

**ADAPTED INSTRUCTIONAL MATERIALS AND ASSISTIVE LEARNING RESOURCES AS
PREDICTORS OF INCLUSIVE EDUCATION EFFECTIVENESS IN PUBLIC PRIMARY
SCHOOLS IN AKWA IBOM STATE, NIGERIA**

Ifeanyi, Charity Ifeoma
divinecomputers04@gmail.com
&
Ukoette, Uduak Udeme-Law
uduakukoette24@gmail.com

ABSTRACT

Inclusive education requires more than the placement of learners with special educational needs in ordinary classrooms; it requires instructional resources that make the curriculum accessible and participation feasible. This study examined adapted instructional materials and assistive learning resources as predictors of inclusive education effectiveness in public primary schools in Akwa Ibom State, Nigeria. The study was anchored on the Social Model of Disability and complemented by Universal Design for Learning. A quantitative cross-sectional correlational design was specified for a target population of 18,738 public-primary-school teachers reported in the 2022 Universal Basic Education Commission school digest. A sample of 392 was derived using Yamane's formula at a 5% margin of error, with multistage sampling specified across the state. The proposed instrument contained 18 Likert-type items measuring adapted instructional materials, assistive learning resources and inclusive education effectiveness. For this article-development draft, the numerical results are based on a research-calibrated synthetic benchmark dataset of 378 teacher cases and are therefore not presented as observed field findings. Benchmark reliability coefficients were .835, .873 and .833 respectively. Adapted instructional materials correlated positively with inclusive education effectiveness ($r = .397, p < .001$), while assistive learning resources showed a somewhat stronger relationship ($r = .447, p < .001$). The joint regression model was significant, $F(2, 375) = 65.90, p < .001, R^2 = .260$. Both adapted instructional materials ($\beta = .265, p < .001$) and assistive learning resources ($\beta = .347, p < .001$) made unique positive contributions. The model indicates that resource accessibility is a plausible and testable condition for effective inclusion, but the benchmark estimates must be replaced with observed field data before empirical submission.

Keywords: adapted instructional materials; assistive technology; inclusive education; special educational needs; primary schools

INTRODUCTION

Inclusive education has moved from being treated as a specialised educational option to being framed as a rights-based obligation to ensure that learners with disabilities and other special educational needs are present, participate and learn alongside their peers. Article 24 of the Convention on the Rights of Persons with Disabilities requires states to provide reasonable accommodation, appropriate modes of communication and the individualised support necessary for effective education within an inclusive system (United Nations, 2006). UNESCO (2020) similarly emphasises that inclusion depends on removing curricular, environmental and resource barriers rather than merely locating diverse learners in the same physical classroom. In Nigeria, the 2023 implementation guideline for the National Policy on Inclusive Education specifically calls for Braille materials, magnifiers, large-print texts, assistive devices and resources that enable teachers to make teaching more accessible (Federal Ministry of Education, 2023).

The resource question is especially important in primary education because access to basic literacy, numeracy and classroom participation is mediated through the forms in which information is presented and the tools available to learners. A conventional printed worksheet may be inaccessible to a pupil with visual impairment; oral-only instruction may exclude a learner with hearing impairment; a standard writing task may disadvantage a pupil whose motor or communication

condition requires an alternative response mode. Inclusive effectiveness therefore depends partly on whether teaching materials are adapted and whether assistive resources are available in forms that match learners' functional needs. These provisions are not peripheral additions. They are mechanisms through which the curriculum becomes usable.

Adapted instructional materials refer to conventional learning resources that have been modified or purposefully designed to improve accessibility for learners whose sensory, cognitive, communication or physical characteristics create difficulty with ordinary materials. Examples include large-print texts, Braille, tactile graphics, simplified worksheets, pictorial supports, captioned or signed media, colour-coded guides and teacher-made manipulatives. Research with mathematics-disabled primary-school pupils in Nigeria found that teacher-made instructional materials were perceived to improve interest, understanding, recall and participation (Igbo & Omeje, 2014). Earlier evidence from mainstreamed public schools in Southwestern Nigeria also linked the availability of appropriate facilities and learning materials with the performance of students with special educational needs (Fareo & Ojo, 2013).

Assistive learning resources constitute the second resource layer. They include low- and high-technology tools that increase learners' functional access to information, communication, mobility, writing, listening or classroom participation. Depending on need, these may include magnifiers, hearing aids, assistive listening devices, screen readers, text-to-speech or speech-to-text tools, Braille devices, alternative keyboards, augmentative and alternative communication tools and adapted switches. A systematic review of 31 empirical studies concluded that assistive technology generally increases accessibility and educational inclusion, although implementation is constrained by teacher preparation, information, cost and accessibility barriers (Fernández-Batanero et al., 2022). Nigerian studies likewise report a recurring gap between the nominal availability of assistive technologies and their consistent utilisation (Vincent et al., 2024; Dimiri & Sunday, 2025; Shaibu et al., 2025).

Universal Design for Learning adds an important pedagogical perspective to this problem. UDL treats learner variability as predictable and calls for flexible means of representation, engagement, and action or expression (Meyer et al., 2014). Technology can support these principles, but the literature cautions that tools do not automatically create inclusion; their value depends on intentional learning design and fit with learner needs (Bray et al., 2024). Recent systematic reviews show that UDL-supported interventions can improve learning outcomes, while also identifying uneven implementation and the need for stronger theoretical and design alignment (King-Sears et al., 2023; Zhang et al., 2024). Assistive technology and adapted materials are therefore most useful when they are embedded in a coherent accessibility strategy rather than treated as isolated equipment purchases.

The Nigerian policy environment recognises this requirement, yet implementation remains uneven. The Federal Ministry of Education (2023) directs states to provide inclusive instructional materials and assistive technologies and to support teachers in adapting their resources. The Universal Basic Education Commission also identifies procurement, distribution and teacher training in assistive technology as part of its special-needs education responsibilities (UBEC, 2022). Nevertheless, studies across Nigerian settings continue to identify insufficient learning materials, weak infrastructure, limited specialist resources and constrained teacher capacity as barriers to inclusion. Olayi et al. (2019), in a study covering Akwa Ibom and Cross River States, reported resource and implementation difficulties affecting inclusive school practices. More recent work in Akwa Ibom similarly points to the importance of instructional strategies, digital resources and material conditions for supporting learners with disabilities (Imafidon & Odigwe, 2025; Idiong & Idiong, 2025).

A notable research gap remains. Many Nigerian studies document the availability, use or perceived value of particular instructional or assistive resources, often in special schools, secondary settings or tertiary institutions. Far fewer studies estimate the separate and joint predictive contribution of adapted instructional materials and assistive learning resources to the broader effectiveness of inclusion in ordinary public primary schools. Availability is also frequently treated as an endpoint rather than linked statistically to participation, belonging and responsive learning support. This gap

matters because policy can provide equipment without knowing which resource domains are most strongly associated with effective classroom inclusion.

This study therefore examines adapted instructional materials and assistive learning resources as predictors of inclusive education effectiveness in public primary schools in Akwa Ibom State. It addresses three objectives: to determine the relationship between adapted instructional materials and inclusive education effectiveness; to determine the relationship between assistive learning resources and inclusive education effectiveness; and to estimate their joint and relative contributions to inclusive education effectiveness. The corresponding null hypotheses state that adapted instructional materials do not significantly predict inclusive education effectiveness; assistive learning resources do not significantly predict inclusive education effectiveness; and the two resource variables do not jointly make a significant contribution to inclusive education effectiveness. The study contributes a resource-centred model that links policy commitments to measurable classroom conditions and provides a basis for prioritising material investment in inclusive basic education.

Literature Review

Conceptual Review

Adapted Instructional Materials

Adapted instructional materials are curriculum resources whose format, complexity, sensory channel or mode of response has been modified so that learners who experience barriers with conventional materials can access the same instructional purpose. Adaptation may involve enlarging print, converting text to Braille, adding tactile or pictorial representations, simplifying linguistic complexity without removing the instructional objective, captioning audiovisual content, using sign-supported media, developing concrete manipulatives or restructuring worksheets to reduce visual and cognitive load. The defining feature is not that the material is unusual, but that it removes a mismatch between the standard material and a learner's access needs.

In inclusive primary classrooms, adapted materials can operate at three levels. First, representation adaptations change how information is presented: large print, Braille, tactile graphics, high-contrast images and captioned multimedia. Second, processing supports make tasks more comprehensible through pictorial cues, simplified instructions, sequencing aids, manipulatives and structured graphic organisers. Third, response adaptations permit learners to demonstrate learning through alternative forms such as matching, pointing, oral response, manipulatives or assistive writing tools. These categories align with UDL principles because they expand options without lowering the intended learning goal (Meyer et al., 2014).

Nigerian evidence supports the practical relevance of such materials. Igbo and Omeje (2014) reported that mathematics-disabled pupils perceived teacher-made materials as supporting interest, recall and learning. Muhammad et al. (2021) found that instructional-material availability remained a concern for children with hearing impairment in an inclusive school in Bauchi State. Fareo and Ojo (2013) also showed that essential facilities and materials were frequently unavailable or in poor condition in mainstreamed schools, and that facility availability was related to academic performance. These studies suggest that adaptation is both a pedagogical and an equity issue: a curriculum cannot be inclusive when its principal materials remain inaccessible to some of the learners expected to use them.

Assistive Learning Resources

Assistive learning resources are devices, software, equipment or specialised tools used to increase, maintain or improve a learner's functional capacity to participate in education. They range from low-technology resources such as magnifiers, pencil grips, communication boards and adapted rulers to high-technology resources such as screen readers, text-to-speech systems, speech-recognition software, digital Braille displays and assistive listening systems. Their educational value lies in bridging a functional gap between the learner and an instructional task.

Assistive technology should be distinguished from general educational technology. A tablet used by an entire class is a general digital resource, but the same device running a screen reader or augmentative communication application can become assistive when configured to address a learner-specific barrier. This distinction matters because the mere presence of technology in a school does not demonstrate assistive provision. Effective availability requires fit, accessibility, usability, maintenance and teacher competence. Fernández-Batanero et al. (2022) found that assistive technologies generally support inclusion, but barriers related to training, access and information remain persistent.

Nigerian empirical work illustrates the implementation gap. Vincent et al. (2024) found that assistive technologies were present in technical colleges in Ondo State but underutilised. Dimiri and Sunday (2025) reported primary-school teachers' perceptions of limited availability and utilisation of assistive technology for pupils with learning disabilities in Lagos State. Shaibu et al. (2025), studying students with albinism in a Nigerian university, found useful access to some tools but important shortages in specialised devices such as Braille displays and tactile graphics. These patterns imply that inclusive effectiveness depends not merely on nominal procurement but on a usable ecology of devices, maintenance, teacher knowledge and learner access.

Inclusive Education Effectiveness

Inclusive education effectiveness refers to the extent to which educational arrangements enable diverse learners to gain meaningful access, participate, belong and receive responsive instructional support in ordinary learning environments. It is broader than enrolment. A learner may be physically present but remain excluded from lesson content, classroom interaction, assessment or peer participation. UNESCO (2020) therefore treats inclusion as a process of identifying and removing barriers to participation and learning.

For this study, inclusive education effectiveness is represented through three domains: access and participation, belonging and engagement, and responsive learning support. Access and participation concern whether learners can use materials, follow lessons and participate in classroom tasks. Belonging and engagement concern meaningful involvement with peers and classroom activities. Responsive learning support concerns the extent to which instruction and resources are adjusted to learner needs. These dimensions permit teacher respondents to rate implementation conditions without claiming direct measurement of long-term academic attainment.

Relationships among the Constructs

Adapted instructional materials should be associated with inclusive effectiveness because they reduce curriculum-access barriers at the point of instruction. When texts, illustrations, worksheets and demonstrations are available in forms that learners can perceive and process, learners are more likely to participate, complete tasks and remain engaged. Adaptation also gives teachers practical means to differentiate instruction rather than relying on verbal intention alone.

Assistive learning resources should contribute to inclusive effectiveness through a complementary mechanism. Whereas adapted materials change the instructional object, assistive resources increase the learner's capacity to access, manipulate or communicate with that object. A magnifier may make a printed task readable; a hearing system may improve access to oral instruction; a screen reader may convert digital text to speech; and an augmentative communication tool may allow a pupil to contribute to classroom interaction. The two predictor domains are therefore related but not interchangeable, making their simultaneous analysis theoretically meaningful.

Theoretical Review: Social Model of Disability and Universal Design for Learning

The principal theoretical lens is the Social Model of Disability, associated prominently with Oliver (1990). The model distinguishes individual impairment from disability produced by social and environmental arrangements. From this perspective, exclusion does not arise solely because a learner has a visual, hearing, physical, cognitive or communication difference; it also arises when schools organise curriculum, materials, spaces and communication in ways that assume a narrow

range of learner capacities. A printed-only curriculum can therefore create disability for a learner who requires Braille or large print, just as oral-only instruction can create a participation barrier for a learner who requires visual or signed access.

Applied to this study, adapted instructional materials and assistive learning resources are barrier-reduction mechanisms. Adapted materials alter the environment by changing the form of curriculum access, while assistive resources modify the learner-environment interface. The theory therefore predicts that schools with greater resource accessibility should report stronger inclusive participation and responsiveness. Its main strength is that it relocates attention from perceived deficits in the learner to correctable features of the educational environment. A limitation is that the model is broad and does not by itself specify how instruction should be designed across diverse learning profiles.

Universal Design for Learning provides that complementary instructional framework. UDL assumes learner variability and recommends multiple means of engagement, representation, and action or expression (Meyer et al., 2014). Systematic evidence suggests that UDL-oriented instructional designs can support learning, although implementation quality varies and technology alone does not guarantee effectiveness (Bray et al., 2024; King-Sears et al., 2023; Zhang et al., 2024). In the present model, the Social Model explains why inaccessible environments create exclusion, while UDL explains how flexible materials and technologies can be intentionally designed to reduce those barriers. Together, they provide a coherent basis for expecting both predictor variables to contribute to inclusive education effectiveness.

Empirical Review

Fareo and Ojo (2013) examined facilities and academic performance of students with special needs in mainstreamed public schools in Southwestern Nigeria. Their study found that essential resources such as hearing aids, Braille materials and instructional materials were often unavailable or poorly maintained, while the availability of facilities was significantly related to academic performance. The study established the material basis of inclusion but focused mainly on facilities and achievement rather than the joint contribution of adapted materials and assistive learning resources to broader inclusive effectiveness.

Igbo and Omeje (2014) investigated teacher-made instructional materials among 155 mathematics-disabled primary-five pupils. Using questionnaire data analysed with mean, standard deviation and t-test, they reported that learners preferred visual aids and perceived improvements in recall, understanding and learning speed when teacher-made materials were used. The study is important because it demonstrates the value of adapted, locally generated materials, but it did not examine assistive technologies or school-level inclusive effectiveness.

Olayi et al. (2019) studied challenges militating against effective inclusive school practices in public primary schools in Akwa Ibom and Cross River States. Their findings identified practical constraints affecting implementation, reinforcing the argument that policy commitment does not automatically translate into functioning inclusion. The study provides direct regional relevance, but it did not estimate the independent predictive role of specific resource domains.

Muhammad et al. (2021) assessed the availability of instructional materials for children with hearing impairment in an inclusive primary/secondary school in Bauchi State. Using a survey approach, the authors documented limitations in material availability. The study offers evidence that instructional resources remain a basic implementation constraint, although its single-school focus and descriptive analysis limit generalisation.

Fernández-Batanero et al. (2022) systematically reviewed 31 empirical studies on assistive technology and inclusion. The review concluded that assistive technologies generally improve accessibility and participation, while persistent barriers include inadequate teacher education, limited information and restricted access. Because the review synthesised multiple countries and educational levels, it supports the general mechanism but does not resolve how the relationship operates in Nigerian public primary schools.

Vincent et al. (2024) surveyed 104 participants in technical colleges in Ondo State and reported that assistive technologies were available but used to a limited extent. The authors recommended expanded classroom and laboratory access together with adequate human resources. The study highlights the difference between availability and meaningful use, but its technical-college setting differs from basic education.

Dimiri and Sunday (2025) investigated primary-school teachers' perceptions of the availability and utilisation of assistive technology for pupils with learning disabilities in Eti-Osa, Lagos State. Their work directly concerns primary education and reinforces the need to assess not merely whether tools exist but whether teachers perceive them as sufficiently accessible for learning. However, the study did not model inclusive education effectiveness as an outcome.

Shaibu et al. (2025) examined availability and utilisation of assistive technologies for students with albinism at Federal University Oye-Ekiti. Screen readers, magnification and speech-recognition resources were reported as useful, while gaps remained in specialised tools such as tactile graphics and Braille displays. The tertiary context limits direct transfer, but the study demonstrates that resource portfolios are uneven and that different tools serve different access needs.

Imafidon and Odigwe (2025) examined classroom management strategies for autistic pupils in inclusive primary schools in Akwa Ibom State, while Idiong and Idiong (2025) explored teachers' knowledge and use of artificial intelligence in deaf education in the state. Both studies illustrate increasing local attention to inclusive practice and technology. At the same time, neither provides a joint predictive model of adapted instructional materials, assistive learning resources and overall inclusive education effectiveness.

Mukhwana et al. (2026) synthesised 23 empirical studies on assistive technology within a UDL framework and concluded that the integration of assistive technology with inclusive pedagogical design can improve individualised learning opportunities, participation, autonomy and attainment. The review also stressed the importance of provision, teacher development and collaborative planning. Its findings strengthen the theoretical expectation that material resources should be analysed as part of an instructional system rather than as stand-alone devices.

Synthesis and Research Gap

The literature converges on four points. First, inaccessible instructional materials can constitute a direct barrier to participation. Second, assistive technologies can improve access, communication and learning when they are appropriate and usable. Third, Nigerian schools continue to experience deficits in availability, utilisation, maintenance and teacher capacity. Fourth, resource provision is most effective when embedded in intentional inclusive pedagogy. What remains insufficiently tested is the separate and joint statistical contribution of adapted instructional materials and assistive learning resources to teacher-rated inclusive education effectiveness in public primary schools in Akwa Ibom State. The present study addresses this gap by modelling both predictor domains simultaneously and defining effectiveness in terms of access, participation, belonging and responsive learning support.

Conceptual Framework

The framework proposes that adapted instructional materials and assistive learning resources independently and jointly predict inclusive education effectiveness. The model treats the two resource domains as complementary: one modifies instructional content and presentation, while the other modifies the learner-resource interface.

ADAPTED INSTRUCTIONAL MATERIALS Large print/Braille Tactile/visual supports	+	ASSISTIVE LEARNING RESOURCES Magnification/screen reading Hearing/listening supports	PREDICT	INCLUSIVE EDUCATION EFFECTIVENESS Access and participation Belonging and engagement
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Simplified/structured materials		Communication/adaptive tools		Responsive learning support
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Figure 1. Conceptual framework of the study.

Source: Researchers' conceptualisation based on Oliver (1990), Meyer et al. (2014), Federal Ministry of Education (2023), and Fernández-Batanero et al. (2022).

Methodology

Research Design and Study Context

The study specifies a quantitative, cross-sectional correlational survey design. The design is appropriate because the research questions concern the strength and direction of relationships among resource variables and inclusive education effectiveness at one period rather than experimental manipulation. The study context is public primary education in Akwa Ibom State, Nigeria. The use of the term predictor is statistical rather than causal: the design can estimate association and unique explanatory contribution, but it cannot establish that resource availability alone causes inclusive effectiveness.

The theoretical logic is deductive. The Social Model of Disability predicts that environmental accessibility should be associated with stronger inclusion, while UDL provides an instructional rationale for flexible materials and support technologies. The empirical model therefore estimates whether schools perceived as having more accessible materials and assistive resources also receive higher teacher ratings of inclusive effectiveness.

Population, Sample Size and Sampling Technique

The target population is teachers in public primary schools in Akwa Ibom State. The 2022 Digest of Public Schools published by the Universal Basic Education Commission reports 18,738 public-primary-school teachers in the state, comprising 7,320 males and 11,418 females (UBEC, 2022). Using Yamane's (1967) finite-population formula at a 5% margin of error, the minimum sample is approximately 392:

$$n = N / [1 + N(e^2)] = 18,738 / [1 + 18,738(0.05^2)] = 391.64 \approx 392$$

A multistage sampling procedure is specified. The three senatorial districts form geographic strata; local government areas and public primary schools are then selected within strata, followed by proportionate selection of teachers. For the analytical benchmark used in this draft, 378 usable teacher cases are modelled, equivalent to a 96.4% usable-response rate if 392 questionnaires were administered. These 378 cases are synthetic and exist only to demonstrate the complete PROFILICANT statistical workflow pending field data collection.

Instrument and Measurement

The proposed instrument is the Adapted Materials, Assistive Learning Resources and Inclusive Education Effectiveness Questionnaire (AMALRIEEQ). Section A collects limited teacher and school background information. Sections B-D contain 18 items measured on a five-point scale from 1 (strongly disagree/very unavailable) to 5 (strongly agree/very available), depending on item wording. Six items measure adapted instructional materials, six measure assistive learning resources, and six measure inclusive education effectiveness. Higher composite scores indicate greater resource accessibility or greater inclusive effectiveness.

Variable	Operational dimensions	Items	Scale / interpretation	Primary basis
Adapted instructional materials	Accessible representation; structured/simplified supports; alternative response materials	6	5-point Likert; higher = greater accessibility/adaptation	Meyer et al. (2014); Igbo & Omeje (2014)

Variable	Operational dimensions	Items	Scale / interpretation	Primary basis
Assistive learning resources	Visual access; auditory access; communication/adaptive technology	6	5-point Likert; higher = greater assistive-resource availability	Fernández-Batanero et al. (2022); Federal Ministry of Education (2023)
Inclusive education effectiveness	Access/participation; belonging/engagement; responsive learning support	6	5-point Likert; higher = stronger teacher-rated inclusion	UNESCO (2020); United Nations (2006)

Validity, Reliability and Benchmark Data Status

For field implementation, content validity should be established by specialists in special/inclusive education, educational measurement and educational technology, with item revision documented before administration. Construct validity can be strengthened by examining item structure after pilot or field collection. Reliability should be estimated separately for each multi-item construct rather than reported as one coefficient for unrelated items.

Because observed field responses were not supplied for this article-development exercise, the present draft uses a research-calibrated synthetic dataset solely to test the statistical architecture. Benchmark Cronbach alpha coefficients are 0.835 for adapted instructional materials, 0.873 for assistive learning resources and 0.833 for inclusive education effectiveness. These values demonstrate internal coherence of the synthetic item structure; they are not substitutes for pilot or field reliability estimates.

Method of Data Analysis and Model Specification

Analysis is specified in four stages. First, frequencies and percentages describe selected respondent characteristics. Second, means, standard deviations and Cronbach alpha summarise the constructs and benchmark scale consistency. Third, Pearson product-moment correlations estimate bivariate relationships. Fourth, multiple linear regression estimates the unique and joint contributions of adapted instructional materials and assistive learning resources to inclusive education effectiveness. Statistical significance is evaluated at $\alpha = .05$, while confidence intervals and standardised coefficients are reported to support interpretation of effect magnitude.

$$IEE = \beta_0 + \beta_1(AIM) + \beta_2(ALR) + \varepsilon$$

where IEE is inclusive education effectiveness, AIM is adapted instructional materials, ALR is assistive learning resources, β_0 is the intercept, β_1 and β_2 are regression coefficients, and ε is the residual term. Diagnostics include variance inflation factors for multicollinearity, Durbin-Watson for residual independence, Breusch-Pagan testing for heteroscedasticity, and Shapiro-Wilk assessment of residual normality. The null hypotheses are rejected when $p < .05$.

Results, Analysis and Discussion

The results in this section are analytical benchmark outputs generated from the synthetic dataset described in Methodology. They demonstrate the intended reporting logic and must be recalculated from observed field data before the paper can be treated as a completed empirical study.

Response Profile and Descriptive Results

Characteristic	Category	n	%
Gender	Female	264	69.8
	Male	114	30.2
School location	Urban	173	45.8

Characteristic	Category	n	%
	Rural	205	54.2
Inclusive-education training	Yes	146	38.6
	No	232	61.4
Assistive-technology training	Yes	91	24.1
	No	287	75.9

The benchmark profile contains 378 teacher cases. Women constitute 69.8% of the modelled sample and rural-school teachers 54.2%. Only 38.6% report prior inclusive-education training, while 24.1% report specific assistive-technology training. The profile is intentionally plausible rather than evidentiary; its purpose is to expose how response characteristics and resource-training gaps would be reported if similar patterns emerged in field data.

Construct	Items	Mean	SD	Cronbach alpha
Adapted instructional materials	6	2.767	0.881	0.835
Assistive learning resources	6	2.555	0.912	0.873
Inclusive education effectiveness	6	3.062	0.886	0.833

On the five-point scale, adapted instructional materials have a benchmark mean of 2.767 (SD = 0.881), while assistive learning resources have the lower mean of 2.555 (SD = 0.912). Inclusive education effectiveness averages 3.062 (SD = 0.886). The pattern represents a context in which some adaptation is occurring but specialised assistive resources are less readily available. All benchmark reliability coefficients exceed .80, supporting use of composite scores within the synthetic analysis.

Bivariate Relationships

Variable	1	2	3
1. Adapted instructional materials	1.000		
2. Assistive learning resources	0.379	1.000	
3. Inclusive education effectiveness	0.397	0.447	1.000

Adapted instructional materials are positively associated with inclusive education effectiveness ($r = 0.397$, $p < .001$). Assistive learning resources show a somewhat stronger positive relationship with inclusive education effectiveness ($r = 0.447$, $p < .001$). The predictors themselves correlate at $r = 0.379$, indicating related but distinct resource domains. The coefficients support proceeding to multiple regression because the predictors share variance without approaching a level suggestive of problematic redundancy.

4.3 Multiple Regression and Hypothesis Tests

Predictor	B	SE B	Beta	t	p	95% CI for B
Constant	1.464	0.147	-	9.978	< .001	[1.175, 1.752]
Adapted instructional materials	0.267	0.048	0.265	5.526	< .001	[0.172, 0.362]
Assistive learning resources	0.337	0.047	0.347	7.219	< .001	[0.245, 0.428]

The benchmark regression model is statistically significant, $F(2, 375) = 65.90$, $p < .001$, $R^2 = 0.260$, adjusted $R^2 = 0.256$. The two resource variables jointly account for approximately 26.0% of the variance in inclusive education effectiveness. Adapted instructional materials make a significant positive unique contribution ($B = 0.267$, $\beta = 0.265$, $t = 5.526$, $p < .001$), while assistive learning resources make the larger standardised contribution ($B = 0.337$, $\beta = 0.347$, $t = 7.219$, $p < .001$). Accordingly, the analytical benchmark rejects H01, H02 and H03. In substantive terms, the model predicts stronger inclusive effectiveness where teachers perceive greater access to adapted learning materials and assistive resources. The estimates are not field findings; they indicate the magnitude and reporting pattern that the field study is designed to test.

Regression Diagnostics

Diagnostic	Result	Interpretation
Predictor VIF	1.17 and 1.17	No material multicollinearity
Durbin-Watson	1.97	Residual independence acceptable
Breusch-Pagan	$p = 0.792$	No evidence of heteroscedasticity
Shapiro-Wilk residual test	$p = 0.840$	Residual normality not rejected

The diagnostic results show no major statistical inconsistency in the benchmark model. Variance inflation factors are close to 1, residual independence is acceptable, the Breusch-Pagan test does not indicate heteroscedasticity, and residual normality is not rejected. These diagnostics demonstrate the checks that should be repeated with the observed dataset rather than assumed in advance.

Discussion of Findings

The first benchmark relationship indicates that adapted instructional materials are positively associated with inclusive education effectiveness. This pattern is theoretically consistent with the Social Model of Disability because it treats inaccessible materials as an environmental barrier rather than an inevitable consequence of impairment. It is also consistent with UDL, which requires multiple means of representation and response. Nigerian evidence provides a plausible empirical basis for this expectation: Igbo and Omeje (2014) associated teacher-made materials with improved learning experiences among mathematics-disabled pupils, while Fareo and Ojo (2013) linked the availability of appropriate facilities and materials with academic performance among learners with special needs. If the relationship is reproduced in field data, it would support investment not only in commercially produced specialist materials but also in systematic teacher capacity for adaptation and local production.

The second benchmark finding shows a positive relationship between assistive learning resources and inclusive education effectiveness, with a larger standardised coefficient than adapted materials in the joint model. This is consistent with the systematic review by Fernández-Batanero et al. (2022), which found assistive technology generally supportive of inclusion and accessibility. It also aligns with Nigerian studies showing that learners benefit where relevant technologies are available, even though utilisation remains inconsistent (Vincent et al., 2024; Shaibu et al., 2025). In policy terms, the pattern reinforces the Federal Ministry of Education's (2023) emphasis on Braille resources, magnifiers, large print and assistive devices. The key implication is that assistive resources should be treated as functional classroom infrastructure rather than occasional specialist equipment.

The joint model suggests that adapted materials and assistive learning resources explain overlapping but distinct aspects of inclusive effectiveness. Their moderate intercorrelation indicates that a school with stronger accessibility practices may tend to perform better on both domains, yet each retains a unique contribution after controlling for the other. This is conceptually important. Adapted materials change the form of instruction, while assistive resources change the means by which a learner accesses or responds to instruction. Effective inclusive education may therefore require both universal or teacher-led adaptations and individualised technologies.

The benchmark also illustrates the limits of a resource-only model. An R^2 of .260 leaves most variation in inclusive effectiveness unexplained. This is expected because inclusion is influenced by teacher attitudes, instructional commitment, specialist support, class size, leadership, peer climate, family engagement, training and broader infrastructure. The present article therefore complements rather than replaces teacher-centred explanations. Resource provision can remove barriers, but equipment without teacher competence or intentional pedagogy may remain underused - a concern repeatedly raised in the international and Nigerian literature (Bray et al., 2024; Dimiri & Sunday, 2025; Mukhwana et al., 2026).

CONCLUSION AND RECOMMENDATIONS

Conclusion

The study develops and tests, through a transparent analytical benchmark, a two-resource model of inclusive education effectiveness in public primary schools in Akwa Ibom State. The model proposes that adapted instructional materials and assistive learning resources are distinct but complementary conditions for meaningful inclusion. The benchmark analysis produces positive unique effects for both variables and a statistically coherent joint model. The central conclusion is therefore theoretical and provisional: a school is more likely to achieve effective inclusion when the curriculum is available in accessible formats and when learners have the assistive tools needed to interact with that curriculum. Empirical confirmation requires replacement of the synthetic benchmark with observed teacher and school data.

Recommendations

1. Akwa Ibom State Universal Basic Education Board should conduct a school-by-school accessibility audit covering large-print materials, Braille/tactile resources, visual and captioned materials, hearing-support devices, magnification tools, screen-reading access and alternative communication resources.
2. Resource procurement should be tied to identified learner needs and classroom use plans rather than distributed as undifferentiated equipment. Each device should have an assigned user group, trained staff, maintenance responsibility and utilisation record.
3. Public-primary-school teachers should receive practical training in adapting ordinary instructional materials - including worksheets, displays, assessment tasks and digital content - so that inclusion does not depend exclusively on expensive specialist products.
4. Assistive-technology training should accompany procurement. Teachers need repeated hands-on practice in setting up, integrating and troubleshooting devices within normal lessons.
5. AK-SUBEB should establish resource-sharing and maintenance mechanisms at local-government or cluster level for higher-cost technologies that cannot be placed immediately in every school.

6. Subsequent field evaluation should monitor not only availability but actual learner access, frequency of use, participation outcomes and teacher confidence so that investment decisions are driven by functional impact.

Implications

Theoretically, the study integrates the Social Model of Disability with UDL by treating materials and technologies as modifiable environmental conditions through which inclusion can be enabled or constrained. Practically, it distinguishes two resource levers that education managers can assess separately. Policy-wise, it translates broad inclusive-education commitments into observable school-level resource categories that can be monitored, budgeted and linked to implementation outcomes.

Limitations and Further Research

The current version is an article-development benchmark rather than a completed field study because observed responses have not yet been collected. The cross-sectional teacher-report design also cannot establish causality and may be influenced by common-method perceptions. Field implementation should incorporate school-level verification of resources, possible learner or head-teacher perspectives, and where feasible direct observation. Future work may test whether teacher training or instructional commitment moderates the effect of resource availability, whether school location creates differential access, and whether resource availability predicts learner-level participation or achievement outcomes.

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