

Topic: Is Nigeria Experiencing a Learning Crisis: New Evidence from Curriculum-based Learning Assessment

Abstract

Motivation

Agenda 2030 sets an ambitious target to provide inclusive and quality education for all. The first step in this quest is identifying those left behind in accessing quality education and reasons for their exclusion. However, countries like Nigeria where this understanding will be most crucial presently lack data on learning assessment. This article explores how to, in the near-term, address this challenge in the case of Nigeria through innovative use of existing national surveys.

Purpose

The article aims to: (a) develop an approach to construct a measure for the quality of education in Nigeria based on existing surveys and demonstrate this with the Nigeria Education Data Survey (NEDS, 2015). (b) examine the drivers of quality education in Nigeria based on the newly constructed learning indicator.

Approach and Methods

The research draws on qualitative (content analysis, descriptive analysis) and quantitative (ordered probit) methods.

Findings

The new learning indicator confirms that Nigerian education system is indeed facing deep learning crisis and that children mostly affected are those in rural areas, those attending government schools, those from poor households, and those in northern regions in Nigeria. The results suggest that the weak performance is due to differences in students' individual and family characteristics, perceived quality of teachers and adequacy of school facilities, and level of parental involvement.

Policy implications

The policy implications are that the government interventions should prioritize the identified excluded groups, while implementing systemic changes that will improve school infrastructure and teacher training and ensure more parental involvement.

Keywords: Sustainable Development Goals; Quality of Education; Survey; Education Production Function; Nigeria.

1. Introduction

The massive expansion of education access throughout the world in the past few decades signalled a positive progress for global development through human capital accumulation. However, this same growth highlighted the substantial deficiency in the learning that schools are unable to deliver to the children that pass through them. In short, massive expansion in schooling has not delivered quality education, a situation that United Nations Educational, Scientific and Cultural Organization (UNESCO, 2013) termed a global “learning crisis”. The disconnect between schooling and learning in the 21st Century also informed the global aspiration to improve learning outcomes, as captured in SDG 4.

With the global attention now centered on SDG implementation, policymakers and researchers are focused on data for measuring learning outcomes. Measuring performance against SDG 4 entails assessing the extent to which targets set on inclusive and quality of education have been met. However, as the 2017 Goalkeepers Report shows, there is notable conceptual problem and data gap in measuring the quality of education (see also Unterhalter, 2019).

On the conceptual level, there is lack of consensus on the appropriate indicator of quality education. Education quality is a multidimensional concept and encompasses educational inputs, processes and learning outcomes. This concern is apparent even in the SDG system, particularly, in the Tier Classification of Global SDG indicators developed by the Inter-agency and Expert Group on SDG Indicators (IAEG-SDGs). This means that additional work is needed to establish methodology and create an internationally comparable statistic (UN Statistical Commission, 2018).

In the meantime, the concerns with measuring quality education have been mostly sidestepped by focusing only on the learning outcomes such as the Program for International Student Assessment (PISA), on the assumption that educational inputs and processes are already embedded in outcomes. Yet, very few developing countries have data that is globally comparable and nationally representative on learning outcomes to track progress towards achieving quality education. Nigeria is among the countries in this category with paucity of data to measure progress. This is evident in the SDG Baseline Document (2016), where no learning achievement indicator is reported on the state of SDG 4.

In this paper, we demonstrate that innovative use of existing education survey can yield a reasonable measure of quality education. In the past 15 years, national statistical agencies in Nigeria have conducted three waves (2004, 2010, and 2015) of the National Education Data Survey (NEDS) that collects demographic and educational information on schoolchildren from pre-primary to junior secondary schools. Drawing on approaches in the literature in measuring cross-country and in-country learning assessment, we construct quality of education indicator that can serve as a useful metric to track progress on the SDG. We illustrate the idea behind the development of the new indicator using the most recent 2015 NEDS. The data shows clearly that there is an ongoing learning crisis within the Nigerian education system, as only 17% of pupils meets the literacy competency, while a much-improved performance is seen in numeracy with 31% pass rate. In essence, leaving no one behind in quality education in Nigeria will require bold and broad policy interventions and more robust local and global partnerships.

Furthermore, we explore the broader information in the survey to answer key questions on the determinants of quality education in Nigeria. Specifically, we evaluate the role of individual and family factors, students' perception of learning facilities and parent involvements in school activities through funding of school activities. We found these factors to be largely important and significant cursors in the determination of students' education outcomes.

The contributions of this study are in two-fold. The first contribution relates to developing a methodological approach to measure the quality of education from survey data. Recent literature has attempted to address data challenges by building learning profiles from surveys. For example, Pritchett and Sandefur (2017) construct the learning profile of women 25-34years from literacy assessment in Demographic Health Surveys. We develop a measure of quality education for children currently in school, which addresses key education issues around curriculum and learning at the right level. While using survey-based assessment is not a substitute for the globally comparable quality of education indicator, it provides a starting point to understand the depth of learning crisis within the Nigerian education system.

The study also made an empirical contribution on the drivers of quality of education in Nigeria. The literature on the learning crisis in Nigeria has been largely based on anecdotal evidence or at best qualitative evidence. The few quantitative studies, namely Onwuameze

(2013) and Nevo & Egenti (2019), are focused on the role of regional, gender and wealth effects on differences in learning outcomes. We extend on this work by evaluating the role of home/parental characteristics, school and teachers' characteristics, learner's preparedness and parental involvement. This provides a broader picture of the demand and supply issues affecting education performance in Nigeria.

This paper is organized in four sections. Section 2 provides an overview of the approaches used in global education literature to measure quality education. Section 3 discusses our approach to measuring quality education using nationally representative survey data. We apply the approach to analyze exclusion from quality education in Nigeria and discuss findings in Section 4. We conclude in Section 5 with a discussion of the implications of our findings.

2. Review of Cross-Country Experiences in Measuring learning Outcomes

A widely used measure of learning across countries in the empirical literature on education is the Program for International Student Assessment (PISA). PISA is an international assessment coordinated by the Organization for Economic Cooperation and Development (OECD) that measures 15-year-old students' reading, mathematics, and science literacy every three years. The most recent assessment in 2015 that covered 70 countries has been used in the literature to assess different education systems (Cordero & Cristobal, 2017). Other widely used international standardized tests include Trends in International Mathematics and Science Study (TIMSS) and Progress in International Reading Literacy Study (PIRLS). Yet, many parts of the developing world where the learning crisis is more acute do not participate in these test (Psacharopoulos, 2015), especially where the insights that they provide matter most.

In Africa, regional efforts exist to measure the learning outcomes of children. The Southern and Eastern Africa Consortium on Monitoring Education Quality (SACMEQ), which covers 16 Ministries of Education in Southern and Eastern Africa, conducts large-scale collaborative education research to assess the conditions of schooling and performance levels of learners and teachers in the areas of literacy, and numeracy. Programme d'Analyse des Systemes Educatifs de la CONFEMEN (PASEC) conducts a similar exercise for mostly francophone Africa. Again, there is no similar exercise that cuts across the continent or involves Nigeria.

For Nigeria, the Federal Ministry of Education (FME) together with UNESCO and UNICEF has conducted Monitoring Learning Achievement (MLA) project in 1996, 2003 and 2011. The MLA

project measured student learning competencies in literacy, numeracy and life skills at the primary grades 4 and grade 6 levels across a number of Sub-Saharan and North African countries. MLA project is arguably the most relevant attempts at measuring the quality of education in Nigeria at the basic level that was regionally representative and flexible to international comparison. Adekola (2007) used the MLA to highlight the low level of learning among primary school pupils in Nigeria in relation to their peers in 21 other Sub-Saharan and North African countries where MLA was conducted. Similarly, Ogbonna (2016) used the MLA among other datasets to show that the general learning levels among primary school pupils has been declining over the past two decades. Other international assessments that Nigeria partakes in are for certification, such as the West African Examination Council's (WAEC) senior secondary school certificate examination, but do not lend themselves to disaggregated analysis.

The limited coverage of the international standardized assessments discussed and the paucity of relevant data on learning outcomes in many low-income countries warrants innovative approaches to evaluating education systems and the learning outcomes they deliver. National surveys such as the DHS, which enjoy wider coverage globally, can provide an opportunity to generate quality education measures and insights relevant for policy and practice.

3 Construction of the New Quality Indicator

3.1 Some Methodological Issues in NEDS Assessment

National Education Data Survey (NEDS) is arguably the most comprehensive, disaggregated and nationally representative survey on basic education in Nigeria. The survey contains detailed information on parents/guardians and children of school age from pre-primary school to Junior Secondary School (JSS). In the module for schoolchildren, learning assessment is conducted to evaluate literacy and numeracy competences. The assessment is enumerator based. For the literacy assessment, children are evaluated on their ability to correctly identify words, read single short sentences and on basic comprehension in English. Children that are able to read at least one of the sentences shown on the flashcard by the enumerators are considered to have literacy competence. Furthermore, children that can read and answer correctly at least one of the three interrogative sentences displayed by the enumerators are deemed to demonstrate competency in comprehension.

For the numeracy assessment, the enumerator asks a child to add two single digit numbers, which sum to less than 10 (e.g. the sum of 3+4). Those that can correctly sum the numbers are considered to have numeracy skill. In addition, children that are able to sum or subtract at least one double-digit problem are considered to demonstrate advance numeracy skill.

While studies have used the numeracy and literacy assessments in NEDS as indicator of education quality in Nigeria (see Onwuameze, 2013; Antoninis, 2014), there are a number of methodological issues. In fact, the NEDS report alluded to this concern wherein it stated a caveat that “the NEDS provides only one measure each for literacy and numeracy and, therefore, should be interpreted with some caution” (NEDS, 2010 pg. 44). A more fundamental problem with the NEDS is the administration of uniform assessment tests across all class categories. Children are administered the same test irrespective of their level of education (pre-primary, primary and post-primary levels). Going by the Nigerian National Policy on Education (NPE, 2013), the assessment type in NEDS is more related to primary education level where the goal is to inculcate literacy, numeracy and the ability to communicate effectively. Therefore, NEDS assessment would have grossly overestimated learning outcomes for children at post-primary level, while also underestimating the outcome for those still at pre-primary level.

Even for those in primary school, grade-by-grade analysis of curriculum content will suggest that NEDS set a very low bar for numeracy and literacy competencies. For example, the benchmark set for literacy—ability to partly read a sentence— does reflect expected learning outcomes or curriculum at most grade levels of primary education. In essence, there is a mismatch problem in NEDS assessment as it does not sufficiently reveal the value addition from schooling or the expected grade-level performance.

3.2 Matching NEDS Assessment with Curriculum Content

Fortunately, NEDS is not completely irrelevant. Recent literature has demonstrated techniques to construct a more useful quality of education measure from survey dataset. For example, Pritchett and Sandefur (2017) used the literacy assessment in the Demographic Health Survey (DHS) to construct learning profile for women aged 25-34 years in 51 countries. Undoubtedly, in comparison to DHS, the NEDS is richer, broader and has better coverage as it pertains to children currently in school. The NEDS provides information on literacy and

numeracy performance as well as a detailed background information on households, learners preparedness for school, school quality and teachers' quality. Given that the data is disaggregated across grade levels, it makes it possible to link assessment with school curriculum and evaluate value addition of education at specific grade level.

In what follows, we illustrate the construction of a new quality of education indicator from the NEDS dataset. First, we conduct a content analysis on the Nigerian school curriculum for pre-primary and primary levels. The Junior Secondary Schools curriculum is excluded as its goal is geared more towards entrepreneurship development and educational advancement. Given that school curriculum is broad and covers multiple subject areas, we restrict our analysis to literacy and numeracy aspects as covered in the NEDS assessment. By implication, we relate literacy with English Language curriculum and numeracy with Mathematics curriculum. Even at this, the scope of works covered in English Language and Mathematics are still broad. We draw down on this scope of work by focusing on the minimum competency at each grade for subject areas relating to arithmetic (addition and subtraction), reading, and comprehension. Minimum competency is designated as the scope of work at the first term of a given grade. In general, the rationale is to concentrate on subject area that is as close as possible to NEDS assessment.

The results of the content analysis of primary school curriculum is presented in Tables 1 and 2. Overall, the contents of the NEDS literacy and numeracy assessment only covers student competencies from pre-primary to Primary 2 grade levels. Content in the curriculum for grades above Primary 2 is not tested in NEDS. While some pre-primary contents are covered under the NEDS, the assessment at this level is mainly for preparing pupils for smooth transition into primary level. In addition, the overarching objective of pre-primary education is to ensure effective transition of children from home to school. Therefore, for analytical purposes, NEDS assessment is related to expected grade-level performance at Primary 1 and Primary 2 level.

Table 1: Content analysis of primary and pre-primary level curriculum in mathematics

Level	Minimum numeracy skill based on school curriculum	How it is tested in NEDS
Goal of pre-primary: effective transition from home to work		
Pre-primary	✓ Simple addition of numbers	Addition of numbers less which sum to less than 10
<i>The goal of primary: to inculcate literacy, numeracy and the ability to communicate effectively</i>		

Primary 1	✓ ✓	Addition of numbers 1-10 Subtraction of numbers 1 -10	Addition of numbers which sum to less than 10 and subtraction of single-digit numbers
Primary 2	✓ ✓	Addition of whole numbers up to 200 with and without carrying Subtraction of whole numbers up to 200 with and without borrowing	Addition and subtraction of double-digit numbers.
Primary 3	✓ ✓ ✓	Addition of whole numbers with and without carrying Subtraction of whole numbers into and without borrowing Word problems on addition and subtraction of whole number	Not tested
Primary 4	✓ ✓	Addition of whole numbers including word problems Subtraction of whole numbers including word problems	Not tested
Primary 5	✓ ✓	Combination of addition and subtraction Word problems on addition and subtraction	Not tested
Primary 6	✓	Word problems on addition and subtraction	Not tested
<i>Goal of Junior Secondary Education: to provide the child with diverse basic knowledge and skill for entrepreneurship and educational advancement</i>			

Source: Federal Republic of Nigeria, National Policy on Education (2013) and Nigeria Educational Research and Development Council (2019, online)

Table 2: Content analysis of primary and pre-primary level curriculum in education English language

Level	Minimum literacy skill based on school curriculum	How it is tested in NEDS
✓ Pre-primary	✓ Reading (words) ✓ Pattern making	✓ Ability to read word
✓ Primary 1	✓ Identification of letters ✓ Reading (sentences)	✓ Ability to read complete sentence
✓ Primary 2	✓ Reading (fluency) ✓ Comprehension (basic) ✓	✓ Basic comprehension
✓ Primary 3	✓ Comprehension (advance)	✓ Not tested
✓ Primary 4	✓ Composition ✓ Essay writing	✓ Not tested
✓ Primary 5	✓ Grammar ✓ Composition	✓ Not tested
✓ Primary 6	✓ Grammar ✓ Composition ✓ Comprehension (advance)	✓ Not tested
✓ Post-primary		

Source: Federal Republic of Nigeria, National Policy on Education (2013) and Nigeria Educational Research and Development Council (2019, online)

3.3 Developing a New Quality Measure from NEDS

We correct for the mismatch in the NEDS assessment by focusing only on sub-sample of students in Primary 1 and 2, for which the initial NEDS assessment relates to their minimum

competency level. For students in Primary 1, minimum competency in literacy will constitute ability to read at least a complete sentence evaluated by the enumerator, while for numeracy, it entails the ability to correctly sum two single digit numbers. At Primary 2 level, minimum competence in literacy will be the ability to read as well as comprehend, that is answer correctly the interrogative sentences as tested in NEDS. For numeracy, this will require the child to correctly add or subtract double-digit numbers. Essentially, our quality of education indicator is defined as the proportion of Primary 1 and 2 students that meet the expected minimum learning competences in numeracy and literacy at their respective grade level.

3.3.1 Preliminary Result

Our proposed approach to measuring quality of education is demonstrated using 2015 NEDS dataset. The survey covers 84324 students from pre-primary to JSS. We focus on sub-sample that are in Primary 1 and 2. The results are shown in Table 3. Overall, about 17% of pupils in the sample meet the literacy competency in Nigeria, while a much-improved performance is seen in numeracy with 31% pass rate. This evidence is consistent with previous literature on education performance in Nigeria that have found students performing better at numeracy than literacy especially at primary level (Van Der Fleet, 2012).

A further disaggregation of the performance along key demographic characteristics reveals that gender difference in competencies is marginal with girls slightly outperforming boys in numeracy and literacy. However, there is about 17% margin in the rural-urban performance in literacy and this increases to 25% margin for numeracy. Similarly, a wide performance margin is observed respectively in literacy (17%) and numeracy (26%) between students in private schools over those in government schools.

The highest margin in sub-group performance is between the lowest and richest wealth quintiles. Specifically, there is about 14% and 32% margins in literacy and numeracy respectively between households within the highest wealth quintile and those at lowest quintile. Also, analysis of regional achievement shows that for literacy, South-South has the highest performance with about 27% performance rate, followed by South West (25%), South East (15%), North East (13%), North Central (11%) and North West (8%). Regional performance in numeracy is much higher across regions and South West (54%) has the highest

performance, while the order of achievement for other regions is consistent with their performance in literacy.

In summary, the analysis of education performance based on the new indicator shows outcomes are consistently higher in numeracy compared to literacy. Also, the analysis points to four groups that are mostly excluded from quality education in Nigeria as children in rural areas, those attending government schools, those from poorer households, and those from northern regions of Nigeria. This suggests the likely priority groups in terms intervention into the education system in Nigeria. Overall, the indicator reveals that there is indeed learning crisis in Nigeria, as majority of the students do not meet what is defined as the minimum competency at their respective grade levels. As these children transit to higher levels, this means the learning gaps will expand, thereby compounding the learning crisis.

Table 3: Quality of Education Indicator by Literacy and Numeracy Assessments (% Pass rate)

Group	Subgroup	Literacy	Numeracy
National Average		17%	31%
Gender	Male	16.8%	29.3%
	Female	17.4%	31.8%
Location	Urban	26.2	44.9%
	Rural	9%	19.4%
School Type	Private	29.7%	50.5%
	Government	12.7%	24.6%
Wealth Quintile	Lowest	4%	7.4%
	Second	6%	14.5%
	Middle	11.8%	25.9%
	Fourth	19.6%	40.1%
	Richest	35.2%	60.9%
Region	North Central	11.2%	22.9%
	North East	13.3%	12.2%
	North West	8.1%	8.6%
	South East	15%	41.4%
	South South	26.7%	47.9%
	South West	25.3%	53.9%

Data Source: Authors' computation from NEDS

3.3.2 The Comparative analysis of the new education quality indicator with other indicators on Nigeria

Our key premise is that NEDS assessment has a mismatch problem which could potentially bias its measure of quality education. We summarize a validation of this premise in Table 4 by comparing the new indicator (column 3) with NEDS assessment (column 4) and three other quality indicators that have been reported in the literature for Nigeria. First is the Monitoring of Learning Assessment (MLA) by the Federal Ministry of Education (column 5). The assessment was carried out in 2011, testing numeracy and literacy among Primary 4 and 6 pupils based on the national curriculum for the level of education they are attending. We report the result for only Primary 4 which is the closest grade level to Primary 2 used in our computation. Second is the Universal Basic Education Programme (2003) assessment of Primary 4, 5 and 6 students on English and Mathematics school curriculum for their respective grade. Based on data availability, we report the national results, which is the average score for the three grade levels. Lastly, the Education System Support Programme in Nigeria (ESSPIN) (column 7) between 2012 and 2016 tested for numeracy and literacy for Primary 2, 4 and 6 students in six states in Nigeria where it implemented some special intervention. We report result for those in Primary 2 in 2012, which covers the period before the intervention.

The comparative analysis results in Table 4 confirm many of the premises we made. First, performance in NEDS is higher than all other indicators. As argued earlier, NEDS will overestimate the result for grade level above Primary 2, and underestimate the result for those below Primary 1. Since there are more students in the upper grade than the lower grade, NEDS will generally overestimate education performance in Nigeria. Secondly, numeracy and literacy performances are higher in urban than rural areas, while the gender gap in performance is marginal. Third, compared to NEDS, the performance level based on the new indicator is closer to other quality indicators regarding the learning profile in Nigeria. For example, using NEDS, 55% and 49% of the schoolchildren surveyed demonstrate competencies in numeracy and literacy respectively. This will suggest Nigeria has made modest progress in ensuring quality and inclusive education. However, consistent with our proposed measure, all other quality indicators indicate a much dismal performance.

Table 4: Comparison of quality of education indicator for Nigeria

Group	Sub-group	New Quality Indicator (2015)		NEDS (2015)		Federal Ministry of Education (2011)		UBEP (2003)		ESSPIN for Grade 2 (2012)	
		L	N	L	N	L	N	L	N	L	N
National Average		15	30	49	55	31	36	25	37	24	24
Gender	Male	16.8	29.3	62	54	31	37				
	Female	17.4	31.8	60	70	31	36				
Region	Urban	26.2	44.9	68	75	35	34				
	Rural	9	19.4	35	40	30	30				
School Type	Private	29.7	50.5	57	66	31	40				
	Government	12.7	24.6	69	77	32	36				

Source: Authors computation, NEDS (2015) and Ogbonna (2016)

Note: L stands for Literacy; N for Numeracy; UBEP for Universal Basic Education Programme; ESSPIN for Education Sector Support Programme in Nigeria

While the new indicator does not resolve the problem of lack of nationally representative and disaggregated dataset on quality of education, it provides a starting point on the discourse on learning achievement for those in school and tracking their progress with respect to Agenda 2030. As shown in Table 4, the new indicator in many ways follow closely the other quality indicators for Nigeria. Besides, the new quality indicator has two advantages over these other indicators. First, the periodicity is assured in the new indicator since NEDS is carried out every 5 years. Second, the NEDS is linked to the DHS for Nigeria, making it possible to observe trend and relate the result to the entire population and also ensure availability of comparable indicators to measure progress along other SDG areas.

4. Exploring the determinants of education outcomes

The first important step in addressing the learning crisis in Nigeria is to have a measure of quality of education. However, for appropriate policy intervention, it will be crucial to have a sense of the drivers of the educational outcomes. In this section, we further investigate the key drivers of the weak quality of education from the observable educational inputs.

4.1 Model - the education production function

The underlying model in literature on the determinants of education outcomes has focused on the education system as an input-output process. The outcome from an educational process in terms of the achievement of students is mainly connected to the inputs that could be directly controlled by education policy makers, such as the underlying characteristics of the schools, instructors and curricula, and the uncontrolled inputs such as the family background, peers and innate possession and learning capabilities of the students (Hanushek, 2008). Generally, education outcomes are modelled using variants of education production functions which draw on the human capital theory (Britton & Vignoles, 2017). For this study, the following education production function (EPF) for a cross-section of students is specified:

$$y_i = \sum_{j=1}^J \beta_j I_{i,j} + \sum_{k=1}^K \phi_k F_{i,k} + \sum_{m=1}^M \varphi_m X_{i,m} + \varepsilon_i$$

where y_i is the education outcomes of student i measured as described in the preceding section. The education outcomes are determined by a set of individual characteristics (I) , a set of cumulative family and household inputs (F) and a set of cumulative resource inputs from the education system (X) . β , ϕ and φ represents the vectors of coefficients. The individual characteristics, I , are the observable characteristics of the students included in the model which include gender and age group. Family inputs are characterized by parents' education, income level and household size. The cumulative inputs from the education system are captured in the model using NEDS module on respondents' perception of teachers' characteristics (qualification and performance), the school organization (class size, facilities and administrative efficiencies) as well as community factors (such as involvement in developmental education expenditures).

The key variable in Equation [1], education outcome, is a discrete variable coded into performing and non-performing, based on the outcome of students' assessment on literacy and numeracy evaluation described in Section 3. The model is estimated using discrete-probability model – the ordered logistic regression. Odds ratios are computed for all the explanatory variables and education outcomes.

4.2 Estimated odds ratio for the determinants of education outcomes

The odds ratio (OR) reflects the likelihoods that a student will transit from poor to better performance in terms of literacy and numeracy outcomes. On the other hand, marginal effects are carried out as robustness checks in order to evaluate the possibility of changes in students' literacy and numeracy outcomes given changes in the factors as considered in the model. The estimation and results are discussed under three headings based on the factor groupings –innate and family factors; students' perception of learning facilities, and; parent involvements. Tables 5 (a-c) comprise the summary of odds ratios and marginal effects for each of family and pupils' individual attributes (Table 5a), students' perception of learning environment (5b), and parents' involvement (Table 5c).

Determinants of education outcome: individual and family factors

Starting with the students' gender, the odds ratio (OR) result shows that the probability of literacy and numeracy performance of students do not differ between female and their male counterparts. This further lends credence to the gender distribution earlier presented in the descriptive analysis. For wealth characterisation of households, the estimated odds ratio and marginal effects indicate that income class of students' household is an important marker to their literacy and numeracy performance. The OR shows that the higher the income level of a representative household, the higher the probability of a student from such household meeting the minimum competency in literacy and numeracy assessments. Besides, the differential intercept coefficients indicate that higher wealth quintile have greater outcomes probability than for lower wealth quintile. For illustration, students from household in the highest wealth quintile are approximately twice more likely to perform better in both literacy and numeracy tests than students in the lowest wealth quintile.

The odds ratio further provides evidence of performance differentials across students based on parental educational background. Although the OR indicate no significant difference in literacy outcomes of students with parents that have incomplete and complete primary education, the results however, show significant variation between parents with primary education and parents with secondary (incomplete and complete) and post-secondary education. The estimated results show that pupils that have parents with post-secondary

school qualification have about 0.56 and 0.23 odds of performing better in literacy and numeracy tests respectively than pupils with parents without education.

Furthermore, the result reflects that household size is a significant factor in the numeracy performance differentials across students. The estimated odds for a student from a household with more than ten members performing in numeracy tests below a student from a household with three members or less is about 0.58. The performance in literacy is not significantly different across household sizes. Lastly, on the effects of attending preprimary school on students' current literacy and numeracy performance, the results show that students that attended preprimary school have a higher and statistically significant probability¹ of performing better in literacy (43%) and numeracy (52%) assessments than their counterparts that do not attend preprimary school.

Table 5a: Determinants of education outcomes - innate and household characteristics

	Literacy	Numeracy
	Odds ratio	Odds ratio
<i>Gender [ref: male]</i>		
Female	0.079 (0.067)	0.066 (0.045)
<i>Wealth quintile [ref: lowest quintile]</i>		
Lower	0.459 (0.252)*	0.358 (0.122)***
Middle	0.633 (0.241)***	0.729 (0.116)***
Fourth	1.091 (0.238)***	1.142 (0.117)***
Highest	1.592 (0.240)***	1.682 (0.121)***
<i>Parent education level [ref: incomplete primary]</i>		
Complete primary	0.072 (0.195)	0.219 (0.100)**
Incomplete secondary	0.154 (0.207)	0.164 (0.111)
Complete secondary	0.367 (0.193)*	0.218 (0.102)**
More than secondary	0.551 (0.195)***	0.251 (0.106)**
<i>Household size [ref: 2 to 3]</i>		
4 to 6	-0.014 (0.116)	-0.133 (0.080)*
7 to 9	-0.062 (0.133)	-0.275 (0.089)***
10 and above	-0.222	-0.578

¹ The probability values are computed from the estimated odds ratio as $(odds/(1 + odds))$

	(0.182)	(0.116)***
Preschool attendance	0.755 (0.095)***	1.057 (0.054)***
<i>Cutoff point</i>	3.420 (0.286)***	2.276 (0.149)***
<i>Number of observations</i>	6,419	10,390

Note: t statistics in parentheses * p<0.05, ** p<0.01, *** p<0.001

Determinants of education outcome: Pupils perception

Next, we discuss the estimated coefficients of pupil's perception as it affects their literacy and numeracy performance outcomes. These perception variables comprise a set of questions related to pupils' perception of facilities and factors related to learning such as teachers, classrooms and other school facilities. Starting with the perception on teacher's performance and class room size, the estimated odds reveal no significant difference in the literacy performance of pupils with positive and negative perception of their teacher's performance as well as class over-crowdedness. For numeracy on the other hand, there is a significant dichotomy between the performance outcomes of pupils with perception that classrooms are overcrowded and those that think otherwise. We find similar result for perception on teachers' quality. In percentage terms, the estimated odds reveal a probability of about 60% that students with positive perception of teachers' performance and that classes are overcrowded perform better in numeracy test than their colleagues with negative perception. In addition, the estimated regression results reveal that students' perception of teachers care and school administration do not have significant impact on their literacy and numeracy performance. Lastly, the estimated regression result shows that perception about school physical facilities by pupils has significant and positive impact on their performance.

Table 5b: Determinants of education outcomes - pupil's perception

	Literacy	Numeracy
	Odds ratio	Odds ratio
<i>Perception on</i>		
Teachers' performance	0.950 (0.216)	1.530 (0.166)***
Teachers' attendance	2.643 (0.520)***	1.240 (0.138)*
Class overcrowding	1.121 (0.153)	1.511 (0.125)***
Teachers' care	0.670 (0.170)	0.806 (0.113)
School administration	0.960 (0.165)	0.955 (0.099)
School physical facilities	1.737	1.492

	(0.242)***	(0.144)***
<i>Cutoff point</i>	15.751	5.983
	(1.674)***	(0.427)***
<i>Number of observations</i>	9116	15,378

Note: t statistics in parentheses * p<0.05, ** p<0.01, *** p<0.001

Determinants of education outcome: Parents' involvement

Finally, we evaluate parent involvement in the provision of certain learning facilities and the implication on the performance of students. Interestingly, the estimated coefficients revealed that the involvement of parents in learning largely improves pupils' literacy and numeracy performance. For instance, the result shows that the payment of tuition, examination fees, PTA levies, and textbook purchases have significant impact on education outcomes. Also, involvement of parents in school supplies and development levies has significant effect on performance of students in numeracy assessment, although the literacy outcome reveals otherwise. The probability that students with parents involved in development levies and school supplies performing better than the non-involving parents is about 54% and 63% for literacy and numeracy respectively.

Table 5c: Determinants of education outcomes – parents' involvement

	Literacy	Numeracy
	Odds ratio	Odds ratio
<i>Parental involvement</i>		
Developmental levies	0.885 (0.080)	1.170 (0.078)**
Examination fees	1.333 (0.150)**	1.813 (0.135)***
School supplies	1.153 (0.112)	1.676 (0.107)***
PTA levies	1.302 (0.146)**	0.874 (0.066)*
Textbook purchases	3.400 (0.404)***	2.361 (0.157)***
Tuition payment	1.524 (0.163)***	1.797 (0.128)***
<i>Cutoff point</i>	20.636 (2.433)***	9.468 (0.700)***
<i>Number of observations</i>	9,092	15,306

Note: t statistics in parentheses * p<0.05, ** p<0.01, *** p<0.001

5. Conclusion

The central objectives of this study are in two folds. First, we demonstrate that innovative use of existing education survey (NEDS) to construct quality of education indicator for Nigeria can serve as a useful metric to track progress on the SDG. Second, we explore the broader information in the survey to answer key questions on the determinants of quality education in Nigeria. Key discerning findings emanating from our new construct of quality education outcomes is that educational performance in Nigeria is low. Also, we found performance in numeracy to be consistently higher than in literacy. Besides, our descriptive analyses of education outcomes indicate four groups that are mostly excluded from quality education in Nigeria to include children in rural areas, pupils attending government schools, children from poor households and lastly, children of school age from the northern regions of Nigeria. This suggests that these categories of pupils should be the priority groups in terms intervention into the education system in Nigeria. Overall, the indicator reveals that there is indeed learning crisis in Nigeria, as majority of the students do not meet what is defined as the minimum competency at their respective grade levels. As these children transit to higher level, learning deficiencies will increase, thereby compounding the learning crisis.

For the second objective, we corroborate the findings from the descriptive analyses by evaluating empirically the role of family background and other key characteristics that have been established in extant literature to affect quality education. We partitioned the factors into two: (i) individual and household characteristics, and (ii) pupil's perception of quality and parental involvement. We found most of these factors to be largely important and significant drivers of education outcomes in Nigeria. For example, there is statistically significant performance differentials between students from high and low wealth quintile. In addition, children whose parents have high education qualification perform better than those whose parents have no education or incomplete primary education. Furthermore, attendance of preprimary school by pupils is an important factor in educational performance in both literacy and numeracy assessment. This underscores the importance of early childhood education as this could facilitate the learning process and seamless transition of pupils into the primary curriculum and ensure better performance.

Lastly, we found that the perception of students in terms of teachers' attendance and performance, classroom size, and school administrative and physical facilities all have

significant implications on their literacy and numeracy performance outcomes. By implication, this could imply that it is not just the availability or otherwise of learning infrastructure and facilities but the adequacies of these facilities, which is indirectly measured by perception of students, that have significant impacts on their education outcomes.

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