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# Assessing the Use of Assistive Technology and Its Effectiveness in Improving Educational Attainments of Students with Special Needs at Metro Gold Schools in Ablekuma District, Accra, Ghana

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**Abstract**
Assistive technology (AT) is slowly gaining acceptance as one of the key tools for inclusive education, and there is limited evidence of the use and effectiveness of AT in African, constrained settings. This study investigated the trend of using AT, benefits of AT and the challenges of using AT by students with Special Educational Needs at Metro Gold Schools in the Ablekuma District of Ghana. The methodology used for collecting data was a quantitative cross-sectional survey design, based on the Technology Acceptance Model (TAM). Descriptive statistics were used to analyse the data. The findings showed that there was a high prevalence of AT use of tablets and computers with specialised programmes and text to speech applications with most users using AT every day or close to every day. Pupils answered very positive to perceived effectiveness on the 5-point scale with high marks for support when pupils are doing work, when they understand their lessons and when they are involved in lessons. But the study also found that the issues still exist, for example, the lack of devices, technical problems and lack of user knowledge. The findings validate the central constructs of perceived usefulness and perceived ease of use and show that factors beyond the learner's control, like infrastructure, training, and policy, are also crucial in maintaining the AT use among learners with special needs. The study suggests a reinforcement of AT procurement policy, a structured technical support system, compulsory teacher and caregiver training and a home-school AT access scheme as ways to strengthen the benefits of inclusive education in Ghana.

**Keywords:** assistive technology, special educational needs, Technology Acceptance Model, inclusive education, Ghana

## 1. Introduction

Over the past few decades, education systems worldwide have undergone substantial transformation driven by new pedagogical approaches and technological innovation, with particular consequences for learners who require individualised support (Onejeme, 2017; Saabi *et al*., 2025) [27, 30]. Within this shift, Assistive Technology (AT) has emerged as a central instrument for closing gaps in educational inclusion, especially for students with disabilities (Manuel, 2025; Vincent *et al*., 2024) [20, 36]. AT encompasses the devices, software, and systems designed to help individuals with disabilities overcome barriers that would otherwise limit their participation in learning, ranging from low-tech tools such as pencil grips and enlarged print materials to high-tech solutions such as screen readers, text-to-speech applications, and interactive whiteboards (Manuel, 2025; Olayemi & Oluwaseun, 2023) [20, 26].

AT is not merely a compensatory aid; it is a facilitative mechanism that sustains, enhances, or rehabilitates the functional capacities of learners, thereby improving both academic engagement and quality of life (Saabi *et al*., 2025; Alzahrani, 2025) [30, 3]. Empirical evidence associates AT integration with measurable gains in academic performance, motivation, and independence (Manuel, 2025; Ramya & Shanthi, 2024) [20, 29]. For example, text-to-speech applications have been shown to

mprove reading comprehension among students with dyslexia, while adaptive keyboards enable students with physical disabilities to participate more fully in writing tasks (Alzahrani, 2025) [3]. AT also fosters social inclusion by allowing students with disabilities to learn alongside their peers, reducing isolation and reinforcing a sense of belonging (Vincent *et al*., 2024) [36].

These developments align with global commitments to inclusive education embedded in the United Nations Convention on the Rights of Persons with Disabilities and Sustainable Development Goal 4 (UNICEF, 2022) [35]. In developing contexts such as Ghana, AT holds particular promise for addressing infrastructural and resource constraints (Ogirima *et al*., 2017; Mohammed, 2018) [25, 23], yet its implementation remains uneven, often constrained by cost, availability, and prevailing cultural attitudes toward disability (Onejeme, 2017; Cygnet, 2019) [27, 9]. Despite growing recognition of its value, empirical study of AT use from the perspective of the students themselves, rather than teachers alone, remains scarce in the Ghanaian literature. This study addresses that gap by examining the extent of AT utilisation, its perceived effectiveness, and the challenges affecting its implementation among students with special educational needs at Metro Gold Schools in the Ablekuma District, Greater Accra Region of Ghana. Specifically, the study sought to: (i) examine the patterns and extent of AT utilisation among students with special educational needs; (ii) assess the perceived effectiveness of AT in improving educational attainment; and (iii) identify the challenges and barriers affecting AT implementation, in order to inform evidence-based recommendations.

## 2. Literature Review

### 2.1. Theoretical Framework

This study is anchored in the Technology Acceptance Model (TAM), originally developed by Davis to explain and predict user acceptance of information technology systems (as cited in Opoku *et al*., 2023) [28]. TAM has become one of the most influential models in technology-adoption research owing to its parsimony, strong empirical support, and predictive validity across diverse settings (Khan & Mahmood, 2022; Hassan, 2024) [17], including educational technology contexts, making it well suited to the study of AT acceptance among students with special educational needs.

TAM posits that technology acceptance and use behaviour are shaped by two core beliefs: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU), which jointly determine users' Attitude Toward Using (ATU), Behavioural Intention (BI), and, ultimately, Actual System Use (Opoku *et al*., 2023) [28]. PU refers to the degree to which a person believes that using a given technology will enhance task performance; in an educational setting, this translates into students' belief that AT will improve academic achievement and learning efficiency (Opoku *et al*., 2023; Fernández *et al*., 2022) [28, 12]. PEOU concerns the degree to which a person believes that using the technology will be free of effort, a construct of particular relevance for students whose cognitive, physical, or sensory impairments shape their interaction with technological systems (Martín-García *et al*., 2024) [21]. ATU mediates the relationship between these beliefs and BI (Opoku *et al*., 2023; Johnson *et al*., 2020) [28, 16], while BI is the most immediate antecedent of actual use (Aditia *et al*., 2018; Tekerek *et al*., 2024) [1, 33]. Ease of use is theorised to influence usefulness indirectly, since more accessible technologies tend to be perceived as more useful (González Enríquez *et al*., 2023) [15], and usefulness, in turn, exerts a direct effect on behavioural intention regardless of attitude (Singh & Masuku, 2014) [32].

Applied to special education, TAM's user-centred orientation resonates with contemporary practice that privileges learner agency and involvement in educational decision-making (Clark-Wilson *et al*., 2022) [6]. The model's emphasis on ease-of-use foregrounds how interface design, training adequacy, and technical complexity shape technology acceptance among learners with diverse needs (Petersen & Larsen, 2024), while its emphasis on usefulness is directly tied to AT's core purpose in special education: enabling access to curriculum content, supporting demonstration of learning, and enhancing participation (Mukhtarkyzy *et al*., 2025; Mbugua *et al*., 2022) [24, 22].

### 2.2. Definition, Scope, and Effectiveness of Assistive Technology

AT is broadly defined as any item, equipment, or product system, whether commercially acquired, modified, or customised, that increases, maintains, or improves the functional capabilities of individuals with disabilities (Tony, 2019; Olayemi & Oluwaseun, 2023) [34, 26]. AT devices are typically classified by technological intensity into low-tech tools (e.g., pencil grips, communication cards, large-print materials), mid-tech devices (e.g., modified keyboards, digital recorders, hearing aids), and high-tech devices (e.g., screen readers, speech-to-text software, Braille note-takers, interactive whiteboards), which require greater training and support but offer more sophisticated functionality (Tony, 2019; Ogirima *et al*., 2017; Wood, 2015; UNICEF, 2022) [34, 25, 35].

A growing body of literature affirms AT's positive effect on academic performance and engagement among students with disabilities. Teachers widely regard AT as beneficial for learners with special needs (Mohammed, 2018; UNICEF, 2022) [23, 35], and studies report that AT supports remediation, intervention, and inclusive instruction (Liman *et al*., 2015) [18]. AT tools have been linked to improved reading comprehension, writing skills, communication, and overall academic performance, particularly through text-to-speech, speech-to-text, and graphic-organiser applications (Tony, 2019; UNICEF, 2022) [34, 35], although some subject-specific tools, such as certain mathematics e-learning applications, still exhibit design limitations that constrain their effectiveness (Ramya & Shanthi, 2024) [29]. Beyond academic outcomes, AT has also been associated with improved self-esteem, self-efficacy, and independence among students (Samaila, 2019) [31], and it plays a critical role in supporting the developmental needs of children with multiple disabilities (Ramya & Shanthi, 2024) [29].

### 2.3. Factors Influencing Utilisation and Implementation Challenges

Several factors shape the successful use of AT in special education settings. Teacher and caregiver training is consistently identified as a determinant of effective AT use; inadequate training and limited professional development opportunities are among the most cited barriers (Wood, 2015; Samaila, 2019; Olayemi & Oluwaseun, 2023; Alkahtani, 2013; Cygnet, 2019) [31, 26, 2, 9]. More experienced and better-trained educators tend to hold more favourable perceptions of AT effectiveness (Olayemi & Oluwaseun, 2023) [26], which

reinforces calls for regular workshops and capacity-building activities (Samaila, 2019; Vincent *et al*., 2024) [31, 36]. Availability of suitable devices and adequate technical support constitutes another persistent constraint, driven partly by high costs and importation challenges in African contexts (Onejeme, 2017; Ogirima *et al*., 2017; Saabi *et al*., 2025) [27, 25, 30]. Attitudinal factors also matter: while most educators view AT positively (Ogirima *et al*., 2017; Samaila, 2019; Chukwuemeka, 2020) [25, 31, 5], some express reservations about over-reliance, disruption of curriculum delivery, or additional workload (Wood, 2015; Olayemi & Oluwaseun, 2023) [26]. Infrastructural issues, including unreliable internet connectivity, inconsistent power supply, restricted access to AT outside school, and insufficient device-to-student ratios, further constrain optimal implementation (Tony, 2019; UNICEF, 2022; Alkahtani, 2013) [34, 35, 2].

Taken together, the literature indicates that although AT holds substantial promise for enhancing the educational attainment, engagement, and independence of students with special needs, its full potential remains constrained by systemic barriers relating to training, resource availability, technical support, and infrastructure (Cygnet, 2019; Mohammed, 2018) [9, 23]. This underscores the need for empirical, learner-centred evidence, of the kind generated in the present study, to inform targeted interventions in specific institutional contexts such as Metro Gold Schools.

## 3. Methods

### 3.1. Research Design

The study adopted a quantitative, descriptive cross-sectional survey design, which enabled the systematic collection of data on AT utilisation patterns and perceived effectiveness at a single point in time (Creswell & Creswell, 2018) [8]. This design was considered appropriate because it permits standardised comparisons across respondents, generates numerical data amenable to statistical analysis, and is well suited to producing evidence-based practice and policy recommendations (Fowler, 2014; Bryman, 2016) [13, 4].

### 3.2. Population and Sampling

The target population comprised students with special educational needs in Ghana who had access to, or exposure to, assistive technology tools within an inclusive education setting. Inclusion required active enrolment in special education programming and demonstrable exposure to AT; students without such exposure, or with insufficient special education engagement, were excluded. The accessible population was drawn from Metro Gold Schools in the Ablekuma District, Greater Accra Region. A purposive sampling technique, a non-probability approach suited to identifying information-rich cases with the relevant lived experience (Etikan *et al*., 2016) [10], was used to select 38 students. The sample size was determined through a priori power analysis using G*Power (Faul *et al*., 2007) [11], which, assuming a medium effect size (Cohen's d = 0.5), an alpha of 0.05, and power of 0.80, indicated a minimum requirement of approximately 34 participants; the achieved sample of 38 therefore exceeded the statistical threshold generally
regarded as adequate for descriptive analysis under the central limit theorem (Cohen *et al*., 2018; Fraenkel & Wallen, 2019) [7, 14].

### 3.3. Instrumentation and Data Collection

Data were collected using a structured, self-administered questionnaire comprising four sections: demographic information, patterns of AT use, perceived effectiveness (measured on a five-point Likert scale ranging from 1 = "not at all" to 5 = "very much"), and implementation challenges. Completion took approximately 15–20 minutes, with assisted completion available where necessary. A digital version, accessible via QR code on a mobile-friendly online platform, served as a secondary collection channel, incorporating automated validation to enhance data completeness.

### 3.4. Ethical Considerations

Ethical clearance was obtained from the University of Education, Winneba, alongside research permits from the Ghana Education Service and approvals from relevant district education offices and participating schools. Written informed consent and, where applicable, student assent was secured prior to participation. Participation was voluntary, and confidentiality was safeguarded through anonymised data collection, a participant coding system, aggregate-level reporting, and secure, access-restricted data storage.

### 3.5. Data Analysis

Data were analysed using descriptive statistics, including frequencies, percentages, means, and standard deviations, to characterise demographic patterns, AT utilisation, perceived effectiveness, and implementation challenges. Likert-scale responses on perceived effectiveness were interpreted using a defined scale (1.00–2.00 = low agreement; 2.01–3.00 = moderate agreement; 3.01–4.00 = high agreement; 4.01–5.00 = very high agreement).

## 4. Results

### 4.1. Demographic Characteristics

The sample comprised 38 students, of whom 22 (57.9%) were male and 16 (42.1%) were female, a distribution broadly consistent with epidemiological trends indicating higher prevalence of certain special educational needs among male learners. In terms of age, the largest proportion of participants (47.4%, n = 18) fell within the 9–12-year bracket, followed by 26.3% (n = 10) aged 13–15 years, 21.1% (n = 8) aged 5–8 years, and 5.3% (n = 2) aged 16 years or older. By class level, 44.7% (n = 17) were in Key Stage 2 (Years 3–6), 31.6% (n = 12) in Reception/Key Stage 1 (Years 1–2), and 23.7% (n = 9) in Key Stage 3 (Years 7–9), indicating that AT implementation at Metro Gold Schools is concentrated at, but not confined to, the foundational and intermediate levels of basic education.

**Table 1:** Demographic Profile of Study Participants (N = 38)

| Variable | Category | Frequency | Percentage |
|---|---|---|---|
| Gender | Male | 22 | 57.9% |
| | Female | 16 | 42.1% |
| Age | 5–8 years | 8 | 21.1% |
| | 9–12 years | 18 | 47.4% |
| | 13–15 years | 10 | 26.3% |
| | 16 years or older | 2 | 5.3% |
| Class level | Reception/KS1 (Yr 1–2) | 12 | 31.6% |
| | KS2 (Yr 3–6) | 17 | 44.7% |
| | KS3 (Yr 7–9) | 9 | 23.7% |

### 4.2. Patterns of Assistive Technology Utilisation

AT utilisation was very high: 35 of the 38 students (92.1%) reported using AT in their learning, 5.3% (n = 2) reported no use, and 2.6% (n = 1) were unsure. Among the types of AT employed, tablets or computers with specialised programmes were the most prevalent (82.9%), followed by text-to-speech applications (68.6%), educational games and learning apps (60.0%), audiobooks or recorded lessons (51.4%), speech-to-text applications (45.7%), large-print materials or magnifiers (40.0%), specialised keyboards or adaptive writing tools (34.3%), and communication boards or picture-based systems (22.9%); 8.6% reported other, unspecified tools. This pattern indicates that most students combine multiple AT tools rather than relying on a single intervention. Regarding frequency of use, 45.7% of AT users engaged with the technology a few times per week and 40.0% used it daily, meaning that 85.7% of users incorporated AT into their routine on at least a near-daily basis; 11.4% used it sometimes, and 2.9% rarely.

**Table 2:** Prevalence, Types, and Frequency of Assistive Technology Use

| Indicator | Category | Frequency | Percentage |
|---|---|---|---|
| AT use (n = 38) | Yes | 35 | 92.1% |
| | No | 2 | 5.3% |
| | Not sure | 1 | 2.6% |
| Type of AT (n = 35) | Tablets/computers with special programmes | 29 | 82.9% |
| | Text-to-speech apps | 24 | 68.6% |
| | Educational games/learning apps | 21 | 60.0% |
| | Audiobooks/recorded lessons | 18 | 51.4% |
| | Speech-to-text apps | 16 | 45.7% |
| | Large print/magnifiers | 14 | 40.0% |
| | Special keyboards/writing tools | 12 | 34.3% |
| | Communication boards/picture cards | 8 | 22.9% |
| Frequency of use (n = 35) | Every day | 14 | 40.0% |
| | A few times per week | 16 | 45.7% |
| | Sometimes | 4 | 11.4% |
| | Rarely | 1 | 2.9% |

### 4.3. Perceived Effectiveness of Assistive Technology

Perceived effectiveness was rated on a five-point Likert scale. The overall mean effectiveness score was 4.11 (SD = 0.90), falling within the "very high agreement" range. Students most strongly endorsed the statement that AT helps with schoolwork (M = 4.31, SD = 0.76), followed by improved lesson understanding (M = 4.26, SD = 0.82), increased classroom participation (M = 4.14, SD = 0.88), and greater confidence in class (M = 4.09, SD = 0.95). Improved communication and idea-sharing received a slightly lower but still high rating (M = 3.97, SD = 0.98), while independent completion of schoolwork received the lowest, though still positive, rating (M = 3.89, SD = 1.02), with the largest variability, suggesting differential effects across individual needs, device type, and support structures. When asked to give an overall assessment, 57.1% of AT users reported that AT helped them "a lot" and 34.3% reported that it "helped," a cumulative positive response rate of 91.4%; only 5.7% reported minimal benefit and 2.9% reported little benefit, with no student reporting no benefit at all.

**Table 3:** Student-Perceived Effectiveness of Assistive Technology (n = 35)

| Statement | M | SD | Interpretation |
|---|---|---|---|
| AT helps me with my schoolwork | 4.31 | 0.76 | High |
| I understand lessons better with AT | 4.26 | 0.82 | High |
| I feel more confident in class with AT | 4.09 | 0.95 | High |
| I can do work independently with AT | 3.89 | 1.02 | High |
| AT makes it easier to communicate/share ideas | 3.97 | 0.98 | High |
| I participate more in class activities with AT | 4.14 | 0.88 | High |
| Overall mean | 4.11 | 0.90 | Very high |

### 4.4. Challenges and Barriers to Implementation

Despite the generally positive assessment, students identified several barriers to optimal AT use. The most frequently cited challenge was limited availability of AT tools when needed, reported by 57.1% of AT users, followed by technical malfunction or equipment breakdown (45.7%). Insufficient knowledge of how to use AT effectively was reported by 22.9% of students, and 14.3% found the tools too complex to use. Social barriers were minimal, with only 5.7% reporting peer teasing related to AT use. Notably, 17.1% reported no problems at all, and 8.6% cited other, unspecified difficulties. Open-ended responses further highlighted infrastructural constraints, including unreliable internet connectivity, power supply interruptions during instruction, restricted access to AT devices at home, and an insufficient overall supply of devices relative to student need.

**Table 4:** Challenges Reported by Assistive Technology Users (n = 35)

| Challenge | Frequency | Percentage |
|---|---|---|
| Tools not always available when needed | 20 | 57.1% |
| Tools break or malfunction | 16 | 45.7% |
| Do not know how to use tools well | 8 | 22.9% |
| Tools are hard to use | 5 | 14.3% |
| Peer teasing related to AT use | 2 | 5.7% |
| No problems reported | 6 | 17.1% |
| Other | 3 | 8.6% |

## 5. Discussion

The very high prevalence of AT use recorded at Metro Gold Schools (92.1%) stands in marked contrast to the wider Ghanaian and regional picture, in which many schools report little or no access to reliable AT (Mukhtarkyzy *et al*., 2025) [24], suggesting that the institution has developed a comparatively robust AT infrastructure relative to peer institutions. The concentration of use among tablets, computers with specialised programmes, and text-to-speech applications reflects a school-level orientation toward high-tech and audio-visual solutions, consistent with the classification of assistive technologies by learning modality (Manirajee *et al*., 2024) [19], while the tendency of students to draw on multiple AT tools simultaneously supports the view that effective AT provision requires individualised, multi-modal solutions rather than a single, uniform intervention (Liman *et al*., 2015) [18].

The near-daily frequency of use reported by most students (85.7% using AT daily or several times a week) indicates that AT has become embedded within routine instructional practice rather than functioning as a peripheral resource, corroborating findings that successful AT integration is characterised by sustained, habitual use (Tony, 2019) [34]. The overall effectiveness rating of 4.11 provides strong support for the TAM proposition that perceived usefulness is a central driver of technology acceptance and, by extension, of continued use (Opoku *et al*., 2023) [28]; students' clear endorsement of AT's contribution to schoolwork and lesson comprehension mirrors prior evidence that AT enhances reading, writing, and general academic performance (Tony, 2019; UNICEF, 2022) [34, 35]. Similarly, the gains in classroom participation and confidence align with earlier findings that AT positively influences engagement, motivation, and self-efficacy (Mohammed, 2018; Samaila, 2019) [23, 31], while the comparatively lower and more variable rating for independent task completion suggests that autonomy-related benefits are more sensitive to individual differences in disability type, device fit, and the availability of scaffolding support, an area meriting further, more fine-grained investigation.

At the same time, the challenges identified, principally device unavailability (57.1%) and technical unreliability (45.7%), demonstrate that high adoption and positive perceptions do not, by themselves, guarantee optimal implementation. These findings extend TAM by highlighting that external, structural conditions, such as infrastructure, maintenance systems, and device-to-student ratios, function as necessary enablers of the perceived usefulness/ease-of-use pathway, rather than as peripheral concerns (cf. Cygnet, 2019; Onejeme, 2017) [9, 27]. The knowledge gap reported by 22.9% of students, despite high overall usage, similarly indicates that training deficits identified in the teacher-focused literature (Wood, 2015; Olayemi & Oluwaseun, 2023) [26] also manifest at the level of the end users themselves, and that orientation for students, not only professional development for teachers, deserves greater attention. Encouragingly, the low incidence of peer-related stigma (5.7%) suggests that Metro Gold Schools has cultivated a relatively inclusive social climate around AT use, a condition that is not automatic in all settings and that likely reinforces the observed high adoption rates (Vincent *et al*., 2024) [36].

## 6. Conclusion

This study set out to examine the patterns, perceived effectiveness, and implementation challenges of assistive technology among students with special educational needs at Metro Gold Schools in the Ablekuma District of Ghana. The findings demonstrate that AT is both widely adopted and highly valued by students, with strong evidence that it supports academic performance, classroom engagement, and confidence, thereby lending empirical support to the core constructs of the Technology Acceptance Model within a special education context in a resource-constrained setting. At the same time, the persistence of availability, reliability, and knowledge-related barriers indicates that the conventional TAM framework, centred on individual perceptions, requires extension to account for the structural and infrastructural conditions that determine whether positive perceptions translate into consistent, optimal use. For students with special needs, AT functions less as a supplementary enhancement and more as a foundational access technology, underscoring the imperative of addressing the systemic gaps that currently constrain its full potential.

## 7. Recommendations

Based on the findings, the following recommendations are proposed. First, school authorities and education agencies should establish minimum standards for AT availability, including appropriate device-to-student ratios, to address the availability gap reported by more than half of AT users.

Second, systematic, scheduled maintenance and technical support protocols should be instituted to reduce the high incidence of equipment malfunction, supported where feasible by partnerships with technology providers. Third, dedicated budget lines for the procurement, maintenance, and replacement of AT devices should be secured, alongside exploration of grant and donor-funded schemes to support sustainable AT provision in special education programmes. Fourth, structured orientation and training should be extended not only to teachers but directly to students and caregivers, to close the knowledge gap that persists despite high device adoption. Finally, schools and policymakers should develop home-school AT access policies, including device-lending arrangements and clear guidelines for safe home use, to extend the benefits of AT beyond the classroom and to reinforce the multi-tech, individualised approach that characterises effective AT integration. Future research should extend this inquiry across multiple sites and larger samples to strengthen the generalisability of these findings and to examine the moderating role of disability type, teacher training, and school resourcing on AT effectiveness.

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