

ORIGINAL RESEARCH ARTICLE

Sustainable Strategies for Raising the Standard of Education in Nigeria (A Case Study of Enugu Urban)

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ABSTRACT

The persistent decline in the perceived standard of education in Nigeria has prompted calls for strategies that yield durable, rather than episodic, improvements in learning. This study examined the extent to which three sustainable strategies, namely teacher professional development (TPD), information and communication technology (ICT) integration, and community–parental partnership (CPP), are implemented in public secondary schools in Enugu Urban, and the degree to which they predict the standard of education. Anchored on human capital theory and the education production function, the study adopted a correlational survey design. A multi-stage cluster sample of 300 teachers was drawn from 12 public secondary schools across Enugu East, Enugu North, and Enugu South Local Government Areas; 276 usable questionnaires (92.0%) were analysed. The sample exceeded the minimum of 119 derived from an a priori power analysis. The four scales showed acceptable to good internal consistency (Cronbach's $\alpha = .78-.87$; McDonald's $\omega = .78-.87$). TPD ($M = 2.86$) and CPP ($M = 2.67$) were implemented to a high extent, whereas ICT integration was low ($M = 2.39$), and the standard of education was rated as moderate ($M = 2.64$). Multiple regression showed that the three strategies jointly explained 37.3% of the variance in the standard of education, $F(3, 272) = 53.96, p < .001, f^2 = 0.60$. TPD was the strongest predictor ($\beta = .41, p < .001, f^2 = 0.21$), followed by ICT integration ($\beta = .19, p < .001, f^2 = 0.05$) and CPP ($\beta = .18, p = .001, f^2 = 0.04$). All three null hypotheses were rejected. The study recommends institutionalised school-based professional learning, solar-backed ICT infrastructure, and formalised community partnership frameworks as mutually reinforcing levers for sustained improvement.

Keywords: sustainable education, standard of education, teacher professional development, ICT integration, community partnership, Enugu

Education occupies a central place in Nigeria's development agenda. The National Policy on Education describes it as an instrument “par excellence” for national development and commits government to education that is functional, relevant, and of acceptable quality (Federal Republic of Nigeria [FRN], 2013). The Compulsory, Free Universal Basic Education Act (FRN, 2004) further extended the state's obligation to guarantee access to schooling. At the global level, Sustainable Development Goal 4 reframed the target from access alone to “inclusive and equitable quality education” and lifelong learning for all (United Nations, 2015). Yet public debate in Nigeria continues to be dominated by the complaint that the standard of education has fallen, evidenced by weak performance in external examinations, poor mastery of foundational literacy and numeracy, deteriorating facilities, and graduates who are judged to be underprepared for further study or work (Odia & Omofonmwan, 2007).

A recurring weakness of reform efforts has been their episodic character. Many interventions, including one-off supplies of equipment, short workshops, and emergency renovation drives, produce visible activity but fade once funding or political attention shifts. International evidence confirms that simply adding inputs to schools is an unreliable route to learning gains (Glewwe et al., 2011; Hanushek, 2003). What appears to matter more is how resources are converted into instruction: the knowledge and practice of teachers, the use of technology to support learning, and the accountability relationships between schools and the communities they

serve (Glewwe & Muralidharan, 2016; Kremer et al., 2013). Strategies that build these capacities are sustainable in the sense that they renew themselves, remain affordable within existing budgets, and continue to produce benefits after the initial intervention has ended (Sterling, 2001; UNESCO, 2017).

Enugu Urban, which comprises Enugu East, Enugu North, and Enugu South Local Government Areas (LGAs), offers a useful setting in which to examine these questions. As the administrative capital of Enugu State and a long-standing educational centre in South-East Nigeria, it hosts a dense concentration of public secondary schools managed by the Post Primary Schools Management Board (PPSMB). Urban schools in the area face pressures common to Nigerian cities, including large classes, uneven power supply, and variable parental engagement, but they also have comparatively better access to training providers, technology vendors, alumni networks, and civil society organisations. If sustainable strategies are to succeed anywhere in the state, their effects should be observable in this setting.

Statement of the Problem

Despite repeated policy commitments, stakeholders in Enugu Urban continue to express concern about the quality of learning in public secondary schools. Much of the available commentary on the problem is descriptive and relies on opinion rather than systematic measurement. Few studies in the South-East have examined, within a single model, how multiple improvement strategies jointly and uniquely relate to the standard of education, and fewer still report effect sizes that would allow policymakers to judge which strategy deserves priority when resources are scarce. Without such evidence, education managers risk spreading limited funds thinly across initiatives of uneven value. The problem of this study, therefore, is to establish the extent to which selected sustainable strategies are implemented in public secondary schools in Enugu Urban and to quantify their relative contributions to the standard of education.

Purpose of the Study

The main purpose of the study was to examine sustainable strategies for raising the standard of education in public secondary schools in Enugu Urban. Specifically, the study sought to (a) determine the extent to which teacher professional development is implemented; (b) determine the extent to which ICT integration is implemented; (c) determine the extent to which community–parental partnership is implemented; (d) ascertain teachers' ratings of the standard of education in their schools; and (e) determine the predictive contribution of each strategy to the standard of education.

Research Questions

Four research questions guided the study: (1) To what extent is teacher professional development implemented in public secondary schools in Enugu Urban? (2) To what extent is ICT integration implemented? (3) To what extent is community–parental partnership implemented? (4) How do teachers rate the standard of education in their schools?

Hypotheses

The following null hypotheses were tested at the .05 level of significance:

H₀₁: Teacher professional development does not significantly predict the standard of education in public secondary schools in Enugu Urban.

H₀₂: ICT integration does not significantly predict the standard of education in public secondary schools in Enugu Urban.

H₀₃: Community–parental partnership does not significantly predict the standard of education in public secondary schools in Enugu Urban.

Significance of the Study

The findings are expected to benefit the Enugu State Ministry of Education and the PPSMB by indicating where improvement funds are likely to yield the greatest returns. School principals may use the results to prioritise professional learning and partnership activities within their schools. Parent–teacher associations, alumni bodies, and corporate partners may find evidence that their contributions are associated with measurable differences in school quality. For researchers, the study contributes effect-size estimates from a South-East Nigerian urban context, a setting that remains under-represented in the international literature on school improvement.

Literature Review

Conceptual Clarification

Standard of Education

The standard of education refers to the level of quality attained by an education system relative to expectations set by policy, society, and the demands of further study and work. It is multidimensional. Output indicators include students' mastery of core subjects and performance in external examinations; process indicators include discipline, instructional practice, and time on task; and input indicators include facilities, materials, and class size (Hanushek, 1986; Odia & Omofonmwan, 2007). Hanushek and Woessmann (2008) argue that the most consequential dimension is the cognitive skill that students actually acquire, since it is skills rather than years of schooling that drive individual earnings and national growth. In this study, the standard of education is operationalised as teachers' ratings of students' subject mastery, examination performance, discipline, facility adequacy, class-size conditions, and preparedness for post-secondary transitions.

Sustainable Strategies

Sterling (2001) characterises sustainable education as a shift from transmissive, short-term provision toward systems that build their own capacity for learning and change. Applied to school improvement, a strategy is sustainable when it (a) develops capacities that remain after the intervention ends, (b) can be financed from recurrent budgets or local contributions, and (c) aligns with the long-term goals set out in SDG 4 (UNESCO, 2017). Three strategies meet these criteria and are prominent in the literature. Teacher professional development builds human capital that remains within the school. ICT integration, when supported by reliable energy and trained teachers, provides reusable instructional resources at low marginal cost. Community–parental partnership mobilises local resources and creates accountability relationships that persist beyond any single government programme (Epstein, 2011).

Theoretical Framework

Human Capital Theory

Human capital theory holds that the knowledge and skills embodied in people constitute a form of capital that yields returns in productivity and earnings (Becker, 1964; Schultz, 1961). Schultz (1961) observed that conventional measures of physical capital and labour could not account for much of the economic growth recorded in industrial economies, and attributed the residual to deliberate investment in people through education, training, and health. Becker (1964) extended the argument by distinguishing general from specific training and showing that investment continues after initial schooling.

The theory is relevant to this study in two ways. First, it frames students' learning as the ultimate product of the education system, which justifies a focus on outcomes rather than inputs. Second, and less often noted, it applies to teachers themselves. Teachers' knowledge and pedagogical skill are the human capital of the school; investment in their continuing development should raise the productivity of instruction and, in turn, students' attainment. Human capital theory therefore predicts a positive relationship between teacher professional development and the standard of education (H_{01}).

Education Production Function

The education production function models student outcomes as a function of school inputs, family background, peer influences, and students' innate abilities (Hanushek, 1986). Early applications focused on quantifiable inputs such as expenditure per pupil and teacher–pupil ratios, and repeatedly found that these inputs were weakly and inconsistently related to achievement (Hanushek, 1986, 2003). The lesson drawn from this literature is not that resources are irrelevant, but that the way resources are used matters more than their quantity. Technology, for example, raises learning only when it changes what happens in instruction (Escueta et al., 2020), while family and community inputs enter the function directly through home support and indirectly by shaping school accountability (Fan & Chen, 2001).

The production function provides the structure of the conceptual model used in this study. The standard of education is treated as the output; teacher professional development, ICT integration, and community–parental partnership are treated as inputs that are amenable to policy and that, if well managed, are sustainable. Multiple regression is the natural estimation strategy for this model because it yields the unique contribution of each input while holding the others constant. Taken together, the two theories generate the expectation that all three strategies will predict the standard of education, with teacher-related investment expected to exert the largest effect.

Conceptual Model of the Study

The conceptual model of the study can be stated as follows. Three policy-amenable inputs, teacher professional development, ICT integration, and community–parental partnership, are hypothesised to exert direct, positive effects on the standard of education. The inputs are also expected to be positively correlated with one another, because schools that invest in one area frequently invest in others and because the strategies can reinforce each other; for example, PTA levies may fund teacher workshops or solar installations for computer laboratories. The model therefore distinguishes between the unique contribution of each strategy, which is the variance in the outcome explained by that strategy alone after the others are held constant, and the shared contribution, which reflects their joint operation. This distinction has practical value. A strategy with a large unique contribution is a candidate for priority funding, whereas a large shared contribution indicates that the strategies should be coordinated rather than pursued in isolation.

Empirical Review

Teacher Quality and Professional Development

Rivkin et al. (2005) used matched panel data on students and teachers in Texas and found substantial variation in teacher quality that was only weakly explained by observable credentials such as advanced degrees, although teachers improved markedly during their first years of experience. The implication is that what teachers do in the classroom, which can be developed, matters more than the qualifications they hold at entry. Darling-Hammond (2000), analysing state-level data across the United States, reported that measures of teacher preparation and certification were among the strongest correlates of student achievement in reading and mathematics, even after controlling for student poverty and language background.

Kraft et al. (2018) conducted a meta-analysis of 60 studies with causal designs and found that teacher coaching improved instructional practice by about half a standard deviation (0.49 SD) and student achievement by 0.18 SD. The effects were smaller in larger programmes, which highlights the challenge of maintaining quality at scale. Hattie's (2009) synthesis of more than 800 meta-analyses similarly placed teacher-related influences, including feedback, clarity, and formative evaluation, among the most powerful determinants of achievement. In a focused review, Hattie and Timperley (2007) reported that feedback carried an average effect of approximately 0.79, although effects varied considerably with the type of feedback given.

Evidence from low- and middle-income countries points in the same direction. Evans and Popova (2016) compared six systematic reviews of learning interventions and found that, despite differences in their

conclusions, the reviews converged on two categories: pedagogical interventions that match teaching to students' learning levels, and individualised, repeated teacher training tied to specific instructional methods. Piper et al. (2018) documented how Kenya's Tusome programme scaled structured pedagogy nationally by combining teachers' guides, instructional coaching, and textbooks, and sustained literacy gains at scale. In sub-Saharan Africa, Bold et al. (2017) analysed Service Delivery Indicator surveys from seven countries, including Nigeria, and found that many teachers lacked the subject knowledge expected of their students' grade level and that substantial instructional time was lost to classroom absence. These findings suggest that professional development targeted at content knowledge and classroom presence may carry large returns in the Nigerian context.

Instructional Leadership and Accountability

Robinson et al. (2008) meta-analysed studies of school leadership and found that the effect of instructional leadership on student outcomes was roughly three to four times that of transformational leadership, with the largest effect associated with leaders promoting and participating in teacher learning. Leithwood et al. (2008) concluded that school leadership is second only to classroom teaching among school-related influences on learning. Muralidharan and Sundararaman (2011) evaluated a teacher performance pay experiment in Andhra Pradesh, India, and found that students in incentive schools scored 0.27 SD and 0.17 SD higher in mathematics and language, respectively, after two years. Bruns and Luque (2015), using standardised classroom observation across Latin America, found that teachers used considerably less than the recommended share of class time for instruction, indicating that supervision and feedback on time use are fertile areas for professional development. These studies inform the present study's measurement of supervision and feedback as a component of teacher professional development.

ICT Integration

Escueta et al. (2020) reviewed experimental research on educational technology and concluded that providing hardware access alone had limited effects on learning, whereas computer-assisted learning, particularly adaptive software in mathematics, produced meaningful gains. Bulman and Fairlie (2016) reached a similar conclusion: the evidence on computer and internet access was mixed, but well-designed computer-assisted instruction could raise achievement. Banerjee et al. (2007) evaluated two interventions in urban India; a computer-assisted mathematics programme increased scores by 0.35 SD in the first year and 0.47 SD in the second, while a remedial tutoring programme increased scores by 0.14 SD and 0.28 SD over the same periods. Collectively, these studies suggest that ICT raises standards when it is linked to pedagogy, sustained over time, and supported by teacher training, conditions that depend in Nigeria on reliable electricity and connectivity.

School Inputs, Complementarities, and Pedagogy

Glewwe et al. (2011) reviewed studies from developing countries published between 1990 and 2010 and found that few school inputs were consistently associated with learning, although basic furniture, teacher knowledge, and teacher attendance showed more consistent relationships. Hanushek (2003) reached a comparable verdict in his critique of input-based policies. Kremer et al. (2013) argued that reforms that change pedagogy or strengthen accountability had produced more reliable gains than general increases in inputs. Mbiti et al. (2019) tested this proposition in Tanzania; unconditional school grants alone had no significant effect on test scores, teacher incentives had modest effects, and the combination produced gains significantly larger than the sum of the separate effects. Duflo et al. (2011) showed in Kenya that tracking students by initial achievement raised test scores for pupils across the distribution by about 0.14 SD after 18 months, which again underlines the value of matching instruction to learners' levels. Glewwe and Muralidharan (2016) synthesised this body of evidence and concluded that interventions addressing pedagogy and governance were more cost-effective than those that simply expanded inputs.

Community and Parental Partnership

Jeynes (2007) meta-analysed 52 studies of urban secondary school students and found that parental involvement was associated with academic achievement at an effect of roughly half a standard deviation, with subtle forms such as parental expectations carrying substantial weight. Fan and Chen (2001) reported a small-to-moderate overall correlation between parental involvement and achievement, with the strongest association for parental aspirations and expectations. Desforges and Abouchaar (2003), reviewing evidence for the English Department for Education and Skills, concluded that at-home parental involvement had a significant positive effect on achievement even after other factors were controlled. Epstein (2011) conceptualised school–family–community partnership as six types of involvement and argued that schools which plan partnership activities systematically sustain higher levels of engagement. In Nigeria, Odia and Omofonmwan (2007) identified inadequate funding, poor infrastructure, and weak stakeholder commitment as major problems of the education system and called for greater community participation in school management.

Summary and Gap in the Literature

The reviewed literature establishes that teacher quality and professional development, well-designed ICT use, instructional leadership, and parental involvement are each associated with learning outcomes, and that input expansion without changes in practice is an unreliable path to improvement. Three gaps are apparent. First, most causal evidence comes from the United States, India, Kenya, Tanzania, and Latin America, with limited systematic evidence from South-East Nigeria. Second, studies typically examine strategies in isolation, which makes it difficult to judge their relative importance when they are implemented simultaneously. Third, Nigerian studies on the standard of education seldom report reliability for each construct or effect sizes for tested relationships. The present study addresses these gaps by estimating the unique and joint contributions of three sustainable strategies to the standard of education in Enugu Urban, with reliability and effect sizes reported throughout.

Method

Research Design

The study adopted a correlational survey design. The design was appropriate because the study sought to describe the current level of implementation of each strategy and to estimate the relationships between the strategies and the standard of education without manipulating any variable. Because the design is non-experimental and cross-sectional, the findings are interpreted as predictive associations rather than causal effects.

Area of the Study

The study was conducted in Enugu Urban, Enugu State, South-East Nigeria. Enugu Urban comprises three LGAs: Enugu East, Enugu North, and Enugu South. Public secondary schools in the area are administered by the Enugu State Post Primary Schools Management Board. The area was selected because it contains the state's largest concentration of public secondary schools, it combines older established schools with newer schools in expanding neighbourhoods, and its schools are exposed to a wide range of improvement initiatives from government, alumni, and private partners.

Population

The population comprised all teachers in public secondary schools in the three LGAs of Enugu Urban. Teachers were chosen as respondents because they are directly involved in the implementation of professional development, ICT use, and community engagement, and because they observe students' learning, discipline, and preparedness on a daily basis.

Sample Size Determination and Justification

The minimum sample size was determined through an a priori power analysis for multiple linear regression with three predictors (Faul et al., 2007). A medium effect size was assumed ($f^2 = 0.15$; Cohen, 1988), since the reviewed literature suggested that school-improvement strategies typically have small-to-moderate effects on outcomes. With $\alpha = .05$ and statistical power of .95, the analysis indicated a minimum sample of 119 respondents; at the more conventional power of .80, the minimum would have been 77. Because respondents were sampled in clusters (schools), the minimum was inflated by an assumed design effect of 2.0 to account for within-school similarity (Kish, 1965), giving 238. This figure was further divided by an anticipated usable response rate of 80%, yielding 298, which was rounded to 300 for equal allocation across schools. The final usable sample of 276 was more than double the power-analysis minimum. A post hoc sensitivity check showed that, with $N = 276$, the study had .93 power to detect the smallest unique effect eventually observed ($f^2 = 0.04$) at $\alpha = .05$.

Sampling Technique

A multi-stage cluster sampling technique was used. At the first stage, the three LGAs were treated as strata. At the second stage, four public secondary schools were randomly selected from each LGA by simple balloting, giving 12 schools. At the third stage, 25 teachers were randomly selected from the staff list of each school using a table of random numbers, giving 300 teachers. Of the 300 questionnaires distributed, 283 were returned and 7 were excluded because more than 10% of the items were unanswered, leaving 276 usable responses (92.0%).

Instrument for Data Collection

Data were collected with a researcher-developed instrument titled the Sustainable Strategies and Standard of Education Questionnaire (SSSEQ). Section A captured respondents' demographic characteristics. Section B contained 22 items in four clusters: teacher professional development (6 items), ICT integration (5 items), community–parental partnership (5 items), and standard of education (6 items). Items on the three strategies were rated on a four-point extent scale: Very High Extent (4), High Extent (3), Low Extent (2), and Very Low Extent (1). Items on the standard of education were rated on a four-point agreement scale: Strongly Agree (4), Agree (3), Disagree (2), and Strongly Disagree (1). The item wordings were adapted from constructs described in the reviewed literature (Epstein, 2011; Escueta et al., 2020; Kraft et al., 2018) and contextualised to Nigerian secondary schools.

Validity of the Instrument

Face and content validity were established by three experts, two in educational administration and planning and one in measurement and evaluation. The experts assessed the clarity, relevance, and coverage of the items, and their suggestions led to the rewording of four items and the removal of two redundant items from an initial pool of 24. Construct validity was examined using the main-study data. Principal axis factor loadings for each scale ranged from .59 to .79 (Table 1). Following Fornell and Larcker (1981), discriminant validity was supported because the square root of the average variance extracted (AVE) for every construct exceeded that construct's correlations with the other constructs, as reported with the intercorrelations in the Results section. Three constructs had AVE values slightly below .50; however, their composite reliabilities exceeded .70, a pattern that Fornell and Larcker (1981) regard as adequate evidence of convergent validity.

Reliability of the Instrument

Internal consistency was estimated separately for each construct using Cronbach's alpha and McDonald's (1999) omega. Omega was reported alongside alpha because it does not assume equal item loadings. As shown in Table 1, all coefficients exceeded the .70 threshold recommended by Nunnally and Bernstein (1994), and corrected item–total correlations ranged from .52 to .72, well above the .30 minimum commonly used for item retention (Hair et al., 2019).

Reliability and Convergent Validity Statistics per Construct (N = 276)

Construct	Items	Cronbach's α	McDonald's ω	Item-total r	Loadings (λ)	AVE
Teacher professional development	6	.84	.84	.53–.68	.59–.76	.47
ICT integration	5	.81	.81	.53–.63	.59–.73	.47
Community–parental partnership	5	.78	.78	.52–.60	.59–.71	.41
Standard of education	6	.87	.87	.61–.72	.66–.79	.53

Table 1. Reliability, item–total correlations, factor loadings and average variance extracted

Method of Data Collection

Permission was obtained from the PPSMB and from the principals of the sampled schools. The researcher and two trained research assistants administered the questionnaires in person and collected them within two weeks. Participation was voluntary, respondents gave informed consent, and no names or school identifiers were recorded on the questionnaires.

Method of Data Analysis

Research questions were answered using means and standard deviations. A criterion mean of 2.50, the midpoint of the four-point scale, was used for decisions: item or cluster means of 2.50 and above were interpreted as High Extent (or Agree), and means below 2.50 as Low Extent (or Disagree). Composite scores for each construct were computed as the mean of the constituent items. The hypotheses were tested with standard multiple linear regression at $\alpha = .05$. Effect sizes were reported as Cohen's f^2 for the overall model ($f^2 = R^2/[1 - R^2]$) and for each predictor ($f^2 = sr^2/[1 - R^2]$), where sr^2 is the squared semipartial correlation. Following Cohen (1988), f^2 values of 0.02, 0.15, and 0.35 were interpreted as small, medium, and large. Regression assumptions were examined through variance inflation factors, the Durbin–Watson statistic, the Shapiro–Wilk test on residuals, and Cook's distance. Because all constructs were measured with a single self-report instrument, common method variance was assessed with Harman's single-factor test (Podsakoff et al., 2003). A supplementary one-way analysis of variance compared the standard of education across the three LGAs.

Results

Demographic Characteristics of Respondents

Table 2 presents the demographic characteristics of the 276 respondents. Female teachers constituted 64.5% of the sample. The largest age group was 40–49 years (37.7%), and most respondents held a first degree in education (62.0%). More than half (58.0%) had over 10 years of teaching experience. The distribution across Enugu East (33.0%), Enugu North (34.1%), and Enugu South (33.0%) was nearly equal, which reflects the equal allocation of the sample across LGAs.

Demographic Characteristics of Respondents (N = 276)

Variable	Category	n	%
Sex	Male	98	35.5

	Female	178	64.5
Age (years)	Below 30	31	11.2
	30–39	88	31.9
	40–49	104	37.7
	50 and above	53	19.2
Highest qualification	NCE	29	10.5
	B.Ed./B.Sc.(Ed.)	171	62.0
	PGDE	38	13.8
	M.Ed. and above	38	13.8
Teaching experience (years)	1–5	45	16.3
	6–10	71	25.7
	11–20	102	37.0
	Above 20	58	21.0
LGA	Enugu East	91	33.0
	Enugu North	94	34.1
	Enugu South	91	33.0

Table 2. Demographic characteristics of respondents (N = 276)

Research Questions 1–3: Extent of Implementation of Sustainable Strategies

Table 3 shows that teacher professional development was implemented to a high extent (cluster M = 2.86, SD = 0.75). All six items exceeded the criterion mean; mentoring of newly posted teachers received the highest rating (M = 3.11), and sponsorship for further studies received the lowest (M = 2.60). ICT integration was implemented to a low extent (cluster M = 2.39, SD = 0.80). Only two items, teachers' use of digital resources (M = 2.57) and teachers' ICT training (M = 2.62), reached the criterion, while reliable electricity or internet for instructional ICT received the lowest rating of all 16 strategy items (M = 2.14). Community–parental partnership was implemented to a high extent (cluster M = 2.67, SD = 0.76), although support from private or corporate partners fell below the criterion (M = 2.38).

Mean Ratings on the Extent of Implementation of Sustainable Strategies (N = 276)

Item	M	SD	Decision
Teacher professional development	Teacher professional development	Teacher professional development	Teacher professional development
Teachers attend regular in-service training organised by the PPSMB or school	2.74	1.02	HE
Newly posted teachers are mentored by experienced colleagues	3.11	0.97	HE

Teachers are sponsored for further studies or professional certification	2.60	1.01	HE
Lesson notes and lesson delivery are supervised with feedback	2.99	1.00	HE
Teachers take part in subject-based peer learning or departmental meetings	2.83	1.02	HE
Teachers are trained in learner-centred, activity-based pedagogy	2.87	1.05	HE
Cluster mean	2.86	0.75	HE
ICT integration	ICT integration	ICT integration	ICT integration
The school has a functional computer laboratory accessible to students	2.38	1.08	LE
Teachers use digital resources (videos, simulations, e-content) in lessons	2.57	1.07	HE
Reliable electricity (grid or solar) and internet support instructional ICT	2.14	1.00	LE
Teachers have received training on the use of ICT for teaching	2.62	1.07	HE
The school uses digital systems for records, results, and communication	2.23	1.05	LE
Cluster mean	2.39	0.80	LE
Community–parental partnership	Community–parental partnership	Community–parental partnership	Community–parental partnership
The PTA contributes to infrastructure maintenance and repairs	2.72	1.03	HE
Parents monitor their children’s homework and attendance	2.86	0.96	HE
Alumni associations support school projects	2.54	1.08	HE
Community leaders and the SBMC participate in school decisions	2.85	1.06	HE
Private or corporate partners supply materials or sponsorship	2.38	1.06	LE
Cluster mean	2.67	0.76	HE

Table 3. Mean ratings of the implementation of sustainable strategies (N = 276)

Research Question 4: Teachers' Ratings of the Standard of Education

As shown in Table 4, the overall rating of the standard of education was marginally above the criterion (cluster $M = 2.64$, $SD = 0.81$), indicating a moderate standard. Respondents agreed that students displayed acceptable discipline ($M = 2.93$), were adequately prepared for post-secondary transitions ($M = 2.77$), and demonstrated mastery of core subjects ($M = 2.74$). They disagreed that performance in external examinations was satisfactory ($M = 2.46$) and that class sizes allowed individual attention ($M = 2.43$).

Mean Ratings of the Standard of Education in Public Secondary Schools ($N = 276$)

Item	M	SD	Decision
Students demonstrate mastery of core subjects appropriate to their class level	2.74	1.03	Agree
Students' performance in external examinations (WASSCE/NECO) is satisfactory	2.46	1.06	Disagree
Students exhibit acceptable discipline and punctuality	2.93	1.01	Agree
Instructional materials and facilities are adequate for effective learning	2.52	1.06	Agree
Class sizes permit individual attention to students	2.43	1.10	Disagree
Students are well prepared for tertiary education or work	2.77	0.99	Agree
Cluster mean	2.64	0.81	Agree

Table 4. Mean ratings of the standard of education in public secondary schools ($N = 276$)

Descriptive Statistics and Intercorrelations

Table 5 reports descriptive statistics and Pearson correlations among the composite scores. Skewness (-0.34 to 0.12) and excess kurtosis (-1.03 to -0.78) were within ± 2 , indicating approximately symmetrical distributions. All correlations were positive and significant at $p < .001$. The standard of education correlated most strongly with teacher professional development ($r = .55$), followed by ICT integration ($r = .42$) and community-parental partnership ($r = .37$). Correlations among the predictors ranged from $.32$ to $.41$, which suggested no multicollinearity problem.

Descriptive Statistics and Intercorrelations of Study Variables ($N = 276$)

Variable	M	SD	Skew	Kurt.	1	2	3	4
1. Teacher professional development	2.86	0.75	-0.34	-0.78	(.68)			
2. ICT integration	2.39	0.80	0.12	-0.96	.41***	(.68)		

3. Community–parental partnership	2.67	0.76	–0.10	–0.88	.32***	.33***	(.64)	
4. Standard of education	2.64	0.81	–0.03	–1.03	.55***	.42***	.37***	(.73)

Table 5. Descriptive statistics and intercorrelations of study variables (N = 276)

Regression Diagnostics

Before the hypotheses were tested, regression assumptions were checked. Variance inflation factors ranged from 1.17 to 1.27 (tolerance = .79–.85), far below the conventional threshold of 10. The Durbin–Watson statistic of 1.97 indicated independence of residuals. The Shapiro–Wilk test showed that residuals did not depart significantly from normality, $W = .99$, $p = .051$. The largest Cook’s distance was 0.03, indicating that no single case exerted undue influence. In Harman’s single-factor test, the first unrotated factor accounted for 32.2% of the variance across the 22 items, and four factors had eigenvalues greater than 1, consistent with the four hypothesised constructs. Common method variance was therefore unlikely to account for the observed relationships (Podsakoff et al., 2003).

Test of Hypotheses

Table 6 shows that the regression model was significant, $F(3, 272) = 53.96$, $p < .001$. The three strategies jointly accounted for 37.3% of the variance in the standard of education ($R = .61$, adjusted $R^2 = .366$), representing a large overall effect ($f^2 = 0.60$).

Model Summary and Analysis of Variance for the Regression of Standard of Education on Sustainable Strategies

Source	SS	df	MS	F	p
Regression	67.52	3	22.51	53.96	< .001
Residual	113.45	272	0.42		
Total	180.97	275			

Table 6. Model summary and analysis of variance for the regression of standard of education on sustainable strategies

Table 7 presents the regression coefficients. With respect to H_{01} , teacher professional development significantly predicted the standard of education, $B = 0.44$, 95% CI [0.33, 0.56], $\beta = .41$, $t(272) = 7.60$, $p < .001$. It uniquely explained 13.3% of the variance ($sr^2 = .133$), a medium effect ($f^2 = 0.21$). H_{01} was therefore rejected. With respect to H_{02} , ICT integration was a significant predictor, $B = 0.20$, 95% CI [0.09, 0.31], $\beta = .19$, $t(272) = 3.60$, $p < .001$, uniquely explaining 3.0% of the variance ($sr^2 = .030$), a small effect ($f^2 = 0.05$). H_{02} was rejected. With respect to H_{03} , community–parental partnership significantly predicted the standard of education, $B = 0.19$, 95% CI [0.08, 0.30], $\beta = .18$, $t(272) = 3.46$, $p = .001$, uniquely explaining 2.8% of the variance ($sr^2 = .028$), a small effect ($f^2 = 0.04$). H_{03} was rejected. The unique contributions summed to 19.0%, indicating that the remaining 18.3% of explained variance was shared among the predictors. The outcomes of the three hypothesis tests are summarised in Table 8.

Multiple Regression Coefficients and Effect Sizes for Predictors of Standard of Education (N = 276)

Predictor	B	SE	β	t	p	95% CI for B	sr^2	f^2	VIF
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Constant	0.40	0.18		2.14	.033	[0.03, 0.76]			
Teacher professional development	0.44	0.06	.41	7.60	< .001	[0.33, 0.56]	.133	0.21	1.26
ICT integration	0.20	0.06	.19	3.60	< .001	[0.09, 0.31]	.030	0.05	1.27
Community–parental partnership	0.19	0.06	.18	3.46	.001	[0.08, 0.30]	.028	0.04	1.17

Table 7. Multiple regression coefficients and effect sizes for predictors of standard of education (N = 276)

Summary of Hypothesis Testing

Hypothesis	Predictor	β	t	p	f ²	Magnitude	Decision
H ₀₁	Teacher professional development	.41	7.60	< .001	0.21	Medium	Rejected
H ₀₂	ICT integration	.19	3.60	< .001	0.05	Small	Rejected
H ₀₃	Community–parental partnership	.18	3.46	.001	0.04	Small	Rejected

Table 8. Summary of hypothesis testing

Supplementary Analysis: Differences Across Local Government Areas

A one-way analysis of variance was conducted to establish whether the standard of education differed across the three LGAs, which would affect whether data could appropriately be pooled. Levene's test indicated homogeneity of variance, $F(2, 273) = 1.28$, $p = .279$. As Table 9 shows, the differences among Enugu East ($M = 2.59$), Enugu North ($M = 2.73$), and Enugu South ($M = 2.61$) were not significant, $F(2, 273) = 0.90$, $p = .408$, and the effect was negligible ($\eta^2 = .007$). Pooling the data across LGAs for the regression analysis was therefore justified.

One-Way ANOVA of Standard of Education by Local Government Area

LGA	n	M	SD
Enugu East	91	2.59	0.76
Enugu North	94	2.73	0.83
Enugu South	91	2.61	0.84
Total	276	2.64	0.81

Table 9. One-way ANOVA of standard of education by local government area

Discussion

Implementation of Sustainable Strategies

The finding that teacher professional development was implemented to a high extent suggests that schools in Enugu Urban have established routines of mentoring, supervision, and departmental collaboration. That mentoring and supervision received the highest ratings is significant, since both are low-cost, school-based practices of the kind that Evans and Popova (2016) and Kraft et al. (2018) associate with durable changes in instruction. The comparatively lower rating for sponsorship of further studies reflects the fact that this component depends on external funding and is therefore less sustainable within school budgets.

ICT integration was the only strategy implemented to a low extent, and the weakest item concerned reliable electricity and internet. The pattern indicates that the binding constraint is infrastructural rather than attitudinal: teachers reported having received some ICT training and using digital resources to a high extent, but lacked the energy and connectivity required to use them consistently. This is consistent with Escueta et al. (2020) and Bulman and Fairlie (2016), who found that the benefits of educational technology depend on sustained, pedagogically integrated use rather than on hardware alone. In the Nigerian context, off-grid solar solutions offer a sustainable route to closing this gap.

Community–parental partnership was implemented to a high extent in terms of PTA contributions, parental monitoring, and community participation in decision-making, but private and corporate sponsorship lagged behind. This suggests that partnership in Enugu Urban currently relies heavily on parents and local leaders, while the potential of corporate social responsibility and alumni endowments remains underused.

Standard of Education

Teachers rated the standard of education as moderate. The disagreement with statements about external examination performance and class size is consistent with the concerns reported by Odia and Omofonmwan (2007) and reinforces the argument of Hanushek and Woessmann (2008) that the quality of learning, rather than enrolment alone, should be the central concern of policy. Discipline and preparedness for transition were rated more favourably, which suggests that schools are more successful at maintaining order than at producing high academic attainment.

Teacher Professional Development and the Standard of Education

Teacher professional development was the strongest predictor of the standard of education and the only strategy with a medium unique effect. The finding supports human capital theory (Becker, 1964; Schultz, 1961) as applied to teachers: investment in teachers' knowledge and skills was associated with higher-quality outcomes. It is consistent with Rivkin et al. (2005) and Darling-Hammond (2000), who identified teacher quality as the most consequential school-level factor, and with Robinson et al. (2008), who found that leaders' promotion of teacher learning had the largest effect on student outcomes. The finding is also relevant in light of Bold et al. (2017), whose evidence of gaps in teacher knowledge in sub-Saharan Africa, including Nigeria, suggests that professional development may have high returns in this region. The effect size ($f^2 = 0.21$) implies that professional development should be the first priority where resources are limited.

ICT Integration and the Standard of Education

ICT integration made a significant but small unique contribution. The modest magnitude is best understood in the light of its low level of implementation: a strategy that is used inconsistently has limited opportunity to affect outcomes. The positive coefficient nonetheless indicates that schools with better ICT infrastructure and use were rated as having higher standards, which is in line with the gains reported for computer-assisted learning by Banerjee et al. (2007) and Escueta et al. (2020). The relatively strong correlation between ICT integration and teacher professional development ($r = .41$) suggests that the two strategies are complementary, since teachers who have been trained are better able to use technology productively.

Community–Parental Partnership and the Standard of Education

Community–parental partnership also made a significant but small unique contribution. This is consistent with the meta-analytic evidence of Jeynes (2007) and Fan and Chen (2001), and with Epstein’s (2011) argument that partnership is most effective when organised systematically. The small unique effect, alongside a moderate zero-order correlation ($r = .37$), indicates that much of the influence of partnership overlaps with the other strategies. For example, PTA funds may pay for teacher training or solar installations. The finding echoes Mbiti et al. (2019), who showed that inputs and incentives produce larger gains when combined than when implemented separately. Taken together with the 18.3% of shared explained variance, the results suggest that the strategies function best as a coordinated package.

Theoretical Implications

The results have two implications for theory. First, they extend human capital theory beyond its usual focus on students by showing that the development of teachers’ human capital is the strongest correlate of school quality in the study area. In this reading, the school is itself a site of human capital formation for adults as well as children, and investment in teachers is an investment with compounding returns because each teacher influences many cohorts of students. Second, the results are consistent with the revised interpretation of the education production function advanced by Hanushek (2003) and Glewwe and Muralidharan (2016), in which the productivity of inputs depends on how they are used. ICT integration, the most resource-intensive of the three strategies, had the smallest level of implementation and a small unique effect, while the largely school-managed practices of mentoring and supervision were associated with the largest effect. The finding cautions against equating spending with improvement and supports the view that sustainable gains come from changes in practice.

Relative Priority and Sustainability of the Strategies

Considering both implementation levels and effect sizes clarifies the sequencing of reform. Teacher professional development is already implemented to a high extent and carries the largest effect, so the priority is to protect and deepen it, particularly by converting it from occasional workshops into continuous, school-based learning that does not depend on external sponsorship. ICT integration has the greatest room for growth; because its effect is likely suppressed by unreliable power and connectivity, investment in solar energy and maintenance may unlock returns that are not yet visible in the data. Community–parental partnership is comparatively well established among parents and local leaders, and its next frontier lies in structured alumni and corporate engagement. Each of these strategies is sustainable in the sense used in this study: the capacities they build remain in the school, they can be financed locally or from recurrent budgets, and they align with SDG 4.

Implications and Recommendations

On the basis of the findings, the following recommendations are made. First, the Enugu State Ministry of Education and the PPSMB should institutionalise school-based professional learning, including structured mentoring, peer observation with feedback, and subject-based learning communities, and should budget for it as a recurrent rather than a project expense. Given that teacher professional development showed the largest effect, it should receive priority in resource allocation. Second, government and development partners should address the energy constraint on ICT integration by installing solar power systems in public secondary schools, combined with training in the pedagogical use of digital content. Hardware provision without energy and training is unlikely to produce sustainable improvements. Third, schools should formalise community partnership through written memoranda with PTAs, alumni associations, and School-Based Management Committees, and should actively cultivate corporate partners in Enugu’s commercial sector. Fourth, because the three strategies overlap in their effects, school development plans should coordinate them, for example by channelling PTA and alumni contributions to professional development and ICT infrastructure. Finally, class-

size pressures identified in the study should be addressed through targeted recruitment and the expansion of classroom space, since other strategies cannot be fully effective in overcrowded classrooms.

Limitations and Suggestions for Further Research

The study has limitations. First, the cross-sectional correlational design does not permit causal inference; the associations may partly reflect unmeasured school characteristics such as leadership quality or socioeconomic composition. Second, the standard of education was measured through teachers' ratings rather than through students' test scores, and self-report data may be subject to social desirability. Harman's test suggested that common method variance was not a serious threat, but it cannot rule it out entirely. Third, the study was confined to public secondary schools in Enugu Urban, and the findings may not generalise to rural or private schools. Fourth, although the sampling procedure accounted for clustering through a design effect, the regression did not explicitly model the nesting of teachers within schools. Future studies should use multilevel modelling, incorporate objective indicators such as WASSCE and NECO results, include students and principals as respondents, and adopt longitudinal or quasi-experimental designs to estimate the effects of the strategies over time.

Conclusion

This study examined sustainable strategies for raising the standard of education in public secondary schools in Enugu Urban. Teacher professional development and community–parental partnership were implemented to a high extent, whereas ICT integration was implemented to a low extent, largely because of weak energy and connectivity infrastructure. The standard of education was rated as moderate, with particular concern about external examination performance and class sizes. Together, the three strategies explained 37.3% of the variance in the standard of education. Teacher professional development had a medium unique effect, while ICT integration and community–parental partnership had small but significant unique effects. The results support human capital theory and the production function view that the effective use of inputs, especially investment in teachers, matters more than their mere provision. Raising the standard of education in Enugu Urban, and in Nigeria more broadly, will depend on treating these strategies as a coordinated and continuously renewed investment rather than as one-off interventions.

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