revamp the education system in accordance with the national development policy and global agenda. While these reforms have been designed to address many education challenges, the reforms are mostly skewed towards expanding access to education and improving 'inputs', such as better school infrastructure (Federal Ministry of Education, 2022). Only in a few instances have reforms attempted to address the classroom environment and translate curriculum into effective practice and learning (Saavedra and Simone, 2023; Kaduna State Education policy, 2019). Previous reform initiatives, however, have

[1] Early childhood education (children aged 0 to 5) is voluntary, and as a result, enrollment rates in creches, nurseries, and kindergartens fall below 40 percent (Statista, 2023). However, both private and public institutions offer Early Childhood Care and Development Education (ECCDE) programs. Between 2012 and 2020, an average of 36 percent of Nigerian children participated in early childhood education programs (Statista, 2023).

not attempted to understand or address more complex systemic issues such as the alignment between curriculum standards, classroom instruction and examinations, and how this impacts learning achievements.

2.2 Curriculum Standards

Curriculum standards and teaching guidelines for basic education are developed at the national level by the Nigerian Education Research and Development Council (NERDC). Following the adoption of the Universal Basic Education Act in 2004, NERDC developed a new curriculum in 2008 to reflect the needs and structure of basic education at the time. This led to the development of the nine-year Basic Education Curriculum (BEC). The curriculum was revised in 2015 to extend the content and coverage and to align the curriculum with the 2013 National Policy on Education.

The BEC is divided into three levels. The lower basic education level covers Primary 1-3. At this level, the emphasis is on proficiency in foundational literacy, numeracy, and communication. The approach at this level is child-centered, participatory, and localized, with instruction in the mother tongue and teaching aids drawn from the child's immediate environment. The middle basic education level covers Primary 4-6 and builds on the foundational skills learned in the previous level while also introducing students to pre-vocational subjects. The upper basic education marks the transition from primary to secondary education and covers Junior Secondary 1-3.

The goal of the BEC is to ensure that students receive nine years of quality education under which they acquire essential foundation skills either for education advancement or vocational enterprises. This curriculum is usually complemented with teacher guides and other materials to support implementation in the classroom. In most cases, teachers do not engage directly with the curriculum but instead derive its content through teacher guides and textbooks. These textbooks are produced by private publishing companies and state governments.

2.3 Classroom instruction

The institutions responsible for the hiring and professional development of teachers vary across states between either the Ministry of Education or the state's SUBEB. Policies around promotion, deployment and capacity development also vary across states. SUBEB plays a more central role in teacher deployment, evaluation and monitoring of classroom instruction. Only 62 percent of the primary school teaching force are formally appropriately qualified (having obtained the Nigeria Certificate in Education, NCE) (Universal Basic Education, 2018). In Kaduna state, 75 percent of primary school teachers did not pass a competency test equivalent to the Primary 4 curriculum (Guardian Nigeria, 2022).

There are some government regulations in place which require teachers to prepare lesson notes and maintain weekly diaries of their work. The quality of teaching in terms of competencies in subject matter and pedagogy, however, contribute to challenges in curriculum implementation. Furthermore, interruption either on the part of the learners (such as absenteeism) or competing teacher responsibilities can also lead to disconnects between the intended, enacted and learned curricula.

2.4 Examinations

At the primary level, the end-of-cycle examinations are conducted by the National Examination Council (NECO) in federal government schools and by state examination boards in state schools. End-of-cycle examinations are conducted in private schools by the schools themselves. At the end of the nine years of basic education, a

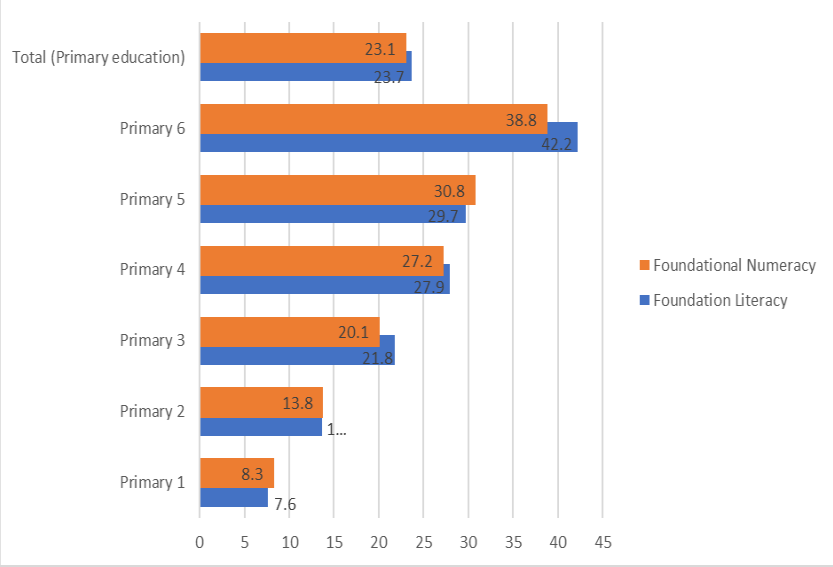
mandatory high-stakes end-of-cycle assessment is conducted by NECO called the Basic Education Certificate Examination (BECE) which is to be taken by both public and private school students

These high-stakes examinations typically occur too late in the schooling cycle to be effective for diagnosing and evaluating the state of the education system (see Rossier et al., 2021; Suen & Yu, 2006). As a result, the following survey-based and large-scale learning assessments are used for monitoring learning in Nigeria: Monitoring Learning Assessment (MLA) by the Ministry of Education, the National Assessment on Learning Achievement in Basic Education (NALABE) by UBEC, Multiple Indicator Cluster Survey (MICS) by UNESCO and Let's Engage, Assess and Report Nigeria (LEARNigeria) a citizen-led assessment by the TEP Centre.

2.5 Student performance

Learning trajectories are quite flat in Nigeria. The most recent education performance data based on UNICEF MICS 6 (2021) indicates that only 23.1 and 23.7 percent of school aged children (7–14-year-olds) can demonstrate foundational reading and numeracy skills respectively (Figure 1). Among those at the final grade of primary education, the results show 38.8 percent and 42.2 percent proficiency in literacy and numeracy respectively.

Figure 1: Percentage of school children with foundational skills



Source: UNICEF MICS6 Nigeria (2021)

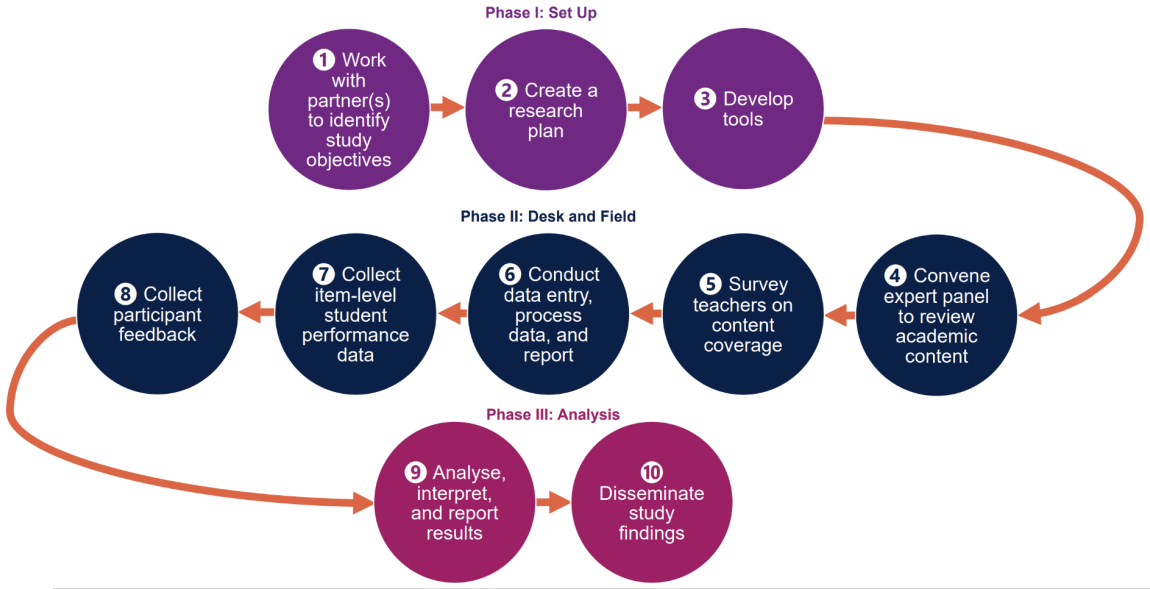
3. Methods

3.1 The SEC methodology

The Surveys of Enacted Curriculum (SEC) methodology enables researchers and practitioners to systematically analyze and quantify the academic content and alignment of instructional components, such as curriculum standards, assessments, teachers' classroom instruction, and more, as well as analyzing the alignment of these components with children's academic performance (Blank, Porter & Smithson, 2001; Porter, 2002; Smithson 2013).

Implementing the SEC methodology is a multistep process and is summarized in Figure 2 below.[2] The SEC methodology is based on recruiting a panel of experts who code and rate document-based instructional components, such as curriculum standards and assessments, and surveying teachers who report on classroom instruction.

Figure 2: Ten steps for conducting an SEC study in low- and middle- income country contexts



Source: Atuhurra et al. (2023a)

The SEC approach uses multiple, contextualized research tools. First is a context-specific, subject-level taxonomy for each subject that will be analyzed, which is either adapted from a standard taxonomy or produced by the expert panel. This taxonomy contains all the topics and subtopics that could be covered for the subject and school level under analysis (for instance, the primary level mathematics taxonomy would contain all topics and subtopics that may be covered during mathematics instruction in the primary school grades). The tools also include a set of performance expectations or levels of cognitive demand that are also adapted by the expert panel. These levels of cognitive demand are on a five-point scale, from least demanding (as in memorize or recall) to

[2] While the methodology is described in this section, full details on the methodology upon which this study was conducted can be found in Atuhurra et al. (2023a).

most demanding (as in evaluate or apply knowledge to non-routine problems). An illustrative definition (using performance descriptors) for each level is provided in Table 1.

Table 1. Levels of cognitive demand and illustrative definitions of each

Level of cognitive demand	Illustrative definition
Memorize/Recall	Recognize, identify, or recall facts, definitions, or formulas
Explain/Perform Procedures	Perform procedures, solve routine problems, do computations, make observations, take measurements
Generate/Demonstrate understanding	Communicate ideas, explain findings from analysis, explain reasoning
Analyze/Conjecture	Make and investigate conjectures, infer and predict
Evaluate/Apply to non-routine problems	Apply and adapt strategies, solve novel problems, make connections

Based on this taxonomy and levels of cognitive demand, the panel of experts codes (for topics/subtopics) and rates (for cognitive demand level) document-based instructional components along these two dimensions. Each curricular objective or assessment item is coded based on the subtopic it is covering and the level of cognitive demand expected of students. At the end of this process, a rich dataset is produced with each expert's individual codes and ratings for each document-based instructional component, providing insight into the content coverage and cognitive demand requirements in each document-based instructional component.

For analyzing teacher instructional content, teachers are trained on the SEC methodology, the taxonomy of topics and subtopics, and levels of cognitive demand. Teachers are then tasked with completing self-report surveys on the topics and levels of cognitive demand covered in their instruction. Surveys are typically conducted at the end of a school year and cover content taught in the year that just ended.

To further enrich the study, data on student performance is analyzed to illuminate what students have learned, and how the content of instructional components aligns with or supports students' learning. This data on student performance is generally comprised of results from the examination(s) being analyzed in the study, and is analyzed as secondary data from the examination body.

The outputs of the SEC methodology are three-dimensional content maps with topics or subtopics on the Y axis, levels of cognitive demand on the X axis, and level of emphasis (percent of total coverage) on the Z axis (Smithson, 2015). These three-dimensional figures visualize the content in the instructional component being analyzed. Utilizing a simple two-step process to interpret the maps, specific data points are first identified at the intersection of topic/subtopic and cognitive demand level, and then emphasis is determined by variations in color schemes for each data point (Atuhurra & Alinda, 2017). Student performance content maps use a modified approach because the Z axis has a different interpretation; in these maps the Z axis represents the proportion of students who answered a relevant question correctly. The Z axis therefore uses a different color-scale, in a traffic-

light style color pattern, to illustrate that these maps are different and to make their interpretation more intuitive.[3]

Alignment across instructional components is reported using alignment indices. Alignment index values range from zero to one, with zero indicating perfect misalignment (no overlap in content) and one indicating perfect alignment (perfect overlap in content). There is not an expectation that instructional components would be perfectly aligned. For instance, assessments may cover a sample of the total items prescribed in the curriculum. A value of 0.5 on the alignment index has often been used as an indication of a reasonable level of alignment between instructional components (Smithson, 2015). However, an appropriate threshold will be context specific, and in some contexts a higher level of alignment may be desired. Analysis of SEC data is a quantitative exercise, but interpretation, including of the alignment indices, is a qualitative undertaking. Finally, SEC is a descriptive tool, describing academic content; the methodology itself does not contain a normative stance on what a correct content map 'should' look like. Instead, it is a tool to be interpreted and used by experts in the study context to understand and inform change to improve instructional content's alignment for learning.

3.2 SEC contextualization in Nigeria

This study applies the SEC methodology to Nigeria in two states (Oyo and Jigawa) across two subjects (mathematics and English language) for lower primary (Primary 1-3) and upper primary (Primary 4-6). Oyo and Jigawa were intentionally chosen to represent two geo-political zones in Nigeria, with Oyo State in the southern part of the country (the region with the best performance in terms of quality of basic education) and Jigawa State in the northern part of the country (the region with the worst performance in the country) (Dataphyte, 2020).

3.2.1 Study dimensions

The instructional components which were analyzed for this study were as follows:

- *Curriculum standards:* The curriculum standards for Primary 1-6 were sourced from the Nigerian Educational Research and Development Council (NERDC). The sourced curriculum is standard across the 36 states and FCT.
- *Teacher classroom instruction:* Teacher classroom instruction data was reported and directly coded and rated during a survey of teachers from the two states.
- *Examinations:* Assessment instruments for both mathematics and English language for 2017, 2018, and 2019 were obtained for the National Common Entrance Examination (which covers Primary 1 - 6 and is conducted at the end of Primary 6) from the National Examination Council (NECO). While the assessment is designed at the national level, its use and standardization across all 36 states and the FCT makes it applicable for the two states (Oyo and Jigawa) in this study.
- *Student performance:* Data on student performance was provided by NECO drawing on the NCEE high-stakes assessment conducted at the end of primary school (Primary 6) to inform admission into lower secondary school. This data was for both states (Oyo and Jigawa) for 2017 and 2019.

3.2.2 Expert panel composition

[3] As explained in Atuhurra et al., 2023: "The z-axis of the student performance content maps is split between four categories of increasing height and uses traffic-light style colors to illustrate their different meaning and to make them more intuitive: grade-average scores of less than 40 percent on a particular topic/cognitive demand level combination are displayed as red, greater than or equal to 40 percent but less than 60 percent are yellow, greater than or equal to 60 percent but less than 80 percent are green, and 80 percent and above are blue."

Two expert panels were formed for this study: one composed of experts in numeracy, and the other experts in literacy. These experts coded and rated the curriculum standards and examinations. The experts involved in these two panels were:

- Three curriculum experts
- Two assessment experts
- Two teachers
- One school administrator
- Two from civil society

The selection of these experts brought together actors in assessment, curriculum design, education research, and school practices. The diversity of experts provided richness to the study and more robust results as different levels of expertise were consulted in the coding and rating process.

3.2.3 Teacher surveys

The coding and rating of the teacher instructional content was achieved by teacher survey. The survey tools were first designed, pretested modified before it was administered.

Two hundred teachers were surveyed in the study, of which 100 were randomly sampled from Oyo and 100 randomly sampled from Jigawa. The teacher sample was selected from a random sample of 25 schools in urban areas and 25 schools in rural areas in each state, making a total of 50 schools per state. Each school in the sample nominated one teacher from lower primary for one subject (i.e., mathematics) and a teacher from upper primary for the other subject (i.e., English language). This resulted in a sample of 12 lower primary English language teachers, 12 lower primary mathematics teachers, 13 upper primary English language teachers, and 13 upper primary mathematics teachers from each of the two states.

The teacher survey instrument is a standard instrument under the SEC methodology which was adapted by the expert panel to incorporate the adapted taxonomy and levels of cognitive demand for the study context. It was pre-tested with 30 teachers from different schools and districts from across the two states before finalization of the tool and roll-out of the full teacher survey.

Teacher survey fieldwork was conducted with the support of the State Universal Basic Education Board (SUBEB) and the Ministry of Education, where SUBEB and the Ministry supported the participation of teachers in the survey. The data collection process was facilitated by trained field coordinators and two staff from the local implementation partner (Centre for the Study of the Economies of Africa).

Eight teacher surveys had to be omitted from the sample due to incompletion, reducing the sample size from the surveyed 200 teachers to 192 teachers.

3.2.4 Data processing and analysis

Data processing and analysis was undertaken in partnership with the Center for Curriculum Analysis, as the intellectual property owners of the SEC analysis methodology and software. The result of this process were content maps, alignment indices, marginal tables, and more granular data from which results were generated.

4. Results

4.1 Nigeria Primary Mathematics

4.1.1 Standards: The content and progression of primary mathematics curriculum standards

Figure 3 shows three content maps depicting the topic-level emphasis of content in the Nigerian primary mathematics curriculum standards. Panel A is an aggregation of prescribed content for lower primary (Primary 1-3), Panel B for upper primary (Primary 4-6), and Panel C for all of primary (Primary 1-6). Overall, three topics dominate emphasis: 'Number & Numeration' at 36 percent, 'Basic Operations' at 20 percent, and 'Measuration' at 20 percent. While the intended emphasis structure for Number & Numeration across the two cycles (lower & upper primary) is steady, there are notable differences for the other two topics (Basic Operations is emphasized less in lower primary while Measuration is instead emphasized less in upper primary). The other four topics account for 25 percent coverage in the curriculum standards – with 13 percent almost equally split between 'Everyday Arithmetic' and 'Everyday Statistics', 8 percent for 'Trigonometry & Geometry' and 4 percent for 'Algebraic Processes'. Between lower and upper primary, emphasis on Everyday Arithmetic and Algebraic Processes remains steady while Everyday Statistics doubles as Trigonometry & Geometry falls by half.

Emphasis on cognitive processing in the curriculum standards is heavily skewed towards the lower levels of 'memorize' at 22 percent and 'perform procedures' at 50 percent. Whereas at 18 percent similar emphasis is given to 'demonstrate' as 'memorize', only 10 percent of total emphasis goes to the two highest levels of 'analyze' and 'apply'. Overall, this cognitive emphasis structure is maintained in lower and upper grades, except that at upper primary 'demonstrate' is more emphasized (22 percent) than 'memorize' (14 percent), a reversal of the emphasis structure in lower primary.

Figure 3: Nigeria topic level mathematics curriculum standards: Lower primary (P1-P3), upper primary (P4-P6), and all primary aggregated (P1-P6

A. Math curriculum standard, P1-P3 B. Math curriculum standard, P3-P4 C. Math curriculum Standard, P1-P6

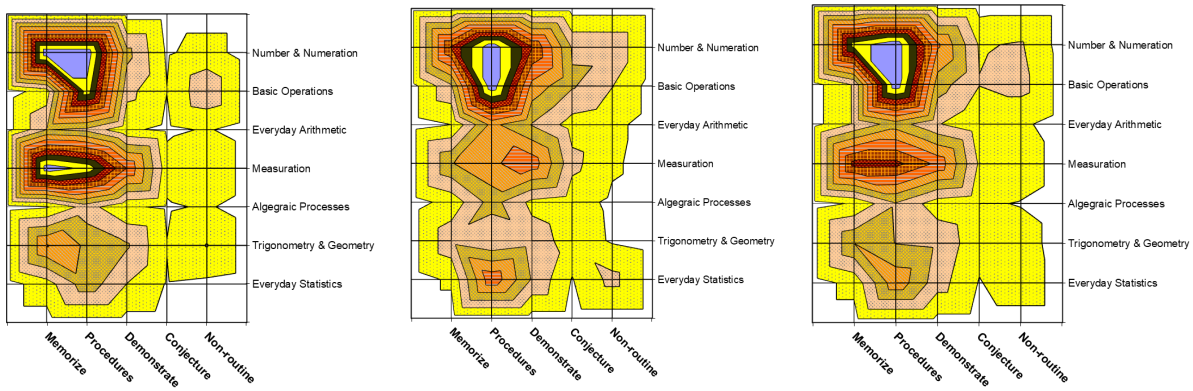


Table 2: Primary math curriculum standards - Nigeria: Content progression alignment measures

	Grade / Cycle	Coarse-grain alignment measures							
		P1	P2	P3	P1-P3	P4	P5	P6	P4-P6
Fine grain alignment	**P1**	1.00	0.75						
	P2	0.56	1.00	0.75					
	P3		0.55	1.00		0.69			
	P1-P3				1.00	0.65			0.65
	P4			0.46	0.44	1.00	0.71		
	P5					0.44	1.00	0.56	
	P6						0.31	1.00	
	P4-P6				0.41				1.00

Analysis of content across grades is important for understanding the intended learning experience for children as they progress from one grade to the next. To learn new content, children need to build on what they already know, hence the cumulative and spiraling nature of content layout or sequencing. There is always a need to maintain a balance, as curricula that progress so fast might leave many children behind, whereas going too slow will also lead to low learning due to boredom. Table 2 shows the between-grade content alignment measures, which are indicative of the prescribed content progression pace in the curriculum standards. Topic-level coarse grain alignment measures appear above the main diagonal, and subtopic-level fine grain measures below the diagonal. Coarse grain measures are always higher than fine grain measures since topic-level analyses reflect aggregation across the many subtopics within a topic. The higher the between-grade alignment measure, the lower the content progression pace between the two grades - since it implies high levels of content overlap between the two grades.

The highest levels of overlap are between Primary 1 and 3, at 0.75 coarse grain for both P1-P2 and P2-P3. This means that at topic level, the prescribed content for each subsequent class varies from the content for the previous class only about 25 percent of the time. This suggests that the curriculum standards intend low levels of stretch in the first three classes - possibly to give children an opportunity to gain sufficient mastery of foundational content in the early grades and thus set the stage for faster progress in subsequent grades.

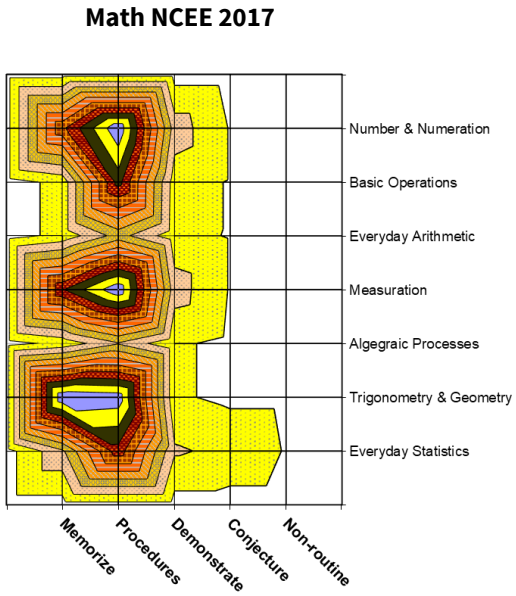
The transition from P3 to P4 indicates a slightly higher level of stretch with 31 percent variation in prescribed content. This slightly faster pace of prescribed content coverage coincides with the lower-to-upper primary transition in Nigeria, which comes with a change in the Language of Instruction (LoI) from 'language of immediate environment' to English. It also coincides with an increase in the number of subjects from 7 to 9. The content progression pace between P4 and P5 is similar to P3 to P4. At 0.56 coarse and 0.31 fine grain, the P5 to P6 transition depicts the highest level of prescribed content stretch.

4.1.2 Learning assessments: The content of the end-of-primary Mathematics National Common Entrance Examinations, NCEEs

The National Common Entrance Exam (NCEE) from NECO, which is a P6 end-of-primary cycle national-level exam, was used in this study. The NCEE is a standardized national examination that all students completing P6 are required to sit and pass before they can join junior secondary school (Grade 7) in Nigeria.

The NCEE for 2017 covered all seven topic areas, with Number & Numeration, Measuration, and Trigonometry & Geometry accounting for 73 percent of coverage (Figure 4). Sixty percent of cognitive processing emphasis on the NCEE for 2017 was on 'perform procedures' and about half as much (31 percent) on 'memorize'. The subtopic areas accounting for most coverage on the NCEE are 'fractions', 'percentages', 'ratios & proportions', 'length & perimeter', 'area & volume', 'time & temperature', 'derived measures', 'angles', 'triangles', 'quadrilaterals' and 'polygons'.

Figure 4: Nigeria topic level mathematics examination: NCCE 2017



Although the NCEEs are standardized, content coverage may vary across years - in this case we have NCEEs for 2017, 2018 and 2019. Figure 3 shows content maps for NCEEs for 2018 and 2019, and an aggregation of all the three years' NCEEs (2017 - 2019). As shown in Table 3, the coarse-grain alignment measures between these assessments are 0.67 (2017-2018), 0.60 (2018-2019), and 0.58 (2017 - 2019) - confirming year-to-year content emphasis variations.

Over these three consecutive years, the emphasis structure over the seven topic areas can be categorized into four levels - consistently high priority (Number & Numeration), high priority (Basic Operations & Measuration), intermittent coverage (Algebraic Processes & Trigonometry & Geometry) and low priority (Everyday Arithmetic & Everyday Statistics). Conversely, the emphasis for cognitive processing on the NCEEs for all three years is highly consistent - with 'perform procedures' accounting for majority coverage (60-70 percent), followed by 'memorize' (20-33 percent) and finally 'demonstrate understanding' at a low 5 percent. The two higher order cognitive demand levels 'conjecture' and 'apply to non-routine' are not emphasized on the NCEEs.

Figure 5. Content maps for NCEEs 2018 and 2019, and an aggregation of all the three years

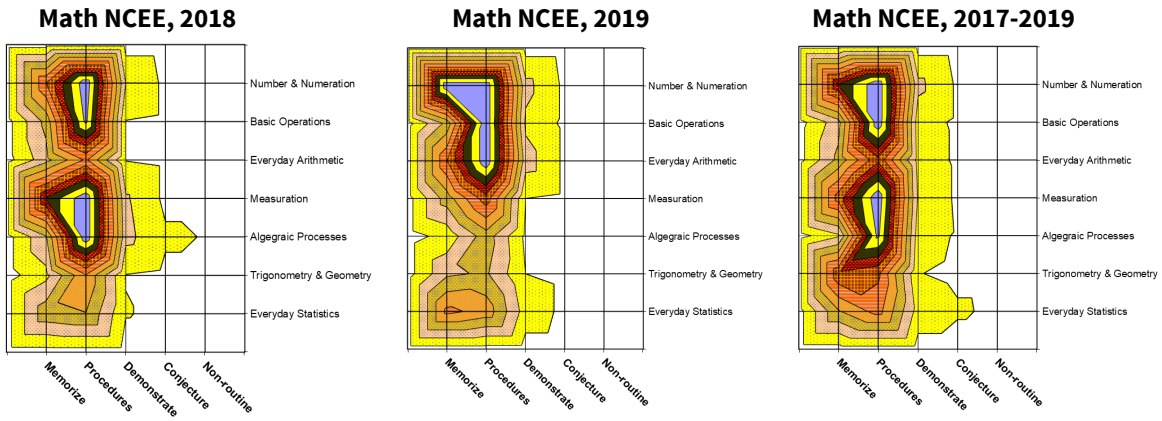


Table 3: Primary math exams - Nigeria: Cross-year alignment measures

	Exam/year	Coarse grain alignment measures		
		NCEE 2017	NCEE 2018	NCEE 2019
Fine grain alignment measures	**NCEE 2017**	**1.0**	0.67	0.58
	NCEE 2018	0.40	**1.0**	0.60
	NCEE 2019	0.39	0.37	**1.0**

4.1.3 Instruction: The content and progression of primary mathematics instruction

Figure 3 shows content maps for teachers' classroom coverage, with aggregations for P1-P3 in Panel A, P4-P6 in Panel B and P1-P6 in Panel C. Teachers cover all seven topic areas throughout the primary cycle, with the exception of 'everyday statistics' which is not covered in lower primary Grades 1-3. The two foundational topics Number & Numeration and Basic Operations attract most emphasis in both lower and upper primary grades totaling 67 percent and 57 percent respectively. These are followed by Measuration at 15 percent and Trigonometry & Geometry at 10 percent. Emphasis on the remaining three topics of Everyday Arithmetic, Algebraic Processes and Everyday Statistics increases from a total allocation of 9 percent in lower to 17 percent in upper primary. Teachers' instructional emphasis on cognitive demand shows an identical structure for both lower and upper primary, with 90 percent coverage almost equally distributed among the three lower levels 'memorize' 'perform' and 'demonstrate' and the remaining 10 percent mostly going to 'analyze'.

Figure 6: Nigeria mathematics teachers' instructional content – Lower (P1-P3), upper primary (P4-P6), and aggregation (P1-P6)

A. Math Instruction, P1-P3 B. Math Instruction, P4-P6 C. Math Instruction, P1-P6

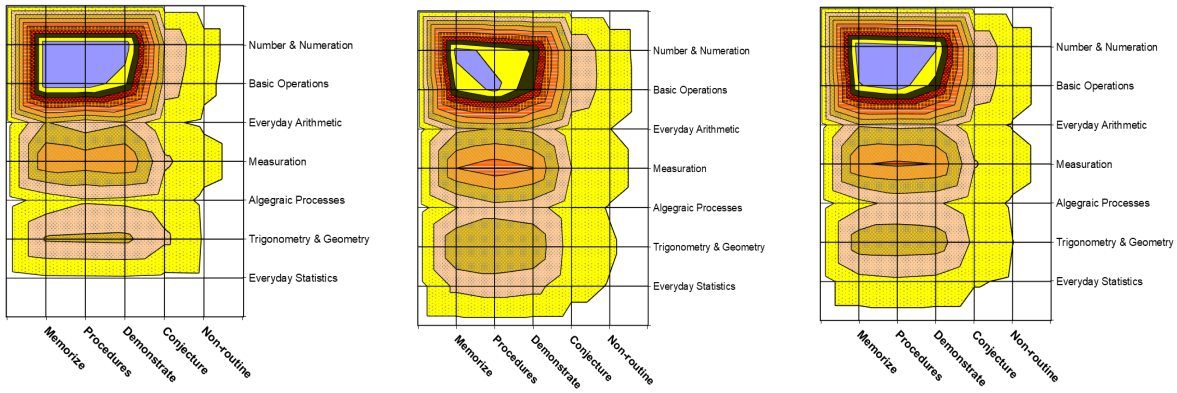


Table 4 below shows alignment measures for instructional content coverage by teachers across grades. These illustrate the content progression pace experienced in the classroom as students move from one grade to the next. Ranging between 0.72 and 0.92 at coarse grain, and 0.51 and 0.80 at fine grain, these relatively high progression alignment measures are indicative of a slow instructional pace. Since teachers are covering almost all content areas in all grades, the high progression alignment measures point towards an emphasis on achieving broad content coverage at the expense of depth.

Table 4: Primary Mathematics Instruction - Nigeria: Content progression alignment measures

	Grade / Cycle	Coarse-grain alignment measures							
		P1	P2	P3	P1-P3	P4	P5	P6	P4-P6
Fine grain alignment	**P1**	1.00	0.72						
	P2	0.51	1.00	0.83					
	P3		0.63	1.00		0.88			
	P1-P3				1.00	0.88			0.87
	P4			0.69	0.69	1.00	0.92		
	P5					0.80	1.00	0.84	
	P6						0.78	1.00	
	P4-P6				0.61				1.00

4.1.4 Student performance: The content and progression of primary mathematics students' performance

Student performance data is influenced by the scope, coverage and purpose of an assessment, and is thus always analyzed in conjunction with examination content maps (Atuhurra et al., 2023). As explained in 3.2.1 Summary of Instructional Components, student performance data was obtained for the NCEE high-stakes assessment conducted at the end of primary school (primary 6) for both states (Oyo and Jigawa) for 2017 and 2019.

Figure 7 provides a birds-eye view of student performance and reveals that the average score obtained on the NCEE examinations differ greatly across Oyo and Jigawa, with the higher-performing state of Oyo having grade averages of 46 percent and 49 percent in 2017 and 2019 respectively, and the lower-performing state of Jigawa having grade averages of 20 percent and 27 percent in 2017 and 2019 respectively. This data provides meaningful context for our analyses: (i) scores do not differ greatly across the two assessments within the same state, and (ii) even students from the higher-performing state are getting over half of the exam questions incorrect, and students from the lower-performing state are getting around three quarters of the exam questions incorrect.

Figure 7: Sample average of raw scores on NCEE 2017 and NCEE 2019 in mathematics

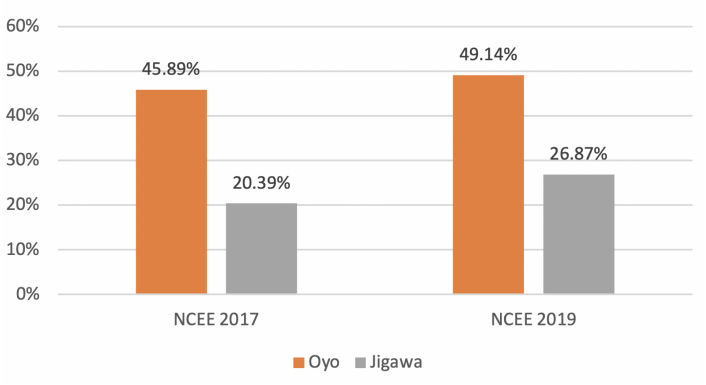


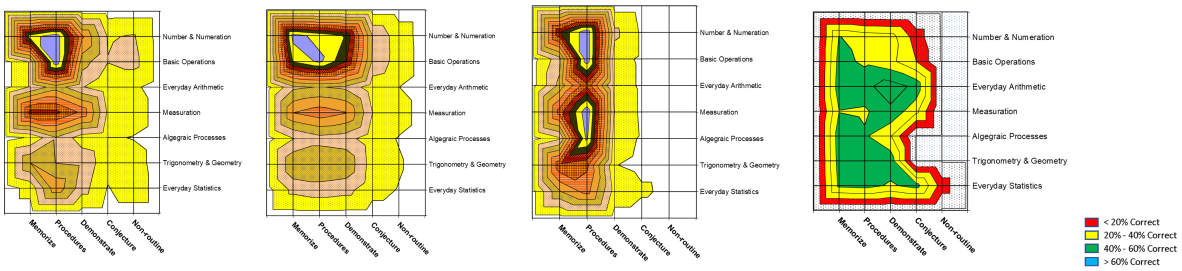
Figure 8 displays student performance data by topic-level and cognitive demand-level, side-by-side with the content maps of other instructional components. Note that the shape of student performance content maps mimic the shape of the NCEE content maps as the performance map uses student performance data from the NCEE (so, we only have performance data on topic/cognitive demand level combinations that were asked on the exam). The student performance maps and NCEE content maps, however, have different Z axes (where Z axis is level of emphasis on the NCEE content map, and average performance level on student performance content maps).[4]

Student performance was highest on everyday arithmetic (50 percent performance average), followed by trigonometry and geometry (around 45 percent), and then measuration and algebraic processes (41 percent and 40 percent respectively). Student performance was lowest on number and numeration (32 percent). The scores are proportionally lower for students from Jigawa than for students from Oyo, but the topic-level trends are similar).

With regards to cognitive demand, student performance was highest on memorize / recall questions (44 percent) and performance gradually reduced as cognitive demand levels increased (students achieved only 16 percent correct for solving non-routine problems). These trends also persist across the two states.

Figure 8. Mathematics Standards, Instruction, Exam and Student Performance

Maths Curriculum Standard, P1-P6 Maths Instruction, P1-P6 Maths Exam (NCEE), 2017-2019 Student Performance, 2017-2019



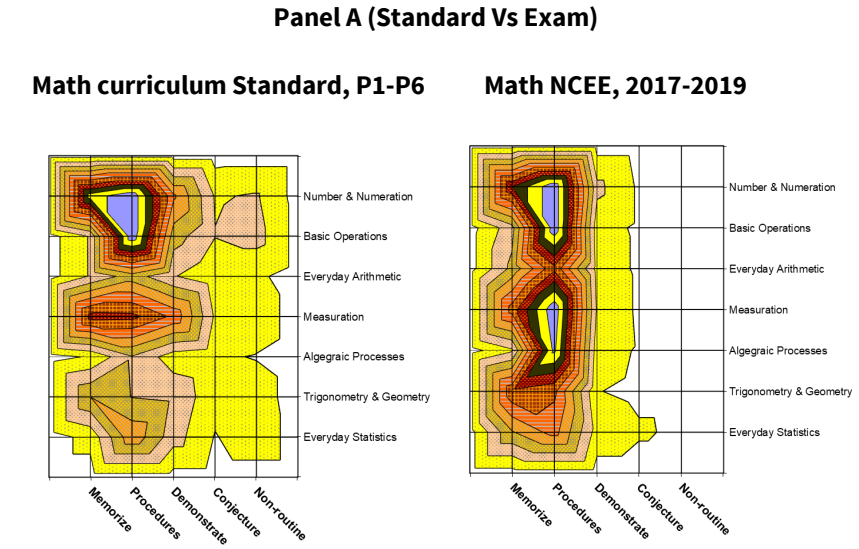
[4] Closer observation will reveal that student performance maps in this study slightly spill outside the bounds of examination content maps. This is due to different sensitivity parameters that produce these two content maps, owing to different Z axes for the two.

A key takeaway from Figure 8 are the levels of alignment between student performance and the instructional components. While there are high levels of emphasis for the number and numeration topic across all three instructional components, students perform relatively poorly on this topic. By contrast, the topics on which students perform best, everyday arithmetic and trigonometry and geometry, do not receive high levels of emphasis.[5]

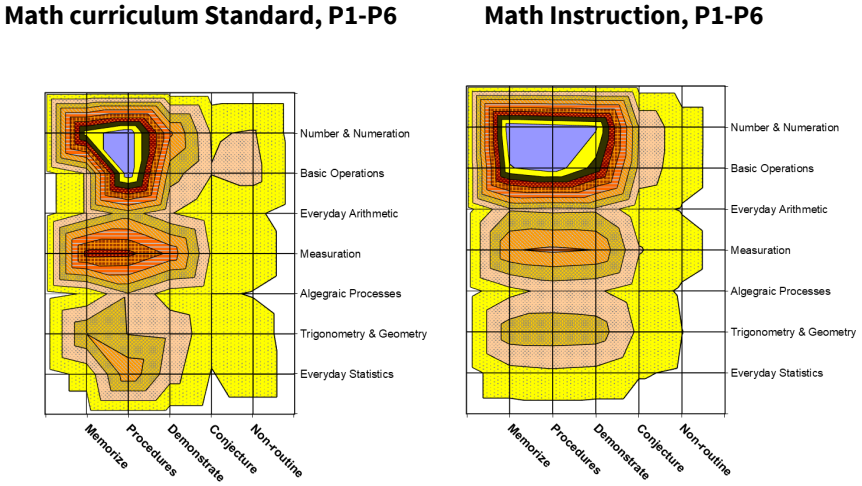
4.1.5 Measuring coherence between mathematics curriculum standards, instruction and examinations

Figure 9: Coherence between standard, Instruction and Exam

Panel A (Standard Vs Exam)



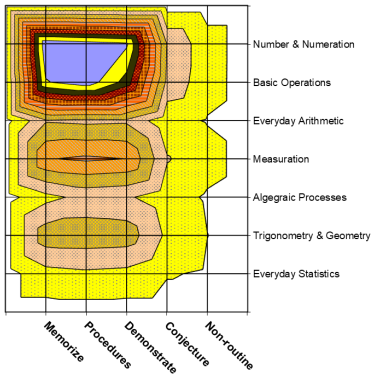
Panel B (Standard Vs Instruction)



[5] One factor driving these unexpected results could be the design of assessments and the reliability of student scores based on topic and cognitive demand emphasis level in the examination. Scores from topic and cognitive demand combinations with high emphasis are more reliable in theory, due to repeated testing, than scores from low emphasis areas, which are more at risk of being impacted by the design of the chosen assessment item. This however needs to be further evaluated.

Panel C (Instruction Vs Exam)

Math Instruction, P1-P6



Math NCEE, 2017-2019

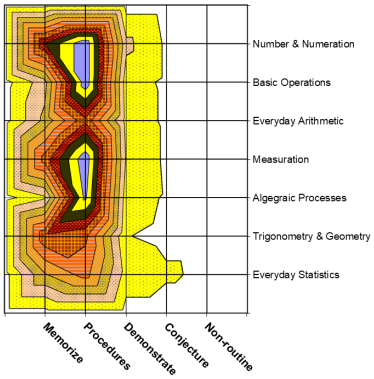


Table 5: Mathematics – Nigeria: Coherence across standards, Examination, and instruction

Grades/Cycles	Overall Alignment indices					
	Standards vs Exams		Standards vs Instruction		Instruction vs Exam	
	Fine	*Coarse*	*Fine*	*Coarse*	*Fine*	*Coarse*
P1-P3			0.40	0.63		
P4-P6	0.44	0.64	0.49	0.74	0.38	0.59
P1-P6	0.41	0.72	0.51	0.73	0.37	0.57
P1			0.38	0.61		
P2			0.28	0.56		
P3			0.32	0.61		
P4			0.40	0.76		
P5			0.39	0.67		
P6			0.27	0.57		

The coarse grain alignment measure between the aggregate primary curriculum standards and aggregate exam content[6] is 0.72 (Figure 9 and Table 5), a high level of content overlap across the two components. Both allocate most emphasis to the three topics Number & Numeration, Basic Operations and Measuration, and to the three lower cognitive demand processes – 'memorize', 'perform' and 'demonstrate'. However, the 28 percent variation in content overlap between the two components also highlights some interesting features.

First, within the high emphasis areas lie some distinct patterns. The standards present greater emphasis on the three most emphasized topics (i.e., 75 percent of total coverage as opposed to 59 percent). The exams, on the other hand, have greater concentration for the three most emphasized cognitive processes (i.e., 99 percent of total coverage as opposed to 90 percent). Second, a significant 40 percent of coverage on the exams goes to the remaining four topics (Algebraic Processes, Trigonometry & Geometry, Everyday Arithmetic and Everyday Statistics), with a topic-level allocation of about 10 percent each. Only 25 percent coverage is prescribed for these four topics on the standards, three of them averaging about 7 percent each and Algebraic Processes attracting only 4 percent. For cognitive demand, the exams give almost no emphasis to the two higher order cognitive processes, while the standards prescribe 10 percent of total cognitive demand coverage towards the two higher order cognitive processes 'analyze' and 'apply'.

The coarse grain alignment measure falls to 0.64 when the prescribed curriculum content is restricted to upper primary Grades 4-6. This suggests that items appearing on the NCEEs cover content prescribed for all primary grades, not just the final three. The fine grain alignment measure increases from 0.41 to 0.44, implying a slightly higher overlap of subtopic areas prescribed for upper primary grades and featured the end-of-cycle exams.

Figure 9, Panel B, compares content of the primary mathematics curriculum standards and instruction. The middle columns of Table 5 show both grade-level and aggregated alignment measures between the curriculum standards and teachers' content coverage in the classroom. The aggregated coarse grain alignment measure for all grades (P1-P6) is 0.73, suggesting that teachers' content coverage matches the curriculum prescriptions most of the time. This is also true at the fine grain level where the level of overlap exceeds 50 percent. Across all grades, the coarse grain alignment measures exceed 0.5. Three topics dominate both the standards and instruction, Number & Numeration, Basic Operations and Measuration – together accounting for 75 percent of the total topical coverage for each of the two instructional components. The three lower levels of cognitive demand are the most emphasized on both components – accounting for 90 percent of total cognitive coverage for each.

Despite the high levels of alignment, an in-depth analysis reveals some component-specific differences. Throughout all grades, the curriculum standards prescribe at least one-third of topic-level emphasis to Number & Numeration, and emphasis on Basic Operations and Measuration is quite dynamic – at 26 percent Measuration is emphasized twice as much as Basic Operations in lower primary and vice versa in upper primary. About one-half of cognitive processing on the standards goes to 'perform procedures' while 'memorize' is more emphasized in lower primary and 'demonstrate' in the upper primary grades. On the other hand, teachers' classroom practice reveals a more balanced emphasis structure across the three topics and cognitive processes throughout the grades. In both lower and upper primary grades, teachers' coverage for each of the two topics Number & Numeration and Basic Operations averages at around 30 percent while Measuration accounts for 15 percent. At an average of 30 percent emphasis for each, teachers allocate equal instructional emphasis to the three lower cognitive demand processes in both lower and upper primary grades.

[6] Note that for the purposes of alignment analysis, the three-year aggregated content of the NCEEs for 2017, 2018 and 2019 are used.

Finally, Figure 9, Panel C, compares mathematics instruction with the NCEE exams. The coarse grain alignment measure between instruction and the NCEE exams is 0.57 (Table 5, right column) and reflects the lowest of all the aggregate alignment measures for primary math in this study, though in absolute terms this measure does not suggest low alignment. This relatively low measure suggests that overall, teachers are not focusing their classroom coverage on the exams. The alignment measure increases to 0.59 when the analysis is restricted to upper primary Grades 4-6, providing some evidence that might indicate upper primary teachers trying to target their teaching to the exams.

There are two key sources of misalignment between instruction and the exams. First, while most coverage on both components is attributed to the three dominant topics Number & Numeration, Basic Operations and Measuration, the extent of their dominance sharply differs across the components – a significantly large 76 percent of total instructional coverage and a moderate 59 percent of total exam coverage. Second, even though both components place most emphasis on the three lowest levels of cognitive demand, there are sharp distinctions between them. The exams only cover the three lowest levels, with 'perform' allocated the most coverage at 67 percent. By contrast, instruction is spread more evenly across the three lowest levels (average of 30 percent for each) and includes 10 percent allocation to the two higher levels of 'analyze' (at 8 percent) and 'apply to non-routine' (at 2 percent).

4.2 Nigeria Primary English

4.2.1 Standards: The content and progression of primary English curriculum standards

Figure 10 contains three content maps which show the emphasis structure of content embedded in the Nigerian primary English curriculum standards. The panel on the left is an aggregation of the prescribed content for lower primary English (Primary 1-3), the middle one for upper primary English (Primary 4-6), and the map on the right for all six grades (Primary 1-6). Three topics account for half the emphasis in lower primary: 'comprehension' at 21 percent, 'grammar' at 15 percent, and 'phonics' at 14 percent. In upper primary, 'phonics' coverage reduces to 8 percent and emphasis on both "comprehension' and 'grammar' increases. The emphasis on 'Listening and speaking' increases significantly in upper primary to 15 percent. In both lower and upper primary, the three topics with the highest prescribed emphasis account for at least 50 percent of total coverage – leaving the other ten topics to share the remaining 50 percent.

The prescribed cognitive demand emphasis is heavily skewed towards the lowest levels: 'memorize/recall' and 'perform procedures' which account for 74 percent of total emphasis. In the lower primary Grades P1 – P3, at least 40 percent emphasis is prescribed for 'memorize/recall', followed by perform procedures at 30 percent. In upper primary, 'perform procedures' is more emphasized at 45 percent, with 'memorize/recall' attracting 28 percent emphasis. Throughout all six primary grades, the prescribed emphasis on 'demonstrate' averages at 16 percent, leaving the two higher cognitive demand levels, 'conjecture' and 'apply to non-routine', accounting for about 10 percent. In primary 6 the emphasis on 'conjecture' increases to 13 percent.

Figure 10: English curriculum standards: Lower primary (P1-P3), upper primary (P4-P6), and aggregated (P1-P6)

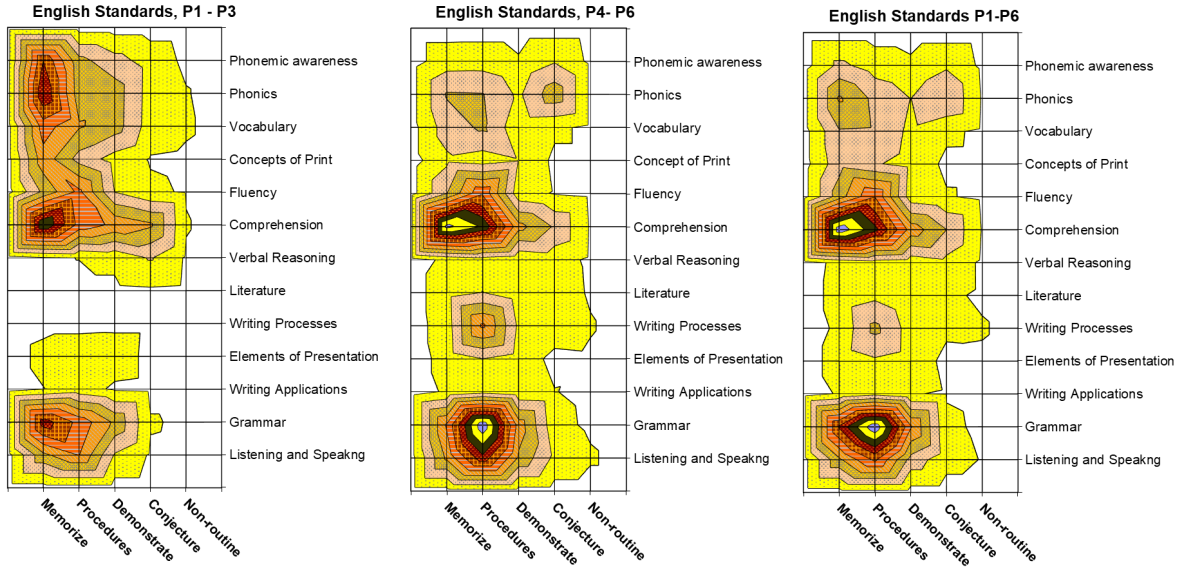


Table 6: Primary English standards - Nigeria: Content progression alignment measures

	Grade/Cycle	Coarse-grain alignment measures							
		P1	P2	P3	P1-P3	P4	P5	P6	P4-P6
Fine grain alignment	**P1**	1.00	0.67						
	P2	0.42	1.00	0.71					
	P3		0.47	1.00		0.72			
	P1-P3				1.00	0.63			0.67
	P4			0.50	0.46	1.00	0.71		
	P5					0.49	1.00	0.58	
	P6						0.33	1.00	
	P4-P6				0.48				1.00

Table 6 shows the between-grade content alignment measures for English curriculum standards, which indicate the pace of the curriculum. Topic-level (coarse grain) alignment indices appear above the main diagonal, while subtopic-level (fine grain) indices are below the main diagonal. High alignment measures indicate high levels of content overlap across grades, implying a slow progression pace and vice versa.

At 0.67, the coarse-grain progression alignment measure between Grades 1 and 2 suggests a moderate level of stretch in the prescribed content. Between the two grades, there are major changes in the prescribed coverage of three foundational reading topics, namely 'phonemic awareness', 'vocabulary', and 'comprehension'. The first two topics account for 38 percent of total emphasis in Grade 1, which falls significantly to 15 percent in Grade 2. Conversely, the prescribed emphasis on 'comprehension' in Grade 1 increases by 20 percentage points to 32 percent in Grade 2. The fine-grain alignment measure is 0.42, also indicative of a moderate stretch in the prescribed sub-topic content.

At 0.71, the Grades 2-3 coarse grain progression alignment suggests a slightly higher level of overlap, and lower level of content variation, between the two grades. The main content coverage changes here involve two topics, 'comprehension' and 'grammar'. The prescribed emphasis on the former falls significantly to 20 percent while that of the latter doubles to 24 percent.

Between Grades 3 and 5, the progression alignment measures are high at both topic and subtopic levels – 0.72 coarse grain and 0.50 fine grain between Grades 3 and 4; and 0.71 coarse grain and 0.49 fine grain between Grades 4 and 5). These measures suggest low levels of stretch in prescribed content between the three classes, that is 28 percent and 29 percent respectively. From Grade 3 to 4, there is a 7 percentage point reduction in emphasis on 'phonics', a 9 percentage point increase in emphasis on 'comprehension', and a 6 percentage point increase in emphasis on 'grammar'. From Grade 4 to 5, the prescribed coverage changes also involve three topics – a 9 percentage point decline in emphasis on 'comprehension' and 8 percentage point increases for both 'writing processes' and 'listening and speaking'.

At 0.58 coarse grain and 0.33 fine grain, the progression alignment measures between Grades 5 and 6 are the lowest – implying a faster curriculum progression pace. Between the two grades there are notable topic-level coverage changes involving four topics – increases for 'phonics' and 'vocabulary' and decreases for 'writing processes' and 'grammar'. Additionally, emphasis on the higher level of cognitive demand, 'conjecture', significantly increases to 13 percent in Grade 6. As seen earlier in the case of Grade 6 mathematics (section 4.1.1), there are two probable reasons for the increased level of stretch in prescribed content at this level – the need to prepare students for the national common entrance exam and the transition from primary to lower secondary.

4.2.2 Learning Assessments: The content of the end-of-primary English Language National Common Entrance Exams, NCEEs

In this section, we describe the content of the National Common Entrance Examinations for English Language which students take at the end of primary school. Figure 11 shows the English content on the NCEE for 2017. Out of 13 topics, three topics constitute most of the content appearing on the NCEE – 'vocabulary', 'comprehension' and 'grammar'. Accounting for 45 percent of total coverage, 'grammar' is the most emphasized, followed by 'vocabulary' at 29 percent and 'comprehension' at 23 percent. Within these three topics, the most emphasized sub-topics are capitalization and punctuation, word/phrase meaning and strategies for the topics grammar, vocabulary and comprehension respectively. For cognitive demand, 40 percent of emphasis goes towards 'demonstrate', 39 percent to 'perform procedures' and 19 percent to 'memorize'.

Figure 11: Nigeria topic level English Language examination: NCEE 2017

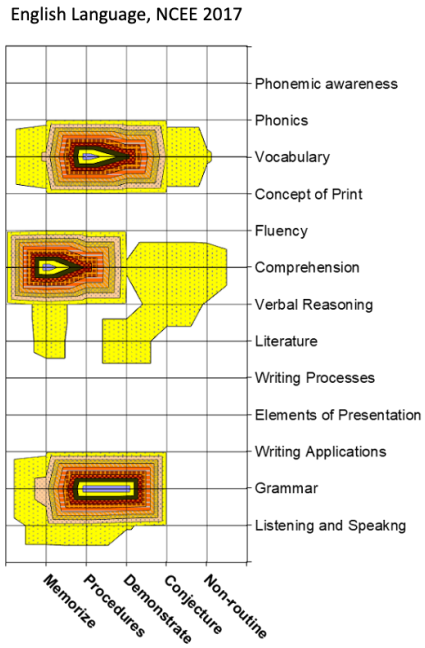


Figure 12 shows content maps for the NCEEs for 2018 (left panel), 2019 (middle panel) and the aggregated content for all three years 2017 – 2019 (right panel). Across all three years, the topic-level emphasis structure is similar to 2017. Table 7 depicts high levels of between-year content overlap for the English Language NCEEs.

Figure 12. Content maps for English NCEEs 2018 and 2019, and an aggregation of 2017 to 2019

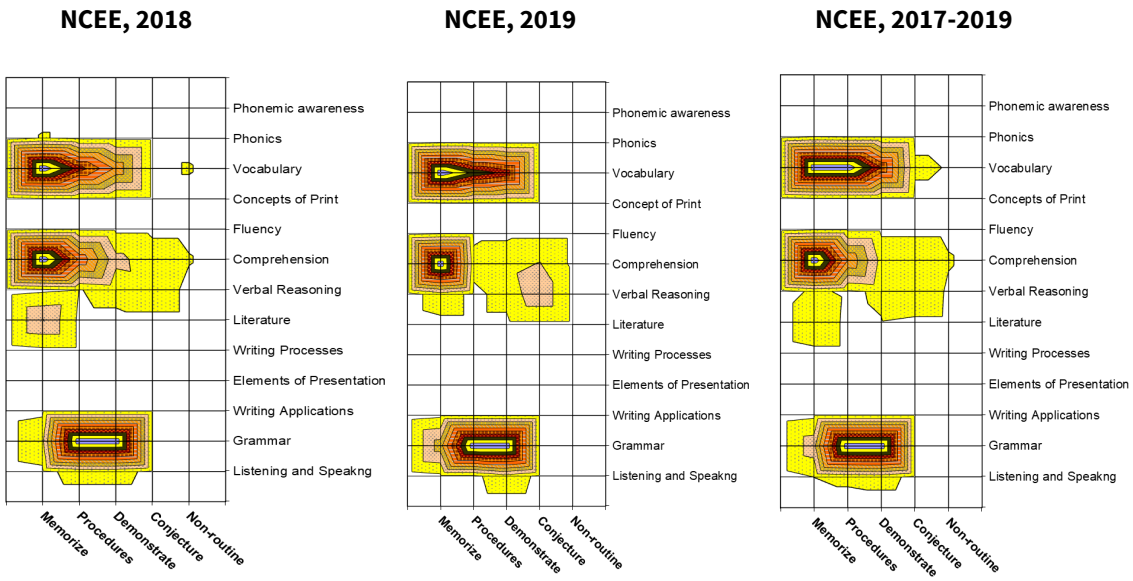


Table 7: Primary English exams - Nigeria: Cross-year alignment measures

	Exam / Year	Coarse grain alignment measures		
		NCEE 2017	NCEE 2018	NCEE 2019
Fine grain alignment measures	**NECO 2017**	**1.0**	0.74	0.78
	NECO 2018	0.60	**1.0**	0.83
	NECO 2019	0.57	0.69	**1.0**

4.2.3 Instruction: The content and progression of primary English instruction

Turning to teachers' classroom instructional content coverage (figure 13), all three content maps depict similar topic and cognitive demand coverage across lower and upper primary cycles. At 18 percent of total emphasis, phonics is the most emphasized of the five foundational reading topics. It is followed by vocabulary & comprehension at 12 percent each and phonemic awareness at 9 percent. At 2 percent fluency is among the six topics that attract minimal emphasis from teachers. With the exception of Grades 1 and 2 teachers whose respective emphasis on 'grammar' is 9 percent and 12 percent, its coverage by Grades 3–6 teachers remains steady at about 16 percent.

In terms of cognitive demand, two-thirds emphasis by teachers goes to the two lowest performance levels of 'memorize/recall' and 'explain/perform'. 'Demonstrate' accounts for one-fourth of total emphasis, and the top two levels of 'conjecture' and 'apply to non-routine' jointly account for only one-tenth of overall emphasis by teachers – mostly in the upper primary Grades 4-6.

Figure 13: English teachers' instructional content – Lower (P1-P3), upper primary (P4-P6), and aggregation (P1-P6)

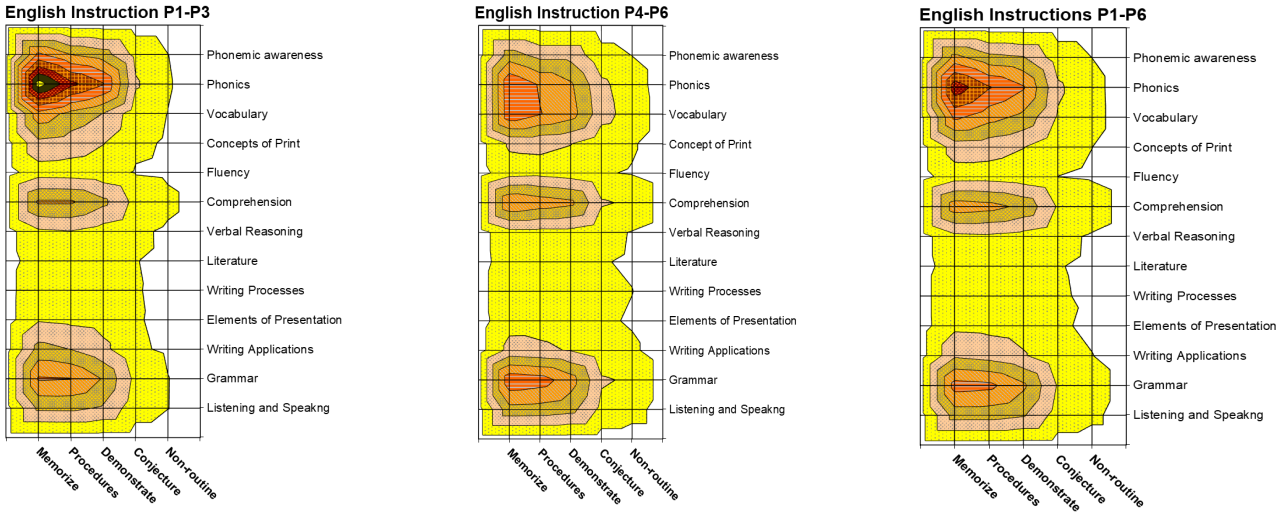


Table 8 shows the grade-to-grade instructional content progression alignment measures that depict the level of overlap and stretch embedded in classroom instruction. At coarse-grain, they range between 0.76 and 0.90, and 0.65 and 0.79 at fine grain. These measures are high – suggesting low levels of variation or stretch between teachers' instructional content delivery between successive grades. With all topics being covered throughout all the six grades, these alignment measures suggest teachers may be emphasizing breadth of coverage over depth. This practice might turn out detrimental to students' learning as they may struggle to gain mastery without sufficient depth of instruction.

Table 8: Primary English Language Instruction - Nigeria: Content progression alignment measures

		Coarse-grain alignment measures							
	Grade/Cycle	**P1**	**P2**	**P3**	**P1-P3**	**P4**	**P5**	**P6**	**P4-P6**
Fine grain alignment	**P1**	1.00	0.76						
	P2	0.65	1.00	0.85					
	P3		0.74	1.00		0.90			
	P1-P3				1.00	0.90			0.84
	P4			0.77	0.77	1.00	0.84		
	P5					0.73	1.00	0.87	
	P6						0.74	1.00	
	P4-P6				0.79				1.00

4.2.4 Student performance: Primary English students' performance in the context of exams

As discussed in 4.1.4, the scope, coverage and purpose of an assessment impacts student performance data and thus student performance analyses must always be done in conjunction with examination content maps (Atuhurra et al., 2023). Student performance data used in this analysis was obtained for the NCEE high-stakes assessment conducted at the end of primary school (primary 6) for both states (Oyo and Jigawa) for 2017 and 2019.

Figure 14 provides an overview of student performance on English language in NCEE 2017 and 2019 by state. Student performance was significantly lower in Jigawa than in Oyo, but absolute performance is low overall: the highest performance average is 51 percent, meaning that on average students got just over half of exam questions correct. Performance remains similar across NCEE 2017 and 2019 in Oyo (at around 50 percent), while in Jigawa average scores increase from 25 percent to 32 percent over the two-year period. This context is crucial for correctly interpreting student performance in this section.

Figure 14: Sample average of raw scores on NCEE 2017 and NCEE 2019 in English language

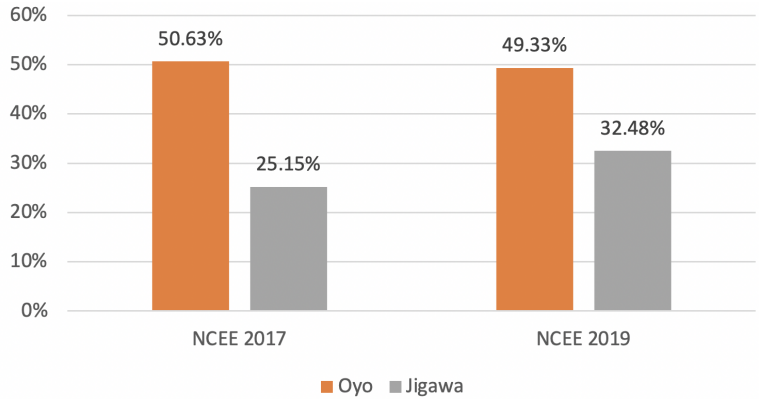
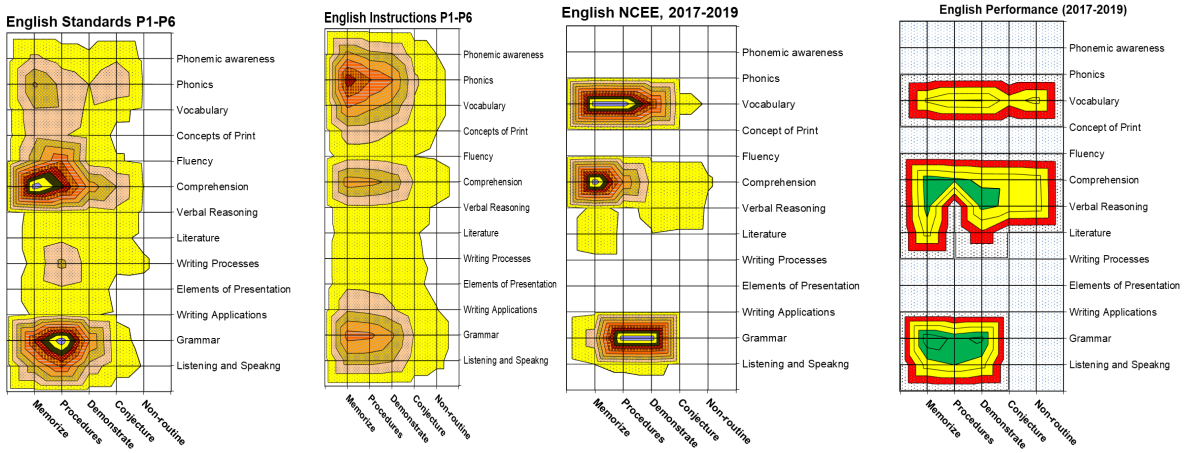


Figure 15 displays aggregate student performance data (for both states) by topic-level and cognitive demand-level, side-by-side with the content maps of other instructional components. Student performance was highest on grammar at 54 percent, followed by verbal reasoning and comprehension at 42 percent and 41 percent respectively. Student performance was lowest on literature at 27 percent. These topical patterns are similar across the two states, though scores in Jigawa are lower than scores in Oyo.

Figure 15: English Standard, Instruction, Exam and Student Performance



Across the three instructional components (curriculum standards, instruction, and exams) there are high levels of emphasis on grammar, comprehension and verbal reasoning, which are also the three areas of highest student performance. There is no performance data for phonics and writing processes, the other areas of instructional emphasis.

With the three topics of highest emphasis on the exams (vocabulary, comprehension, and grammar) attracting significantly high emphasis on both the standards and classroom instruction, the observed low overall student performance remains a puzzle and warrants further investigations.

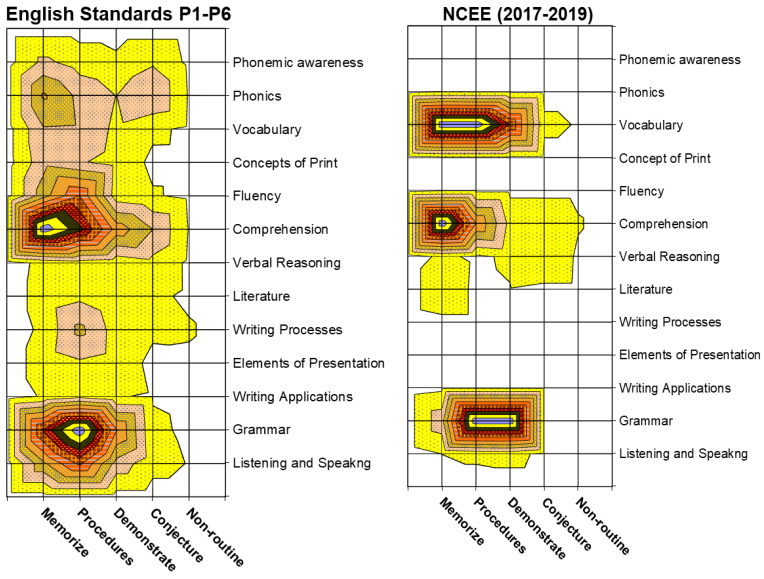
4.2.5 Coherence between primary English curriculum standards and exams

Figure 16 shows the prescribed content in the English curriculum standards and the three-year aggregated content of the NCEEs for 2017, 2018 and 2019. A quick visual review of the two maps suggests low alignment arising from disparities in emphasis on both topics and levels of cognitive demand. While all topics appearing on the exams receive some emphasis in the curriculum standards, seven prescribed topics in the standards do not feature in the exams at all. The topic 'vocabulary' attracts significantly more emphasis in the exams than in the standards: 6 percent in the standards and 29 percent in the exams. Similarly, 46 percent of the content covered on the exams is focused on 'grammar' which is more than double its emphasis of 22 percent in the standards.

In terms of cognitive demand, both the standards and the NCEEs prioritize the same set of lower domain skills, 'memorize/recall', 'perform procedures' and 'demonstrate understanding' which account for at least 90 percent emphasis in each component. At 38 percent however, the exams attach a significantly larger emphasis on 'demonstrate' than do the curriculum standards at 16 percent.

The overall alignment measures between the standards and exams are 0.42 coarse grain and 0.30 fine grain (Table 9). The alignment measures do not change substantially when the curriculum content is restricted to upper primary grades 4-6.

Figure 16: English Standards and examinations content – aggregation of P1-P6 standards and 2017-2019 NECO exams



4.2.6 Coherence between primary English curriculum standards and instruction

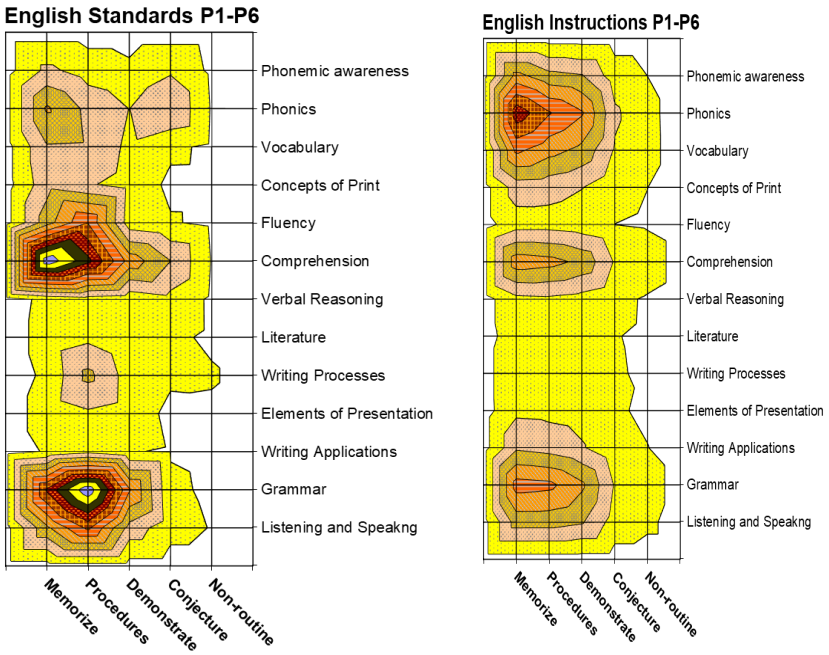
Next, we turn to alignment between English curriculum standards and teacher English instructional content (Figure 17). While both 'comprehension' and 'grammar' attract high levels of emphasis in both components, the combined coverage of 46 percent in the curriculum standards is 20 percentage points higher than the combined coverage by teachers. The opposite is observed with two other high-emphasis foundational reading topics, 'phonics' and 'vocabulary', which account for 30 percent of teachers' coverage and only half that share in the

standards. Finally, teachers assign more coverage to phonemic awareness at 9 percent versus 4 percent while the standards prescribe more emphasis on 'fluency' at 9 percent versus 2 percent. For cognitive demand, both components strongly prioritise the lower three cognitive demand levels with up to 90 percent of total emphasis.

The middle columns of Table 9 show both grade-level and aggregated alignment measures between the English curriculum standards and teachers' content coverage in the classroom. The overall coarse grain alignment measure is 0.65, suggesting a reasonably high level of overlap between teachers' classroom content coverage and the prescribed content in the curriculum standards. At 0.42, the fine grain alignment measure also portrays a reasonably high level of overlap.

The grade-to-grade analyses indicate the lowest levels of alignment between curriculum standards and teacher instruction are in Grades 4 and 5 with the respective coarse grain measures of 0.52 and 0.51 and fine grain measures of 0.26 and 0.24. At 0.68 coarse grain and 0.30 fine grain, Grade 3 portrays the highest level of content overlap between the two components.

Figure 17: Nigeria English Standards and teachers' instructional content – aggregation of P1-P6



4.2.7 Coherence between primary English instruction and examinations

The alignment between classroom instruction and the exams are low at 0.34 coarse grain and 0.14 fine grain (table 9) and are easily identifiable in the visualizations in Figure 18. Of the 13 topics covered during classroom instruction, seven do not appear on the exams. Also, while both components assign major emphases to the lower three levels of cognitive demand, the exams allot a significantly larger share to 'demonstrate' at 38 percent than instruction, at 24 percent.

When restricted to upper primary (P4-P6) instructional content, the alignment measures improve slightly to 0.37 coarse grain and 0.16 fine grain. While this improvement might reflect teachers' tendency to prioritize content areas that attract high emphasis on the exams, as might be true for 'comprehension' and 'vocabulary', it could additionally reflect the prescribed content coverage in the curriculum standards – as for 'grammar'.

Figure 18: Nigeria English Instruction for primary (P1-P6) and NECO Exams (aggregated 2017-2019)

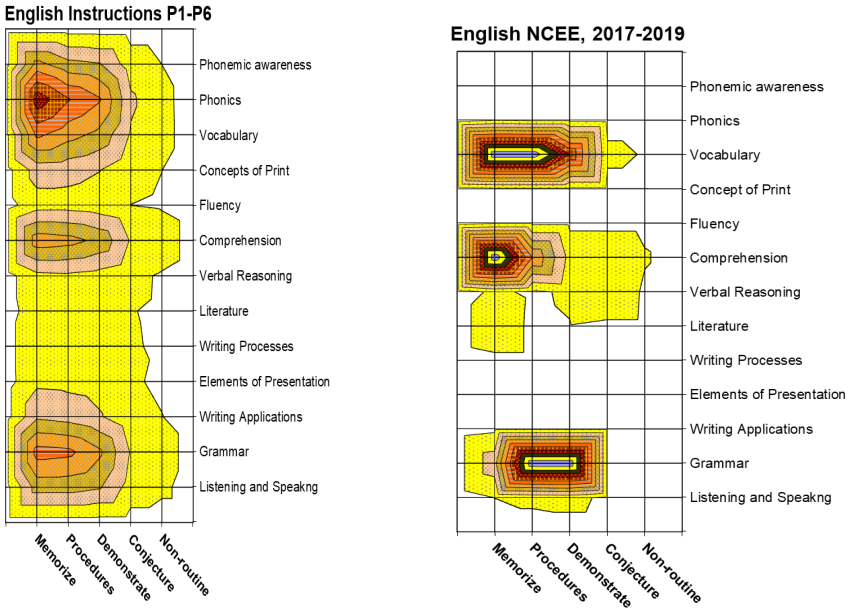


Table 9: Primary English - Coherence across standards, examinations and instruction

Grades/ Cycles	Overall Alignment indices					
	Standards vs Exams		Standards vs Instruction		Instruction vs Exam	
	Fine	Coarse	Fine	Coarse	Fine	Coarse
P1-P3			0.45	0.71		
P4-P6	0.28	0.40	0.38	0.65	0.16	0.37
P1-P6	0.30	0.42	0.42	0.65	0.14	0.34
P1			0.37	0.59		
P2			0.31	0.60		
P3			0.30	0.68		
P4			0.26	0.52		
P5			0.24	0.51		
P6			0.30	0.66		

5. Discussion and Conclusion

Using the SEC framework, this study has evaluated how well the Nigerian primary education system achieves instructional alignment, from curriculum standards to classroom instruction and assessment. Broadly, the results show relatively high alignment between the curriculum and instruction but weaker alignment with assessments – especially primary English. The topics prescribed in the curriculum are mostly taught in the classroom, and the analysis of curriculum progression indicates a relatively slow pace from one grade to the next. The pace of the curriculum and its alignment with instruction imply that student learning achievement should be high if the content was adequately taught and learned.

The performance data, however, shows an average score of 48 percent in the end-of-cycle exams. The assessment data, therefore, suggests that the alignment of curriculum and instruction are not translating into strong learning and high performance, at least among the assessed topics. We are therefore left with the paradox of a system that depicts alignment between curriculum and instruction but does not produce strong learning performance. Education literature has placed significant emphasis on alignment between curriculum and instruction as these are two levers that educators and policymakers can control. It is sometimes assumed that such alignment should translate into effective learning outcomes, but our results contradict this optimism.

One possible explanation for this paradox relates to the relative emphasis, in curriculum and instruction, on low and high levels of cognitive demand. The lack of emphasis on higher levels of cognitive demand (such as conceptual understanding and application of knowledge) reflects a system in which the curriculum and teacher instruction is aligned towards lower levels of understanding and cognitive demand such as memorization and performing procedures.

Table 10 shows two types of alignment and implications for learning outcomes. First, a system can exist in low equilibrium alignment in which curriculum and instruction are focused on low levels of cognitive demand. This will be reflected in higher performance on assessment items relating to such domains. Indeed, children performed better on the Nigerian exam items related to lower levels of cognitive demand. However, at this low equilibrium, students have not achieved deep understanding of the topics they are being taught.

The second type of alignment in Table 10 is referred to as “high equilibrium”, where there is strong alignment between learning components and a focus on higher levels of cognitive demand such as conceptual understanding and ability to apply knowledge. This type of alignment implies a deeper level of mastery and understanding. This level of mastery would also enable children to use the content they have mastered in one grade as a foundation for new content they learn in the following grade. The Nigerian curriculum standards and instruction do not place significant emphasis on these higher levels of cognitive demand. This could explain the low student performance, despite the curricular and instructional alignment and reasonable pace of content progression.

Table 10: Alignment Matrix

		Assessment	
		Memorization/Procedural understanding	Conceptual understanding/ Application
Standard and instruction	Memorization/Procedural understanding	Low equilibrium	Misalignment
	Conceptual understanding/ Application	Misalignment	High equilibrium

The SEC analysis suggests the Nigerian education system may be trapped in a low equilibrium in which alignment is focused on lower levels of cognitive demand, and thus lower levels of mastery. This poses the question, what prevents the system from transitioning from this lower equilibrium to a higher equilibrium? At least two possible factors could contribute to resolving this paradox. First, relatively poor teaching quality might restrict a transition to teaching higher levels of cognitive demand. Addressing shortcomings in both subject matter knowledge and pedagogy could improve teaching quality, depth of student understanding, and ultimately content mastery. Second, assessments can also influence the concentration of classroom instruction in certain areas. For example, if the assessment is focused on conceptual understanding, instruction will likely follow a similar pattern.

Given the relatively high levels of alignment between curriculum standards and instruction, a focus for improving student performance could lie in adapting the curriculum and supporting teachers to instruct at higher levels of cognitive demand. Such an effort could improve children's mastery of content, helping them to engage with more advanced topics as they progress from grade to grade. Other efforts should also be pursued, including further analysis of the curriculum standards results, presented in this paper, to determine adaptations to the content progression and coverage that could help students achieve greater content mastery.

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