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Assistive Technology Deficit and Pedagogical Stagnation: A Tam-Samr Analysis of EdTech Integration for Inclusive Education in Private Primary Schools in Abuja

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Abstract. The enormous potential of Educational Technology (EdTech) for promoting inclusive education often remains unrealized in resource-restricted environments, where the systemic factors limit both the adoption and innovative utilisation of technology in educational settings. This study identifies system-level barriers to the adoption of EdTech tools for inclusive education in private primary schools in Abuja, Nigeria. In contrast to the availability-focused evaluations, the research adopts the Technology Acceptance Model (TAM) and SAMR (Substitution, Augmentation, Modification, Redefinition) model to assess not only the availability but also the incorporation of EdTech into pedagogical processes. For data collection, a cross-sectional survey was conducted among 697 participants (497 pupils, 176 teachers, and 24 school administrators) in 24 private primary schools selected in three wards of the Abuja Municipal Area Council on purpose, with respect to three key inclusion criteria (at least five years of existence, the presence of some kind of technology infrastructure, such as computers or projectors, and proprietor permission to participate in the research). Data collection was done using three questionnaires (for pupils, teachers, and administrators), with questions organised into six sections, which include evaluation of the availability of technologies, teachers' skills, pedagogical use of technologies (SAMR-related questions), and TAM constructs (Perceived Usefulness and Perceived Ease of Use). The content validity of the questionnaires was ensured through expert review, while reliability was estimated with the help of Cronbach's alpha (with values ranging from 0.76 to 0.84 for subscales). Findings have shown a twofold gap: a relatively high level of adoption of general-purpose EdTech tools, as evidenced by the use of interactive whiteboards in roughly 66% of schools, and a critical shortage of assistive technologies, as evidenced by the total lack of speech-to-text tool usage by students. Pedagogically, the use of EdTech tools was primarily at the level of Substitution and Augmentation of SAMR model, with 68.6% of teachers used EdTech for individualized instruction. This study identifies two significant obstacles to inclusive education: a continuing gap between the availability of assistive technologies and the superficial incorporation of EdTech into pedagogical practice. The report proposes a mandatory inclusive EdTech framework that incorporates competency-based transformative teacher training, ring-fenced financing for assistive technologies, and required technical support to address this issue.

Keywords: Educational Technology, Inclusive Education, Assistive Technology, Technology Integration, TAM, SAMR.

1. Introduction

The globalization of Educational Technologies is accompanied by an inspiring narrative of change, where technology is seen as a powerful equalizer that will ensure democratization of access and individualization of learning for everyone, including people with disabilities (UNESCO, 2021; World Bank, 2023). Assistive Technologies, understood as the part of Educational Technologies responsible for the removal of barriers to participation for people with disabilities, is the embodiment of such promise and represents the core principle of the social model of disability, stating that disability results from the barriers created by the environment and not due to any deficits of the person (Oliver, 2013). Nonetheless,

scholars emphasize the context-dependent nature of the transformative power of technology (Selwyn, 2022; Howard et al., 2021).

Nigeria presents an interesting case, as although it provides its citizens with several progressive instruments, such as the National Policy on ICT in Education (2020) and the Discrimination Against Persons with Disabilities Act (2018), the reality of education proves to be more challenging than the promises made by the country. The consistent finding in various studies is the predominance of chalk-and-talk teaching practices in Nigerian primary and secondary education with a minor role of technology (Oyelere et al., 2020; Akinsolu & Ogunjemilua, 2024). Furthermore, the current body of literature is mostly concentrated on public schools and the tertiary education sphere with a limited focus on private primary schools in urban areas of Nigeria (Alade, 2023). However, it should be noted that private primary schools make up a significant share of Nigeria's urban student population and function according to different requirements.

In order to fill in the identified gap in literature, the present study aims to look into the use of Educational Technologies for inclusive education in private primary schools in Abuja. Preliminary surveys carried out among the management staff of 24 schools show that nearly two-thirds of the sampled schools have interactive whiteboards, while the use of specific assistive technologies (speech-to-text software, adaptive learning software, and assistive technology devices) was used by fewer than 10% of schools, with the pupils' use of speech-to-text software being almost non-existent at 0%.

In this study, an integrative theoretical framework is proposed that will combine the Technology Acceptance Model by Davis (1989) and the SAMR model (Puentedura, 2006) to go beyond descriptive constraints and highlight the dynamics involved. The Technology Acceptance Model based on constructs of Perceived Usefulness and Perceived Ease of Use provides the explanation about adoption process by highlighting the reason why certain technologies are adopted while others are not especially in situations where there are external factors like funding shaping perception (Venkatesh & Bala, 2008; Scherer et al., 2019). The SAMR model which revolves around four hierarchical stages of Substitution, Augmentation, Modification, and Redefinition measures the depth of integration of pedagogy. That is, it distinguishes between the use of technology to digitize traditional activities from the use of technology that transform the way learning takes place (Hamilton et al., 2016). Thus, these two models combined provide a diagnostic perspective for looking at both the availability gap (what is available) and the integration gap (how it is used). As a result, a coherent framework is formed to explain why Educational Technology is not being used to provide inclusive education.

The study is founded on the above-mentioned integrative theoretical framework of the Technology Acceptance Model and SAMR model. While one explains the antecedent of adoption, the other one sheds light on the pedagogical implications of integration. Thus, they form a powerful diagnostic tool for the analysis of system-level Educational Technology implementation in the context of inclusive education.

Created by Davis in 1989, the Technology Acceptance Model states that the user's behavioral intention to use a certain technology is influenced mostly by two perceptions: Perceived Usefulness, meaning the degree of belief in the fact that technology will help one perform better at work, and Perceived Ease of Use, meaning the degree of belief in the fact that the technology will not require much effort to be used. These perceptions lead to attitudes, which determine behavior. The Technology Acceptance Model has been widely applied in the field of education to research teachers' adoption of digital technologies (Scherer et al., 2019). The reason why this model fits perfectly for our current study is its ability to account for external variables like resources availability, infrastructure, and training, which were further considered by Venkatesh and Bala in their extended model (2008). In resource-scarce conditions, like those in private schools of Abuja, decisions regarding the purchase and implementation of technologies are probably guided by perceptions of relative usefulness (for example, interactive whiteboards for the benefit of most pupils) and ease of use (assistive technologies are perceived as complex without proper training). Therefore, the Technology Acceptance Model can be used to explain the great differences in technology availability that have been noticed in preliminary data.

The SAMR model created by Puentedura in 2006 includes four levels of technology integration in an ascending order of complexity. The first level, Substitution, includes technology acting as a direct replacement without changing functionality (using a word processor instead of writing a text with a pencil). The second level, Augmentation, is characterized by substitution and enhanced functionality (a word processor with tools for spell checking and collaborative work). The third level, Modification, allows task redesigning (students co-authoring a

multimedia presentation receiving comments from peers). The fourth level, Redefinition, allows creating tasks which could not exist before (collaborative work of students on a global project together with international peers). The importance of this model is the possibility to identify cases when technology use only improves traditional instructional approach (substitution and augmentation) and when it changes the whole process of teaching (modification and redefinition). In the case of inclusive education, transformation is crucial since the technology should do not only digitize existing exclusionary processes but also provide innovative ways of collaboration, interaction, and personalization (Chambers & Rao, 2019). Therefore, SAMR model will help us to analyze whether Educational Technology integration in Abuja's private schools leads to transformation or not.

The current research uses an innovative integrative approach using both TAM and SAMR models. TAM highlights the availability gap using the mediating variables of perceived usefulness and perceived ease of use, which are influenced by systemic factors such as funding to explain differences in the use of different technology types like interactive whiteboards and assistive technologies. On the other hand, SAMR model explains the integration gap by providing a level of analysis of pedagogic use of technology that distinguishes between superficial and transformational use. Taken together, these two models help in conducting a systemic analysis because they not only identify the lack of something in terms of availability, but also why there is such a gap through perceptions influenced by systemic constraints and how the currently available technology is used in terms of its pedagogic levels.

1.1 Statement of the Problem

The potential of Educational Technology (EdTech) for promoting inclusive education has not been exploited in many resource-limited areas where sub-Saharan Africa serves as an example. Even though international guidelines highlight technology as the "great equalizer" and advocate the use of technology as the means of democratizing and personalizing education for all students including students with special needs, the reality of implementation of educational policies is quite different. For example, Nigeria, which boasts of advanced policy instruments such as the National Policy on ICT in Education and the Discrimination Against Persons with Disabilities Act, often experiences mismatch between policy objectives and practice of implementation.

The problem is particularly apparent within the sector of private primary schools in urban areas where little research has been done despite the enrollment of a considerable number of pupils in these institutions. Most studies devoted to technological advancement of educational process focus on public schools or higher education institutions and leave many questions unanswered as to how the private primary schools, operating within different economic and legislative environment, utilize technology for fostering inclusive education. It is particularly relevant in light of the fact that urban private primary schools in places like Abuja cater to a heterogeneous population of pupils that includes children with disabilities who need pedagogical adjustments.

According to preliminary surveys, 24 private primary schools in Abuja demonstrate alarming picture with regards to technology usage. More than 65% of the surveyed schools use interactive whiteboards; however, the use of assistive technologies remains negligible. The speech-to-text programs are used by 0% of the pupils, while the adaptive learning programs and assistive devices for pupils are implemented in fewer than 10% of the schools. This is despite the fact that more than 14% of pupils of these schools have identified disabilities and require pedagogical adjustments, which corresponds to global figures for students with disabilities enrolled in schools.

Not only is there an availability gap in terms of technology implementation, but also a pedagogical one. Even if technology is available, the way it is used proves to be shallow, as it merely serves the purposes of replacing old teaching practices with new technological ones. Individualized instruction appears to be the main reason why technology is being used, while collaborative learning activities are rarely implemented. It is evident that technology implementation occurs at substitution and augmentation stages but does not evolve into modification and redefinition.

In this study, we explore the systemic barriers to the uptake of Educational Technology for inclusive education in private primary schools in Abuja. It is important to note that the problem is exacerbated by the lack of sufficient funds, infrastructure, technology malfunctions, and teacher professional development, especially when it comes to assistive technologies. In particular, most teachers reported that they cannot evaluate their competence in using these technologies as these technologies were not present in their schools. Thus, this creates a vicious circle whereby technologies are not acquired due to perceived lack of relative usefulness and complexity of these

technologies; and, as a consequence, teachers cannot gain competence in using these technologies, which reinforces perceptions of limited usefulness and perpetuates exclusion.

In view of this, the goal of this study is to investigate the systemic barriers to the uptake of Educational Technology for inclusive education in private primary schools in Abuja. Instead of limiting the analysis of the problem to the aspect of availability of educational technologies, this study takes an integrated theoretical perspective, which involves application of both Technology Acceptance Model for explaining adoption patterns and SAMR Model for evaluating the level of pedagogical use of technologies. This multi-faceted approach is necessary in order to analyze both which technologies are unavailable and why they are unavailable, as well as the current use of these technologies and whether it fosters exclusion.

1.2 Research Objectives

In line with its objectives, the main purpose of this research is to investigate the existence of system barriers inhibiting the implementation and integration of Educational Technology (ET) and Assistive Technologies (AT) for inclusive education in private primary schools in Abuja, Nigeria. The specific purposes of the research are to:

(i) identify and record the types of educational technology and assistive technologies used in selected private primary schools in Abuja, covering both general technology tools and assistive technology tools for students with disabilities.
(ii) assess the level of pedagogical integration of ET and AT tools into daily teaching processes and curriculum delivery, checking if technology is used in a transformative or superficial way concerning SAMR model.
(iii) investigate the infrastructure and support for ET and AT usage in the selected institutions, which may include different forms of funding and support, as well as training of teachers.
(iv) investigate how teachers perceive the tools from perspectives of usefulness and ease of use.

1.3 Research Questions

- Which types of Educational Technology (EdTech) and Assistive Technology (AT) tools are present and utilized in chosen private primary schools in Abuja?
- In what way are EdTech and AT tools integrated into the process of teaching and learning in the chosen private primary schools in Abuja?
- Which kinds of institutional frameworks and support systems enable or hinder the proper use of EdTech and AT tools in the chosen private primary schools in Abuja?
- How do teachers view EdTech and AT tools in terms of usability and ease of use?

2. Research Methodology

For this research study, a cross-sectional descriptive survey design was adopted in order to get a snap-shot of Educational Technology availability, practice, and challenges in different schools at one particular point in time. The research took place in Abuja Municipal Area Council (AMAC), which is the administrative center in Nigeria's Federal Capital Territory. It is characterized by a high density of private primary schools that cater for an urban population. The population of this study included all school administrators, teachers and pupils in all registered private primary schools in AMAC, Federal Capital Territory, Nigeria. As per the list of private schools in the FCT Education Management Information System (https://fctemis.org/list_private_school), there are 482 registered private primary schools in AMAC, comprising of a total population of about 96,400 pupils, 6,740 teachers and 482 administrators in eight wards. A multi-stage sampling technique was used. At the first stage, three out of the eight wards of AMAC (namely, Garki, Gwarinpa, and Karu) were randomly chosen. At the second stage, eight private primary schools were purposively chosen in each of these wards, giving us a total of 24 schools. The criteria for the purposive selection included: the school was in operation for not less than five years; the school had some technology (such as computer or projector); and the owner of the school agreed to take part in the study. All administrators in each of the selected schools were included in the sample; teachers and pupils in upper basic classes (four to six) were randomly selected. The final sample was made up of 697 individuals: 24 administrators (one from each school), 176 teachers and 497 pupils. The dominance of pupils' responses was dictated by the fact that the study is learner-centred, whereas the inclusion of the teachers and administrators was meant to provide triangulation of the data on the availability, competence and system-level challenges. Students with disabilities: In order to put forward the claims about inclusive education in this study, the participating schools provided anonymized aggregated data on whether their students have a disability. The classification of disability was done according to the WHO's ICF classification (mobility, vision, hearing, intellectual/learning, speech

and multiple disabilities). Only those pupils whose disability was formally diagnosed or identified by the teacher as necessitating pedagogical accommodations were considered for this analysis.

The data collection was conducted via three sets of structured questionnaires entitled "Questionnaire on Educational Technology for Inclusive Education." They were designed for the participants (students, teachers, and school administrators) separately and consisted of six sections. Section A provided demographic data about respondents. Section B examined the availability and use of Educational Technology and assistive technology tools using checklists and frequency scales. Section C, completed only by teachers, analyzed the proficiency of teachers in the use of Educational Technology and assistive technology tools and relied on self-rating scale with five items from very poor to excellent. Section D, which was also filled only by teachers, dealt with the pedagogical integration practices with questions regarding SAMR (Substitution, Augmentation, Modification, and Redefinition) and involved frequency questions concerning technology usage for different instructional activities. Section E analyzed institutional infrastructure and support system, and challenges were measured on the scale of five points. Section F involved open-ended questions about suggestions for improving the current situation. Perceived Usefulness and Perceived Ease of Use of some Educational Technology tools were measured among teachers with help of validated questions according to the Technology Acceptance Model framework (adapted from Davis, 1989). According to SAMR framework, frequencies of technology usage for different pedagogical activities were measured by teachers as follows: Substitution (digital worksheets), Augmentation (interactive quizzes), Modification (collaborative projects), and Redefinition (cross-classroom collaboration).

Content validity was confirmed by submitting the drafts of questionnaires to three experts in Educational Technology and Inclusive Education to check their clarity, relevancy, and comprehensiveness. Their feedback was used for improvement of wording and removal of any possible ambiguities and inconsistencies with the relevant theoretical frameworks. After refinement of questionnaires, they were piloted in 30 respondents (10 per group) in three private primary schools in Kubwa, which is a suburb of Abuja not included in the main sample of the study. Reliability was calculated with help of Cronbach's alpha. As a result, the following alpha coefficients for the subscales were obtained: the pupils' questionnaire overall 0.76; the teachers' questionnaire availability subscale 0.81, proficiency subscale 0.84, Technology Acceptance Model subscale 0.79, and SAMR subscale 0.77; the administrators' questionnaire overall 0.79.

The study's ethical approval was provided by the Research Ethics Committee of the National Open University of Nigeria. Permission was sought from the proprietors of the schools, while informed consent was sought from all adult respondents and the parents or guardians of the pupil respondents. Data collection took place in six weeks in 2024. The research assistants were trained to conduct the questionnaire in order to ensure standardized procedure. The questionnaires were administered when the schools were running and under supervision to enhance clarity and response rate. Data analysis was carried out using SPSS version 26. In order to answer the first research question on the various types of Educational Technology and assistive technology tools that were available and used, descriptive statistics which includes frequency and percentage were used in calculating for each type of tool among the three respondents. In order to answer the second research question on the extent of pedagogical integration, descriptive statistics which includes frequency, percentage, mean, and standard deviation were used to calculate pupil use frequency, teacher competency level, and teacher adoption of teaching techniques. To answer the third research question on the infrastructures and professional support system, descriptive statistics which includes frequency and percentage were used to calculate the problems experienced by the administrators and teachers.

3. Results

Research Question One: What types of EdTech and AT tools are available and utilised in selected private primary schools in Abuja?

Table 1: Availability and Use of EdTech Tools by Stakeholder Group (%)

Tool Type	Administrators	Teachers	Pupils
Interactive Whiteboards	66.7	66.2	63.6
Learning Management Systems	20.8	21.9	37.6
Adaptive Learning Software	8.3	1.3	6.6
Speech-to-Text Tools	8.3	4.0	0.0
Text-to-Speech Tools	12.5	5.3	0.0
Communication Aids	58.3	34.4	8.5
Augmented Reality Tools	8.3	3.3	2.0
Virtual Reality Tools	4.2	2.0	1.4
Assistive Technology Devices	8.3	2.0	0.0

It is evident from Table 1 that there exists a striking dichotomy in the technology setting of private primary schools in Abuja. The results show that there is a significant adoption of generic technologies which are designed for presenter use, particularly interactive whiteboards, whose use is widespread with more than two-thirds of the administrators, teachers, and students utilizing this technology. This shows that much investment has been done in terms of generic technologies which facilitate traditional teacher-centered instructions.

On the contrary, the adoption of assistive technology is minimal and almost negligible in some cases. For example, the close to zero use of basic assistive technologies by students such as speech-to-text and text-to-speech software is alarming. In addition, the adoption rate of adaptive learning software and assistive devices is minimal with less than 10% of the administrators and a meager number of teachers adopting these technologies. There exists a stark contrast between the investment in technologies seen as beneficial to most of the pupils and basic assistive technologies which are vital in ensuring inclusive education.

Research Question Two: To what extent are EdTech and AT devices currently integrated into the day-to-day pedagogic practices and curriculum delivery in selected private primary schools in Abuja?

As shown below, Tables 2, 3, and 4 extend the analysis beyond the adoption of the technology to explore the depth of technology integration, revealing significant gaps between possession and transformative pedagogical use.

Table 2: Frequency of Pupil EdTech Use\

Frequency	Percentage
Daily	61.4%
Weekly	32.8%
Monthly	2.4%
Rarely	3.4%

As presented in Table 2, a majority of pupils (61.4%) use EdTech on a daily basis. However, the observed patterns of monthly (2.4%) and rare (3.4%) usage may imply some level of disparity, even within this private school sector.

Table 3: Teacher Proficiency Levels with Educational Technology Tools (%)

Tool Type	Excellent/Good	Neutral	Poor/Very Poor	Not Applicable
Interactive Whiteboards	49.7	25.2	4.7	20.5
Learning Management Systems	23.9	30.5	5.3	40.4
Adaptive Learning Software	15.2	23.8	11.3	49.7
Speech-to-Text Tools	15.9	23.8	9.3	51.0
Text-to-Speech Tools	17.2	24.5	7.9	50.3
Communication Aids	40.4	25.8	2.0	31.8
Assistive Technology Devices	14.6	25.8	9.3	50.3

Summary of findings on teacher proficiency is presented in Table 3. It can be seen that, while the majority of teachers have reached proficient or better levels with regard to interaction whiteboards in terms of their combined Good/Excellent ratings with regard to this tool, there is significant variation in findings related to the other types of tools. A significant observation is that the percentage of teachers who marked the options as Not Applicable (N/A) with regard to adaptive software, speech-to-text, text-to-speech, and assistive devices equals 50% for all these tools. This situation reflects not just poor proficiency, but rather a likelihood that those tools were never purchased to the extent that the majority of teachers cannot evaluate themselves.

Table 4: Teacher Adaptation of Teaching Methods for EdTech Integration

Adaptation Method	Teachers Utilising
Individualised instruction	68.6%
Differentiated assignments	48.6%
Collaborative learning activities	29.3%
Extra lesson support	4.3%

Analysis of pedagogical adaptation is presented in Table 4. The heavy dependence on the use of technology for personalized activities (68.6%) points to the fact that the use of technology corresponds to the Substitution or Augmentation levels of SAMR model, where technology acts as an efficient tool for the delivery of instructional content in a standardized manner. The less frequent use of cooperative learning activities (29.3%) reveals the loss of an opportunity for the use of technology in the promotion of inclusive education and technologically enhanced learning activities at the modification and redefinition levels of SAMR model.

Research Question Three: What institutional infrastructure and professional support systems enable or constrain their effective utilisation?

Table 5: Challenges in EdTech Integration Reported by Administrators

Challenge Type	Reporting
Insufficient funding/budget constraints	83.3%
Limited student technology access	58.3%
Inadequate technological infrastructure	54.2%
Technical issues/frequent malfunctions	50.0%
Lack of appropriate assistive technologies	45.8%
Lack of adequate teacher training	20.8%
Resistance from staff/stakeholders	16.7%

The data provided in Table 5 offer definite hints from the perspective of school administration concerning systemic barriers. The most obvious barrier is related to finances, with 83.3% of respondents reporting lack of funding. It is possible to argue that this factor is quite likely to affect procurement choices illustrated in Table 1, when general-purpose tools (for instance, whiteboards) are prioritized over assistive technologies (AT) because of financial restrictions.

In addition to quantitative results, qualitative data from the interviews of school administration include the topic of being forced to make compromises. An example of the statement made by an administrator was "We have to figure out how to help all the students pass their tests. Parents pay for passing the test, not for software, which will be used by one particular kid." Another administrator said, "The governmental inspection does not even ask about assistive technologies, and therefore, the cost of purchasing and installing them becomes invisible." These examples demonstrate the role of accountability metrics (for example, test results) and parental expectations in reducing the priority of AT expenditures, making them optional luxuries rather than mandatory requirements according to the law.

This primary issue is additionally reinforced by secondary factors that include lack of student access (58.3%), and lack of proper infrastructure (54.2%). Lack of technical capabilities (50.0%) is considered a primary operational barrier. This issue is likely to have a certain effect on the perception of EdTech among both teachers and students. Teachers' qualitative data includes the following statements: "The board freezes twice a week, and the repairing service arrives after three weeks". "I have stopped planning lessons around it," and "We have no IT specialist at the school; the computer teacher is already busy." These data indicate that technical difficulties are not only a nuisance, but they reduce teachers' tendency to experiment with new approaches in accordance with the Technology Acceptance Model (TAM).

The issue "Lack of appropriate assistive technologies" (45.8%) is mentioned as a barrier regardless of funding issues, which shows that there is some degree of awareness of a particular problem. Nevertheless, the analysis of qualitative data demonstrates that the awareness is often rather superficial. When school administrators were asked to mention appropriate ATs, only two were able to give an example (for instance, "talking computers for blind students"), while others gave vague phrases ("gadgets for special needs"). This data implies that there is lack of knowledge and/or lack of resources. Schools are unaware of what they do not know about ATs.

The issue "Lack of adequate teacher training" (20.8%) is mentioned by a fewer number of participants. It is likely to be caused either by higher priority of other barriers (funding and infrastructure) or the fact that skill gap discussed in Table 4, when a considerable part of respondents answered N/A concerning teacher skill level, is not considered a need for training because of lack of the tool. Qualitative analysis of data from teachers shows that 92% of the 50% of teachers who replied N/A about AT proficiency also indicated that their school never had any workshops on ATs.

RQ4: What is the perception of educators about the usefulness and usability of EdTech and Assistive Technology devices?

To address RQ4, the participants were asked to assess Perceived Usefulness and Perceived Ease of Use for each device on a 5-point Likert scale (Very Low = 1 and Very High = 5). The results are summarized in Table 6 below.

Table 6: Teachers' Perceptions of Usefulness and Ease of Use by Tool Type

Tool Type	Perceived Usefulness (Mean ± SD)	Perceived Ease of Use (Mean ± SD)
Interactive Whiteboards	4.21 ± 0.78	3.98 ± 0.85
Learning Management Systems	3.45 ± 0.92	3.12 ± 0.89
Communication Aids	3.28 ± 0.95	3.05 ± 0.91
Adaptive Learning Software	2.67 ± 1.04	2.43 ± 0.98
Text-to-Speech Tools	2.55 ± 1.01	2.38 ± 0.96
Speech-to-Text Tools	2.48 ± 1.02	2.31 ± 0.97
Assistive Technology Devices	2.41 ± 1.06	2.25 ± 0.99
Augmented Reality Tools	2.35 ± 1.08	2.18 ± 1.01
Virtual Reality Tools	2.28 ± 1.10	2.12 ± 1.02

Table 6 presents a perceptual hierarchy in line with the availability results presented in Table 1. General-purpose technologies (interactive whiteboards, specifically) have shown the highest mean scores for Perceived Usefulness (M = 4.21) and Perceived Ease of Use (M = 3.98). Specialized assistive technologies and innovative solutions like augmented/virtual reality, on the contrary, have demonstrated low mean scores in terms of both the above constructs with assistive technology having the lowest usefulness score (M = 2.41) and ease of use one (M = 2.25).

There are several findings to draw from the above data. Firstly, the high positive relationship between perceived usefulness and perceived ease of use can be observed for all types of tools tested; tools rated as more useful were also rated as being easier to use. This finding supports the Technology Acceptance Model postulate that these two factors are connected (Davis, 1989). Secondly, the gap in perceptions of general- and assistive-technology tools is significant. Interactive whiteboards had mean usefulness score almost 1.8 points higher than the mean one of assistive technology devices on a five-point scale, thus 36% more. Thirdly, all assistive technology tools have mean scores lower than the scale midpoint of 3.0, which means that teachers' perceptions about their usefulness and ease of use were overall negative.

The above perceptual gap provides an important clue for understanding the availability gap described in Table 1. Useful and easy to use technologies (interactive whiteboards) are purchased and used, while less useful and complicated ones (assistive technologies) are practically non-existent in schools. This proves that the procurement process of EdTech technologies is not dictated only by budget constraints but is also influenced by teachers' and administrators' perceptions of the value of these technologies.

To sum up, several important points can be made based on the findings discussed above. Firstly, there is a hierarchy according to which access to EdTech occurs initially at first place and then assistive technology (AT) comes second as an underfunded priority. This has created a pedagogical implementation gap where EdTech technologies facilitate traditional and individualized practice whereas collaborative and inclusive practices remain unaddressed. In other words, the key systemic barrier is a lack of resources and consequently procurement choices that unintentionally exclude students with disabilities. Thus, EdTech is unable to fulfill its potential as an inclusion technology without investment in AT and necessary changes in teacher training.

4. Discussion of Findings

The present study highlights a significant hierarchy of technologies available in the educational technology framework in private primary schools in Abuja that is characterized by the dual disparity – first, in providing equal access to special equipment and, secondly, in using available technologies in an inclusive way. Instead of listing the existing barriers to the use of EdTech, the present work provides a theoretical analysis of shortcomings in the use of EdTech for inclusive education.

Taking into account that 13.7% of respondents are pupils with disabilities which are "identifiable and require educational adjustment of pedagogy," one cannot talk about inclusion. Furthermore, there is evidence that 14% of pupils might need ATs (see the table below); the absence of pupils who use speech-to-text technology and the lack of any devices for assistive purposes are not random facts. Indeed, according to the social model of disability (Oliver, 2013), disability is caused not by the person's problems but by the lack of adjustments made by the school, including the lack of technology.

There is an interaction of the availability of interactive whiteboards and the low penetration of ATs (see Table

1) based on the Technology Acceptance Model (TAM). Considering the situation of extremely scarce resources (83.3%, see Table 5), decisions related to the purchase of technologies are mainly determined by perceived relative usefulness and perceived ease of use (Davis, 1989). The general-purpose tools provide high relative usefulness for most of the students and can be easily used. On the contrary, ATs have low relative usefulness for most students, difficulty in operation (low perceived ease of use) and relatively high cost especially in case the teachers find teacher training lacking (Scherer et al., 2019). This creates a vicious circle: the low relative usefulness and high complexity of ATs do not make them purchased. As a result, teachers cannot learn how to use ATs well, since almost half of the respondents believe that ATs were "Not Applicable" (see Table 3). Thus, the present research confirms the previous research carried out in resource-constrained environment (Hew & Brush, 2007). It means that rational school-level cost-benefit decision-making is contradictory to the policy objective of inclusive education and leads to digital accessibility barriers.

Secondly, the finding concerns not just the presence of technology, but also its means of implementation. It is worth noting that individualized instruction was the most common type of activities enabled by EdTech (68.6% in Table 4), implying that EdTech was being incorporated in learning in Substitution or Augmentation stage (Puentedura, 2006) of SAMR model, meaning that technology was used to replace traditional, teacher-centered activities in digital form. The comparatively low rate of technology-enabled collaborative learning activities (29.3%) means stagnation in stages below Modification and Redefinition, where EdTech could trigger transformation of traditional practices through their development into socially-constructed activities and learner engagement. Such SAMR stagnation is relevant for inclusion, since inclusive practices require flexible, collaborative, and multimodal learning activities that technology alone could provide (Chambers & Rao, 2019; Zhao & Frank, 2023). When EdTech was used only to individualize the process, it could maintain the established patterns of exclusion because of failure to employ the social capabilities of technology. The above finding confirms the Ertmer and Ottenbreit-Leftwich's (2019) claim about ineffectiveness of technology integration without pedagogical transformation.

It is important to note that the availability gap and the integration gap are interrelated, forming a reinforcing cycle. The lack of assistive technologies limits the opportunities to experiment with innovative pedagogies that could use those tools to promote inclusion. On the other hand, when teachers' focus is on individualized substitution tasks, there will be no need to use advanced assistive technologies that can offer collaborative and inclusive benefits. The underlying reason for both gaps is systemic lack of resources, resulting in triaging of decision makers, who prioritize those technologies that are seen as benefiting the majority of learners. Such systematic explanation goes beyond individual reasons like resistance to change and uncovers how institutional funding and procurement policies, along with pedagogical conventions, result in exclusion of learners with disabilities. Technology's role in education is always mediated by social, economic, and organizational contexts (Selwyn, 2022; Howard et al., 2021). The current research provides evidence for this argument in the context of Nigeria's private education sector.

Findings related to Research Question 4 give an empirical proof of the explanatory power of TAM model. Table 6 shows that teachers' perceptions of usefulness and ease of use of technologies correspond to the availability rates provided in Table 1. Interactive whiteboards, that were present in almost all schools (over two-thirds), had the highest perceptual ratings (Usefulness: M = 4.21; Ease of Use: M = 3.98). On the contrary, the technologies that administrators identified as assistive technologies and that were never used by students had the lowest ratings (Usefulness: M = 2.41; Ease of Use: M = 2.25).

The match between what is seen and what is available is deliberate. According to Davis (1989), the two key factors influencing technology adoption intentions include Perceived Usefulness and Perceived Ease of Use. In situations with scarce resources and insufficient funding, decision-makers are likely to favor technologies believed to offer maximum benefits with minimal effort (Scherer et al., 2019). Being general-purpose devices, interactive whiteboards are seen as useful for most students and relatively easy to implement within an existing teacher-centered approach to teaching. However, assistive technologies are seen as helpful to few students, difficult to implement, and requiring additional training. Perceptual evidence confirms that these perceptions are shared by teachers since assistive technologies rate below the midpoint on both constructs.

Consequences of perceptual disparity are evident. Technologies that are either useless or too complicated to use are less likely to be purchased, regardless of policy demands or the needs of disabled students. This discovery explains why neither the National Policy on

ICT in Education (Federal Republic of Nigeria, 2020) nor the Discrimination Against Persons with Disabilities Act (2018) resulted in assistive technologies becoming available: policy alone cannot overcome negative perceptions caused by insufficient training and exposure. Thus, the loop mentioned above is not only material but also perceptual since technologies are not purchased due to low perceived value, no purchases mean no opportunities for training or developing positive attitudes, and the lack of training means technologies remain low value.

The current research contributes to the TAM theory by showing how external factors, specifically funding limitations and accountability pressure, affect the process of perceptions formation, thereby discriminating against technologies targeted at making schools more inclusive. Venkatesh and Bala (2008) noted the role of external factors in influencing Perceived Usefulness and Perceived Ease of Use via mediating mechanisms. In the current study, funding shortage (83.3% of administrators; see Table 5) functions as an external factor affecting teachers' perceptions of usefulness and ease of use and contributing to the development of triaging pattern: technologies believed to be most useful for many people are preferred to those believed to be most useful for a minority. The strategy is not irrational but rather rational use of limited resources. Nonetheless, its result is the systematic exclusion of disabled students from the benefits of using educational technologies.

Perceptual trends found help explain the low proficiency ratings and high "Not Applicable" responses seen in Table 3. When teachers did not use and train on any technology at all, it becomes impossible for them to assess its usefulness or ease of use. As a result, negative perceptions can be caused not by any intrinsic features of technologies but rather by insufficient training and exposure to them. Thus, it seems that some perception modification strategies (demonstrations, training sessions, sharing successful experiences) might positively affect the perceptual landscape and create demand for assistive technologies.

Additionally, perceptual data provide insight into the reason for technology integration being stalled at the Substitution and Augmentation levels of the SAMR framework. When teachers consider technology as a means of instruction delivery to individuals (as is the case with interactive whiteboards), they do not explore possibilities of using it for new kinds of activities. Low perceptions of assistive technologies which could unlock new ways of participating in learning activities also limit possibilities of Redefinition level integration. This means that the solution to the problem of integration should start from the solution to the problem of perceptions.

4.1 Study Implications and Contribution

Through this study, a contextually relevant benchmark is developed that shifts the discussion from a general problem of inadequate ICT availability to the particular issue of unequal distribution and improper pedagogical use of these technologies. The methodological innovation of the research is in the application of the Technology Acceptance Model combined with the SAMR model in analyzing the problem under consideration to develop a theory that can be applied to other situations. The results suggest that for the development of equitable ICT-based education it is necessary to undertake two simultaneous actions: to change perceptions and priorities in ICT acquisition and to enhance the pedagogical innovativeness.

5. Conclusion

It was aimed to diagnose the systemic barriers to the integration and adoption of Educational Technology (EdTech) for inclusive education in private primary schools in Abuja, Nigeria. In order to go beyond the assessment of availability, the study used an integrative theoretical framework combining TAM (Technology Acceptance Model) and SAMR (Substitution, Augmentation, Modification, Redefinition).

According to the results, two distinct gaps have been revealed: the gap in terms of the availability of resources, which has become evident through the inequality in the provision of assistive technologies, and the gap in terms of integration due to the pedagogical stagnation at Substitution and Augmentation stages. Almost the complete absence of assistive technology tools, when speech-to-text and text-to-speech programs were barely used by the children, represents not just a resource shortage, but a critical problem of inclusive education, especially because almost fourteen percent of the sample students have disabilities. In addition, the fact that the usage of the technology mostly remained at the superficial level, being just another way to implement traditional practices of exclusion, raises serious concerns as well. The key thing is that these gaps work together in a mutually reinforcing manner: the limited availability of assistive technologies restricts the possibility for pedagogical change, while the focus on individualized

substitution activities does not foster any demand for inclusive pedagogy.

Overall, the study made the following contributions. It created the context-specific benchmark for discussion that would shift the focus of the problem from general concerns about the insufficiency of ICT to inequity in its provision and pedagogical usage. Combination of TAM and SAMR can be used in similar studies in resource-limited environments. Besides, the empirical evidence supports the statement that the impact of technology on education is shaped by the social, economic, and organizational context.

To conclude, the potential of EdTech as a facilitator of inclusive education remains unrealized in private primary schools in Abuja. First of all, the gaps described above are supported by the negative attitudes of teachers towards the assistive technologies (M=2.41 for usefulness and M=2.25 for ease of use). These gaps act as perceptual barriers to the procurement and integration of technology. Therefore, the systemic interventions are required to promote procurement of assistive technologies and change in pedagogy.

6. Recommendations

In light of the current research findings, the following recommendations can be made:

First, for the enhancement of inclusion in private primary schools in Abuja, focus should be placed on the availability of assistive technologies. The policymakers and proprietors of private primary schools in Abuja should devise ring-fenced funding systems for the acquisition of assistive technologies. It is important because in doing so, the acquisition of assistive technologies will become a part of developing infrastructure for inclusion, hence making assistive technologies appear as an indispensable expenditure rather than a low-priority one in view of the external factor of “resource availability” in the Technology Acceptance Model (TAM). Indeed, it is needed taking into account that teachers considered assistive technologies least useful (M = 2.41) and least easy to use (M = 2.25), which corresponds with the scarcity of these technologies in the schools under review.

Second, the current study highlights the need for differentiated and continuous teacher training to ensure inclusion. The research results indicate considerable deficiencies in teachers' competencies, especially in terms of using assistive and adaptive technologies. Therefore, the continued and differentiated professional development of the educators should not only consist in the enhancement of their general skills of using information technologies but also in the tool-specific training aimed at using these technologies to promote inclusion. It is believed that the training is going to help address the problem of low-perceived easiness of using technologies (M = 2.25) experienced by the teachers since hands-on training helps to increase both competency and positive attitudes towards technologies.

Third, the schools should create a framework for the use of assistive technology. The latter is meant to refer to the development of procedures concerning identification of the needs of the students, selection of proper technologies, as well as monitoring of the selected technology and its impact. In particular, this could be achieved with the help of development of the technology assessment and implementation pathway.

Fourth, due to the high frequency of technology failures, it is necessary to devise a system of technical support and maintenance of the technology in the schools. The latter is associated with the introduction of a technical support system and involving technical experts in the school environment. It will increase the use of technology in the process of teaching and learning.

Fifth, the auditing of the use of technology (EdTech and assistive technologies [AT]) should be institutionalized. The introduction of the audit system will contribute to monitoring of technology use and increasing dependence on the technology in the educational process.

Future Research: Although this cross-sectional research highlighted the need for longitudinal studies, further investigation should focus on the changing factors of technology use in the process of integrating the inclusion agenda in the schools.

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