Assessment of Availability, Adequacy and Condition of High-Tech Assistive Technology Resources in Special Education Schools in North-West Nigeria

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***Abstract* – Development of assistive technology in education has been boosted with the recent innovations making way into special education schools worldwide. This survey assessed availability, adequacy and condition of high-tech assistive technology in special education schools in North-West Nigeria. The study used a questionnaire and observation checklist. Two hundred teachers (N=200) from special education schools in North-West Nigeria responded to the questionnaire. Multi-stage sampling technique was used to sample both schools and the respondents. The validity of the instruments was determined by experts from special education and educational technology while the reliability of the two instruments used was established through pilot testing and the reliability value of 0.81 and 0.74 was obtained for the two instruments, respectively using Cronbach Alpha and Kappa's inter-rater formulas. The data collected were analysed using frequency count and percentage. Findings of the study showed that 56% of the high-tech assistive resources necessary for quality teaching and learning in special education schools were not available. It was also observed that 44% of high-tech assistive resources found available were grossly inadequate to guarantee better special education service delivery for students with disabilities. It was recommended among others that both the Federal and State governments as well as, other stakeholders, should improve on funding the special education programme so as to ensure that the necessary assistive resources are provided in a required quantity and quality in special education schools among others. Hence, emphasis on their integration in planning curriculum and pedagogy for students with special needs.**

Keywords: **Availability, Adequacy, Special Education, High-Tech Assistive Technology**

I. INTRODUCTION

Developing countries like Nigeria have worked hard to improve access to basic and quality education. This includes the provision of free and compulsory education for all children as contained in the Universal Basic Education Act of 2004. However, there is still significant work to be done, especially in the development of special education. Today, over 13.2 million children of primary school age and 2.7 million adolescents are not going to school in Nigeria [10]. Bulk of these out of school Nigerians are people with disabilities; and with more than fifty percent (50%) of them found in the northern region of the country where physical and economic barriers, as well as socio-cultural norms and other practices, discourage formal education especially for girls and those with disabilities (Joint National Association of Persons with Disabilities ([5],[10]). Consequently, as it may, there is an increasing rate of street begging with most of the people involved having one physical challenge or the other. This is because their education has received very little political will, therefore, it is grossly underfunded, inadequately staffed and out-dated facilities and structures that are cited far away from the communities [5].

Although the issue of out of school children has become one of the national educational challenges, finding ways to reduce the number of out of school children from the street is a matter of national concern. Hence, there is the need to improve the education service delivery for all in Nigeria, most significantly for Nigerians with disabilities who as a result of their functional deficits never think it is possible to acquire formal education [12]. This will involve the provision and use of Assistive Technology (AT) to special education schools, rehabilitation centres and even workplaces.

Assistive technology in this context can generally be regarded to encompass the application of any forms of technology that can assist in the teaching and learning process of individuals with disabilities. Thus, it is an umbrella term which includes assistive, adaptive, rehabilitative technologies and related services which are made specifically to serve the purpose or adapted and used to serve as technical assistance for students with disabilities and professionals [1]. In this case, special education teachers and support staff. Assistive technologies differ widely in quality and effectiveness. Assistive technologies applications in special education are changing rapidly in recent years with wide varieties of choices which are embedded in the special education system [7]. Today, different assistive technologies are used to provide individuals with disabilities with educational opportunities, bringing out the cognitive potential in them, while enabling the curricula and teachers to achieve their objectives and the students to participate in the learning process. Assistive technologies used in the education process of individuals with disabilities have been grouped in various ways in the special education works of literature. [6] grouped assistive technology into low technologies, medium technologies and high technologies.

Low technologies (low-tech), are the common and inexpensive devices and tools purposively designed or

adapted to assist in those areas of difficulties. They include simple pencil-grips, magnificent eyeglasses, and large-print cardholder to mention but the few. However, researchers have noticed that with the recent technological advancement, assistive technologies application in education is also expanding rapidly with a wide variety of choices which can be included in the special education programme; and with these recent innovation penetrating schools worldwide more rapidly, low-tech AT is becoming more of crutch than academic support tools ([1],[8]).

Medium technologies (Mid-Tech) are the simple electronic devices (sometimes battery operated) and some relatively complicated mechanical devices like a wheelchair, audiotape recorder, and ordinary calculator among others [6]. With the application of mid-tech tools still the quality of special education also remains a significant issue; but there is a possibility that the emerging technology could be part of the solution [7].

These emerging technologies are known as high technologies (High-Tech) and they include the advanced electronic and computerized devices in the form of hardware and software that can offer help in writing, reading, reception of information and movement among other functions.

World over, assistive technology has been used as a principal driver of education for individuals with disabilities since the 19th century. Developing countries such as Nigeria, Brazil and Malaysia have adopted it as a major impetus in special education programme using them to promote basic education and even provide the necessary accommodation, substitution, modifications, adjustment, and adaptations that will help individuals with special needs to access curriculum, instruction, environment and employment. Unfortunately, what is noticed from previous researches like that of [4] and [2] shows that the country is yet to catch up with the recent development in assistive technology. In fact, the [14] report on assistive technology need across the globe indicated that in many low and mid-income countries like Nigeria, national assistive product service delivery does not exist, with poorer segment of the population having to wait for erratic donations and or charity services, which deliver large quantities of low quality or used products. This is often not appropriate for use in school or another educational context. On the other hand, some factors such as inadequacy of assistive decives, electricity for the usage of assistive decives, poor classrom structures which lack assistive decives, lack of assitive device awareness, lack of trained teachers to use assitive devices among others have limited the use and contributed negatively towards the conditions of High-tech assistive resources in special education schools in Nigeria [2].

Since there is a call for a shift from a tool-based AT to one that is computerized. The benefits to the use of high-tech assistive products promise to be huge, with these computerised AT products offering important opportunities to tackle the lack of abilities and malfunctioning. They can also help reinvent basic education for individuals with disabilities [6]. Therefore, the provision of these technologies as a means of teaching and learning should be a new area of priority for the governments in Nigeria. As more and more companies across the globe produce assistive products, AT prices and the cost of acquiring them have dropped [14]. This implies that there is a huge potential to reach those excluded from education systems as a result of functional disabilities. The quality of knowledge and skills that are taught in special education schools can also be improved through the implementation of computerized assistive technology (High-tech).

Just as the [13] recommended in the assistive technology priority list that assistive technologies, mostly high-tech should be available in special education schools so as to ensure better education services delivery to students with special education needs. Additionally, it is important that assistive technology resources provided should also be adequate. That is sufficiency in terms of quantity and quality of high-tech assistive resources. Although findings from previous researches like that emanating from [9] have discovered that assistive technology resources supplied was below the requirement for special education schools in North Central Nigeria. Considering the educational potentialities of high-tech assistive technology in the current quest for students-cantered learning and the renewed interest of the government towards reducing the number of out of school children, it has become necessary for educational providers to promote the supply and use of AT resources, and more specifically high-tech assistive resources in a quantity that will meet special education needs and guarantee quality education.

Despite the enthusiasm that may surround the application of high-tech assistive technology in the classroom, it is important to know that high-tech AT does not cure disabilities but play a significant role in assist in learning. It does not provide good teaching, but it can be used alongside a well-designed instruction to deliver quality instructions. It can assist students with disabilities to determine more independently. These set of technology can also help students to work more quickly and more accurately, while at the same time enabling them to navigate through classroom routines and achieve high goals. Hence, the study aimed at assessing availability, adequacy and condition of high-tech assistive technology resources in special education schools across North West Nigeria. Specifically, the study was guided by these three objectives stated below:

- Find out if there are high-tech assistive technology resources available for teaching and learning of students with disabilities in special education schools in North-West Nigeria.
- Assess the adequacy of the available high-tech assistive technology resources for teaching and learning of students with disabilities in special education schools in North-West Nigeria.

- Find out the functioning level of the available high-tech assistive technology in special education schools in North-West Nigeria.

II. RESEARCH METHOD

A. Research Model

The research design adopted for this study is a descriptive survey design. This is a quantitative type of research method that uses questionnaires to elicit numerical responses which are statistically analysed as to determine a conclusion using sampled participants that represents the larger population. A multi-stage sampling technique was used to arrive at the sample of the study. First, Purposive sampling technique was used to select three schools that enrolled students with all forms of physical disabilities (comprehensive special education schools) which were used for the study. This is because the three selected schools were among the only five special education schools that enrolled students with all forms of physical disabilities; two of which were used during pilot testing. The three selected schools included the Kaduna State Special Education School, Kaduna, Kebbi State Special Needs School, Birnin Kebbi and Special Education School, Tudun Maliki, Kano.

B. Participants

A sample of two hundred (200) teachers from special education schools in North-West, Nigeria participated were drawn through simple random sampling technique. Using hat-draw method, pieces of paper written "Yes" and "No" were folded for the teachers to picked from. Teachers who picked "Yes" option were selected, while those who picked "No" option were dropped. This was conducted in order to give the teachers an equal chance of representation.

C. Data Collection Tool

"High-Tech Assistive Technology Availability and Adequacy Checklist" (HATAAC) and "High-Tech Assistive Technology Condition Questionnaire" (HATCQ) were developed and used as the data collection tools for this study. The checklist included a list of high-tech assistive resources needed for the education of individuals with disabilities as presented in the Assistive Technology Priority List of the World Health Organization (2016) and Assistive Technology Requirement List (2018) for one of the special education schools under study which was eventually used as benchmark for determining adequacy. Equally, the questionnaire consisted of a list of high-tech assistive resources needed for the education of individuals with disabilities on the rating scale of" Good, fair and Bad" conditions for the teachers to choose from.

D. Collection of Data

The checklist consisted of 32 high-tech assistive devices/software for the teaching and learning of students with physical disabilities. The researchers used the checklist in finding which high-tech resources is available as well as the quantity of the available high-tech assistive resources in special education schools across North West Nigeria. Similarly, the questionnaire was used to determine the condition of the available high-tech assistive resources.

E. Data Analysis

The data collected were analysed using frequency count and percentage in SPSS. A decision percentage of below 50% was considered as not adequate while 50% and above was considered adequate.

F. Validity and Credibility

The validity of the instruments was determined by experts from special education and educational technology. Additionally, the reliability of the two instruments used was established through pilot testing and the reliability value of 0.81 and 0.74 was obtained for the two instruments, respectively using Cronbach Alpha and Kappa's inter-rater formulas.

III. FINDINGS

A. Findings on the availability of high-tech assistive technologies for teaching and learning of students with disabilities in special education schools in North-West Nigeria

The findings on the availability of high-tech assistive technologies are presented in Table 1.

TABLE 1
HIGH-TECH ASSISTIVE RESOURCES AVAILABILITY IN SPECIAL EDUCATION SCHOOLS

SN	High-Tech AT Resources	Available	Not Available
1	Desktop Computers	√	
2	Laptop Computers		√
3	Talking Calculators	√	
4	Digital Sign language Software	√	
5	Digital Magnifiers		√
6	JAWS	√	
7	Talking Dictionaries	√	
8	Captioning Television		√
9	Text-to-Speech Software		√
10	Portable Digital Assistant		√
11	Book Scanners	√	
12	Frequency Modulated Amplified System		√
13	Voice Recognition System		√
14	Multimedia Projector		√
15	Infrared Technology		√
16	Adaptive Keyboards	√	
17	Behind the Air Audio Enhancer	√	
18	In the air audio enhancer	√	

19	Audio Player/Mp3/4	√	
20	Talking/Touching Watches	√	
21	Gesture-to-Voice Technology		√
22	Electronic Wheelchairs		√
23	Screen Reader		√
24	Mobile Phones	√	
25	Dragon Natural Speaking		√
26	Speech for Good App.		√
27	Word Processor		√
28	Selection Switches		√
29	Speech-to-Text Software		√
30	Digital Recorder/SARA	√	
31	Braille Printer/Thermoform Machine	√	
32	Audio/Hearing Loops		√

The result in table 1 showed that out of the thirty-two (32) assistive resources needed for better special education service delivery, only fourteen (14) assistive technologies that include desktop computers, talking calculators, dictionary, adaptive keyboard, mobile phones, braille printer, book scanner, in the air audio enhancer, audio player/Mp3, talking watches, digital sign language software, JAWS, behind the air audio enhancer and SARA (digital recorder) were found available in schools.

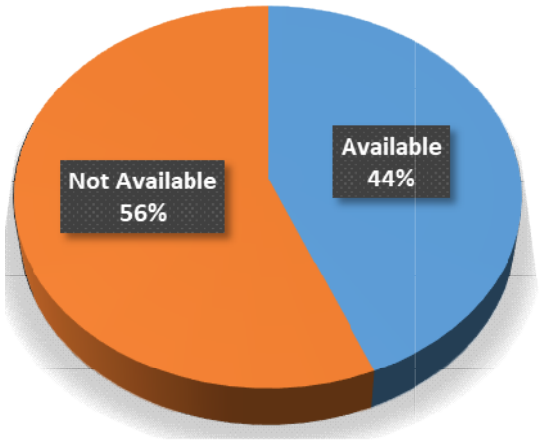

Fig. 1 Frequency of High-Tech Assistive Resources Availability

Fig. 1 shows that only 44% of assistive resources were available while 56% of other assistive resources were not available in those sampled schools. Generally, the results revealed that most of the high-tech assistive resources that are required for quality special education delivery are not available.

B. Findings on the adequacy of the available high-tech assistive technology resources for the teaching and learning of students with physical disabilities in special education schools in North-West Nigeria

The findings on the adequacy of the available high-tech assistive technology resources are graphically presented in Fig. 2.

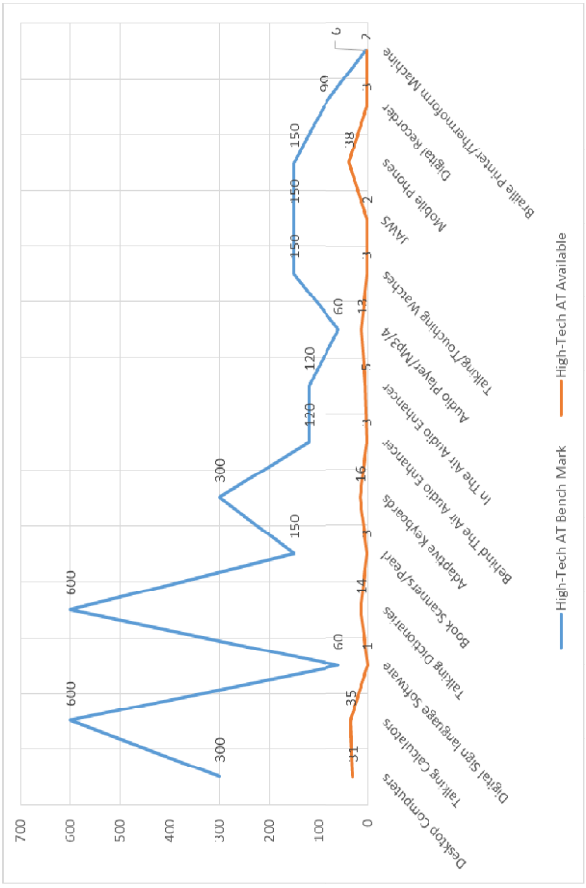

Fig. 2 Graph Representation of High-Tech Adequacy Responses and High-Tech Benchmark of Assistive Technology Resources

From the analysis of Fig. 2, to determine the adequacy the responses were converted to percentages (see Table 2).

TABLE 2
PERCENTAGE OF TEACHERS' RESPONSES ON THE ADEQUACY OF HIGH-TECH AVAILABLE ASSISTIVE RESOURCES IN SPECIAL EDUCATION SCHOOLS

SN	High-Tech AT Resources	% High-Tech Benchmark	% High-Tech available	Decision
1	Desktop Computers	100	10.3	Not Adequate
2	Talking Calculators	100	5.8	Not Adequate
3	Digital Sign language Software	100	1.7	Not Adequate
4	Talking Dictionaries	100	2.3	Not Adequate
5	Book Scanners/Pearl	100	2	Not Adequate
6	Adaptive Keyboards	100	5.3	Not Adequate
7	Behind the Air Audio Enhancer	100	1.7	Not Adequate
8	In the Air Audio Enhancer	100	4.2	Not Adequate

9	Audio Player/Mp3/4	100	21.7	Not Adequate
10	Talking/Touching Watches	100	2	Not Adequate
11	JAWS	100	1.3	Not Adequate
12	Mobile Phones	100	25.3	Not Adequate
13	Digital Recorder	100	3.3	Not Adequate
14	Multimedia Projector	100	33.3	Not Adequate

Decision Percentage Score = 50%

From Table 2, it can be observed that all the high-tech assistive resources found in special education schools received below fifty percentage (50%) scores, which indicated that they are grossly inadequate. From these results, it is reported that, of all the high-tech assistive resources found available in the sampled special education schools, none was adequately available.

C. Findings on the condition of the high-tech assistive technology available in special education schools in North-West Nigeria

Findings on the condition of the high-tech assistive technology available are presented in Table 3.

TABLE 3
PERCENTAGE OF TEACHERS' RESPONSES ON THE CONDITIONS OF HIGH-TECH AVAILABLE ASSISTIVE RESOURCES IN SPECIAL EDUCATION SCHOOLS

SN	Available High-Tech AT Resources	N	Good	Fair	Bad	Decision
1	Desktop Computer	200	117 (58.5%)	65 (32.5%)	18 (9.0%)	Good
2	Talking Calculator	200	69 (34.5%)	120 (60%)	11 (5.5%)	Fair
3	Screen reader	200	27 (13.5%)	109 (54.5%)	82 (41.0%)	Fair
4	Adaptive Keyboard	200	111 (55.5%)	61 (30.5%)	28 (14.0%)	Good
5	Book Scanner	200	101 (50.5%)	87 (43.5%)	12 (6.0%)	Good
6	Sign Language Software	200	51 (25.5%)	15 (7.5%)	134 (67.0%)	Bad
7	In the Air	200	105 (52.5%)	55 (27.5%)	40 (20.0%)	Good
8	Behind the Air	200	109 (54.5%)	41 (20.5%)	50 (25.0%)	Good
9	Audio player/ Mp3	200	100 (50.0%)	91 (45.5%)	9 (4.5%)	Good
10	Talking Watches	200	110 (55.0%)	29 (14.5%)	61 (30.5%)	Good
11	Braille Printer	200	93 (46.5%)	106 (53.0%)	1 (0.5%)	Fair
12	Talking Dictionary	200	47 (23.5%)	39 (19.5%)	114 (57.0%)	Bad
13	Digital Recorder	200	58 (29.0%)	101 (50.5%)	41 (20.5%)	Fair
14	Mobile Phones	200	113 (56.5%)	67 (33.5%)	20 (10.0%)	Fair

Decision Percentage Score = 50%

The results of Table 3 revealed that out of the 14 high-tech assistive resources found available in the sampled special education schools, only sign language software and talking dictionary was reported to be in deplorable condition. However, high-tech assistive resources such as computer, audio enhancers (in and behind the air), adaptive keyboards, book scanners, audio player, talking watches and mobile phones were reported to be in good condition, with each of the items receiving above (50%) rating from the respondents. Other high-tech assistive technology resources found in schools such as talking calculator, screen readers, thermoform machine and digital recorders were rated by the respondents as not totally in good condition, with each receiving above (50%) on the fair category. Hence, it can be deduced from these results that the majority of high-tech assistive resources found in special education schools are in good condition. While a few others were found not totally in good shape and very few of two were completely bad.

D. Summary of Findings

- It was discovered that most of the high-tech assistive resources necessary for quality teaching and learning in special education schools were not available.
- The few high-tech assistive resources found available in special education schools were grossly inadequate to guarantee better special education service delivery for students with disabilities.
- Most of the high-tech assistive resources found in special education schools were discovered to be in good condition; while the condition of the very few was fair.

IV. DISCUSSION AND CONCLUSION

As shown in the results for the first research question, responses generated from teachers from different special education schools revealed that assistive resources required for teaching and learning of students with disabilities were not adequately available in special education schools. This finding might be due to the fact that the special education programme like its sister education programme in Nigeria is ill-equipped with the necessary instructional and learning tools. This finding is in agreement with the previous finding of [11] which found that due to the scaring price tag of assistive resources, they are either not available or insufficiency for students with special needs to participate fully in the university education. The finding is also inconsistent with that of [9] which discovered that most of the special education schools in North Central Nigeria do not have the assistive technology resources that are required for quality special education. Additionally, this finding is in line with the finding of [4] which showed that the country is yet to catch up with the recent development in assistive technology.

Finding regarding the condition of the available assistive devices as presented in this study was based on three different conditions that include Good, Fair and Bad.

Consequently, special education teachers reported that most of the assistive resources available in their respective schools were functioning normally. Some few others were rated fair in condition. This finding could be attributed to the fact that most of these resources were found kept in school stores and were not always brought out for use. This corroborates with the finding of [3] which discovered unused assistive devices sitting on shelves in schools' stores while teachers were not even aware of their existence in the schools. However, this finding is not in conformity with the finding of [9] which discovered that assistive resources found in some special education schools were actually not of good condition.

Based on these findings, the researchers conclude that most of the high-tech assistive resources required for quality teaching and learning in special education schools across North-West Nigeria were not available. The few high-tech assistive resources found in special education schools were not adequate. This inadequacy of assistive devices necessary for teaching and learning of students with special needs could be attributed to poor funding of special education and lack of regular supply of assistive technology by the government. The study also concluded that the few high-tech assistive resources found in special education schools were in good condition.

E. Suggestions

Based on the findings of this study, the following suggestions were given:

- Both the Federal and State governments as well as other stakeholders should improve on the funding of special education programme so as to ensure that the necessary assistive resources are provided in a required quantity and quality in special education schools.
- Curriculum planners should see these assistive resources beyond just the high-tech they are, but life-changing technologies that can bring improvement in the way teachers teach and learners learn. Hence, emphasised their integration in planning curriculum and pedagogy for students with special needs.
- As technology is advancing generally, assistive technologies application in education is equally expanding; therefore, assistive technology providers should ensure that this innovation penetrates special education schools.

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