



THE CHALLENGES OF AFRICAN DEVELOPMENT WITH THE USE OF AFRICAN INDIGENOUS LANGUAGES FOR ICT, MATHEMATICS, SCIENCE AND TECHNOLOGY; YORUBA, HAUSA AND IGBO LANGUAGES OPTION.

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ABSTRACT

Prior to the advent of Europeans, all the Nigerian ethnic groups had their own distinctive cultures, traditions, languages and indigenous system of education. Their medium of instruction was their tongue (Fafunwa, 1996) as Reported by (Ojuope et al., 2021). The first formal (western) education was introduced in Nigeria in 1843 by Christian missionaries; their aim was to convert the heathen African to Christianity through education. Nigerian formal education was patterned after the English system. The emphasis was on 'English' both in thought and culture ability to speak English fluently was considered the hallmark of excellence; and fast majority of Africans most especially Nigerians cannot read and write in English Language (Fafunwa, 1996) as Reported by (Ojuope et al., 2021). This among other things makes access to Information Technology (IT), Mathematics, Science and Technology a difficult task for this category of people. The inception of COVID 19 Corona virus pandemic disease has brought about the challenge of using virtual method of teaching Information and Communication Technology (ICT), Mathematics, Science and Technology a necessity where teaching and learning becomes virtual. This paper focuses on The Challenges of African Development with the use of African Indigenous Languages for ICT, Mathematics, Science and Technology; Yoruba, Hausa and Igbo Languages option. The use of indigenous language will go a long way to increase the scientific skills of those that cannot read and write in English language. It will also help the physically challenged individuals that have little or no access to quality education as a result of difficulties they face in learning and comprehension. From the

report of World Health Organization (WHO) and World Bank (2011), physically challenged persons consist a significant proportion of the world's population, about 15%. The paper observes the degree of efficiency of the use of African Indigenous Languages for ICT, Mathematics, Science and Technology. The design and methodology was based on the research work we carried out in one of the government school for handicap children in Nigeria. From the cognitive ability testing of the research, we found out that the students learn faster and easier with the use of Yoruba developed applications than English Language developed applications. Base on this, the use of African Indigenous Languages for ICT, Mathematics, Science and Technology is highly imperative.

Keywords: African Development, Indigenous Language, ICT, Mathematics, Science, Technology, Virtual System, Education.

INTRODUCTION

Before the advent of colonial rule, African continent believed to be rich in culture and tradition and indigenous system of education. Their medium of instruction was their tongue (Fafunwa, 1996) as Reported by (Ojuope et al., 2021). The first formal (western) education was introduced in Nigeria in 1843 by Christian missionaries; their aim was to convert the heathen African to Christianity through education. Nigerian formal education was patterned after the English system. The emphasis was on 'English' both in thought and culture ability to speak English fluently was considered the hallmark of excellence.

It was observed that a vast majority of Nigerians (Africans) are not capable of reading and writing in English language. Whereas, the major language of use apart from signs and symbols to develop computer packages in Nigeria is English Language; this makes it difficult to most Nigerians accessing of information technology, Mathematics, Science and Technology (Fafunwa, 1996) as Reported by (Ojuope et al., 2021). However, this should be seen as a challenge to the multitude of software developers, Mathematicians and Scientists that abound in Africa, they should imitate countries like China and India to develop computer compilers and application software, mathematics, science and technology signs and symbols that are African-language friendly. This may be a way of surmounting the language obstacles in the accessing of IT, in Nigeria rural communities and this will contribute to sustainable national development; and among other things will enable us to achieve millennium development goals.

Clinical description of Learning Affected Persons

From the report of Learning Impairment Rights Service Inc. (2009), Learning affected persons find it difficult to learn and comprehend and this manifest during the developmental period of life that is before the age of 18, and is characterised by below average intellectual functioning. Several people with Cognitive Impairment are born with the disability. Significantly sub-average collective intellectual functioning is defined as approximately 70 IQ or below as measured by a qualified psychological examiner on Intellectual disability, nationally formed standardized measures of intelligence.

Clinically, and for the purposes of proving that a person has Learning disability, Learning disability is best assessed by a psychologist as:

- a. an IQ of 70 or under.
- b. deficits in at least 2 areas of adaptive behaviour, that is:
 - i. Communication
 - ii. Self-care
 - iii. Home living
 - iv. Social skills
 - v. Self direction
 - vi. Leisure and work
 - vii. Learning.

These categories of people find it difficult to read and write using English Language; whereas most of those living with Learning difficulty can still learn and comprehend faster with the use of their indigenous languages (Ojuope et al., 2021).

Table 1 Clinical description of Learning Challenges

Level of disability	% of people with Learning disability	IQ
BORDERLINE		70-75
MILD (Educable)	75%	55-70
MODERATE (Trainable)	20%	30-55
SEVERE (Totally dependent)	5%	under 30

Source: (IDRS Inc. 2009)

People with Intellectually Challenged Person have little or no access to education due to reasons as:

- a. poor societal perception of persons living with disability
- b. poor funding
- c. policy instability
- d. lack of commitment
- e. curriculum development and

Expression of Yoruba Standard Word

Yorubá is one of the three major languages spoken in Nigeria. Yoruba language is spoken by the South western part of Nigeria and other countries like Republic of Benin, Togo and part of Ghana. It is widely spoken language because of its prevalence both in Nigeria and outside Nigeria (Odetunji, 2008).

The Yoruba Alphabet

Yoruba alphabet has 25 letters which is made up of Eighteen (18) consonants (represented by the graphemes: (*b, d, f, g, gb, h, j, k, l, m, n, p, r, s, s., t, w, y*) and seven (7) vowels (*a, e, e., i, o, o, u*) while the Latin Letters $\langle c \rangle$, $\langle q \rangle$, $\langle v \rangle$, $\langle x \rangle$, $\langle z \rangle$ are not used. There is also addition of a diagraph $\langle gb \rangle$ which combines two consonants together that form a unit (Adeyemo and Idowu, 2015).

Yoruba Vowel

Phoneme Orthography Examples English

/a/	a	ajá	'dog'
àbá		'motion'	
/e/	e	ewé	'leaf'
Ètè		'lips'	

as in English bait

/ e /	e	è j è	blood
è f è		jest	

as in English 'bet'

/i/	I	ìrì	'dew'
ìdí		'buttocks'	

as in English 'beat'

/o/ o owó 'money'

òdo 'zero'

as in English 'boat'

/ ɔ / or / ɔ̃ / c ɔfò

incantation

ojó , day

as in English 'bought'

/u/ u ojú 'eye/face'

òwú 'thread'

as in English 'boot'

Adapted from:

African Studies Institute manual, University of Georgia, USA

RELATED WORKS

Ojuope *et al.* (2021) worked on developing ICT base virtual assistive system in Sub-Sahara African indigenous language Yoruba language option to promote virtual collaboration ability of Intellectually Challenged Yoruba ethnics living in rural communities for sustainable development during the COVID 19 lock down. They affirm that the inception of COVID 19 Corona virus pandemic disease has brought about the challenge of using Information and Communication Technology (ICT) in teaching and learning systems. The use of ICT in education is no longer a new idea, but the question is where the limit is when the use of ICT does not have the desired effect, most especially on the Intellectually Challenged individuals that cannot read and write in English Language. Most systems were developed without considering the fact that, there are different categories of users including people living with disabilities. Base on this, developing ICT base virtual applications in Yoruba Language option that will encourage the virtual learning ability of these individuals during the COVID 19 pandemic outbreak is highly imperative.

Ojuope *et al.* (2020) worked on Developing User Experience Interface in Yoruba Language in Improving Usability of the Intellectually Challenged that cannot Read and Write in English Language. From the work, it was observed that most

interfaces were developed without considering the fact that, there are different categories of users including people living with disabilities. This paper focuses on the development of interface in African Language using Yoruba language option that will promote the user experience of persons with intellectual disability. Theoretical framework on Human computer interaction (HCI) was also carried out and several related articles were reviewed. The design and methodology was based on development of usability interface for people with intellectual disability using one of the government school for handicap children in Nigeria. During the process of this research, we discovered that most of the work reviewed did not focus on the use of local language to develop usability system for this category of persons.

Adeyemo and Idowu (2015), worked on Development and integration of Text to Speech Interface for Visually Impaired Users in Yoruba language. In the work, Text to Speech was described as a process whereby a system accepts text as input and produces a corresponding human voice of the text input. In the paper, Text to speech was developed in Yoruba language to assist users, it equally assist the users that want to learn Yoruba language from scratch, this includes how to learn, pronounce Yoruba language syllable formation from consonant and vowel. Standard performance error metrics was employed to measure the performance of the model. was also measured using a standard error metric. In the work, C# Programming language. Was used to implement a concatenative method of speech synthesis through syllable construction algorithm. And the the performance of the system was measured as well as the quality of 7synthesized speech was evaluated using Mean Opinion Score (MOS) tool; and the result generated was found to be 4.46 and 3.82 respectively. The use of MOS scale proved that the system was a good one.

METHODOLOGY

This section analysed the difficulties faced by the individuals that cannot read and write with the use of English Language in accessing Information Technology device, Mathematics, science and Technology signs, symbols and tools. From the research carried out by the author of this paper in Home School for Handicapped Children, Ibadan, Oyo State 2028, It was discovered that, these people have little or no access to computer and IT facilities due to their inability to read and write in English Language. So they find it difficult to learn and comprehend. Users with

Learning Challenges have problem with navigating around applications, either due to the fact that:

- a. the tools are cluster and difficult to access
- b. the images / pictures of the tools are too small to understand
- c. the Text are not easy to memorise; and
- d. the Text are too small to learn and comprehend.

Interpreting those ICT tools, Mathematics, science and Technology signs and symbols becomes imperative; this will enhance digital inclusion of these people and further promote job creation.

Learning Challenges is significantly sub-average general Learning functioning which exists concurrently with deficits in adaptive behaviour that adversely affects educational performance and originates before age 18 (WHO and World Bank, 2011).

From the report of Intellectual Disability Rights Service (IDRS) Inc. (IDRS, 2009), Intellectual disability is a disability which occurs in the developmental period of life (i.e. before the age of 18) and is characterised by below average intellectual functioning. Most people with intellectual disability are born with the disability. People living with Learning disability have difficulties in access ICT application interfaces, Science and Technology tools, this problem involve, time spent to complete a particular task. From the study we carried out, we discovered that most Africans most especially people living in rural communities and people living with physical challenges never had access to computer / Internet facilities talk less of science and technology signs and symbols. This is because most of the application tools were developed in English Language which makes it difficult for users that cannot read and write in English Language to access. Also the tools of the applications being widely used are too complex for them to learn and comprehend. As a result of this, it will be of great advantage if for African scientists to translate it into African indigenous languages such as Yoruba, Hausa and Igbo (Table 2 and 3).

Tabla 2 Ccomputer / ICT Keywords in Hausa and Yoruba languages

S/N	ENGLISHH	HAUSA	YORUBA
1	File	File	Faili
2	Edit	Gyaran rubutan	Atunse
3	View	Duba	Fihan

4	Insert	Shigar da	Fikun
5	Format	Tsara	Fomati
6	Tools	Kayan aiki	Ohun Elo
7	Table	Gidan dara	Tabili
8	Window	Taga	Ferese
9	Help	Taimako	Iranlowo

Table 3 Translating Science and Technology terms from English Language to Igbo Language

ENGLISH	EXPLANATION	IGBO
access control	A security technique that can be used to regulate who or what can view or use resources in a computing environment.	nchekwa kembanye
ad blocker	A software product that prevents advertisements from appearing with the content the user is intentionally viewing.	mgbochi mgbasa ozi
address bar	The familiar text field at the top of a web browser's	àdreèsi njirichọta
address book	A location of data, usually in main memory or on a disk. You can think of computer memory as an array of storage boxes, each of which is one byte in length.	akwụkwọ àdreèsi
ADSL modem	Asymmetric digital subscriber line (ADSL) is a type of DSL broadband communications technology used for connecting to the Internet. ADSL allows more data to be sent over existing copper telephone lines.	mọdem ADSL
ADSL provider	ISP i.e Internet Service Provider.	ihe na-eme ka ADSL rụọ ọrụ
antivirus provider	A utility that searches a hard disk for viruses and removes any that are found.	ihe na-ewepụ nje
Bandwidth	The amount of data that can be transmitted in a fixed amount of time or range within a band of frequencies or wavelengths.	mkpụrụọzi nziga

Bookmark	In the context of the World Wide Web, a bookmark is a Uniform Resource Identifier (URI) that is stored for later retrieval in any of various storage formats.	usoro nchoputa ihe nchekwa
chat group	A group created for a group of people in order to share likely ideas.	otu mkpakorita uka
Uplink	A wireless connection from a local area network (LAN) to a wide area network (WAN)	mjikọ kemgbago
Startup	Starting something in motion	Mmalite
Popup	A graphical user interface (GUI) display area, usually a small window that suddenly appears (pops up) in the foreground of the visual interface on the world wide web.	popopu
news group	A worldwide network of news discussion group.	otu mkpakorita uka ndi nta akukọ uwa - ebe mkpakorita uka - otu ndi nta akukọ - ebe nzukọ
navigation bar	A user interface element within a webpage that	ịba Ntaneti
encrypton system	The encryption protects the confidentiality of digital data stored on computer systems or transmitted via the Internet or other computer networks.	usoro nzowe ihe na kọputa
Firewall	A network security device that monitors incoming and outgoing network traffic and decides whether to allow or block specific traffic based on a defined set of security rules.	mgbochi mbata ozi ojọọ
FTP access	FTP is used to transfer files between computers on a network.	mnweta FTP

hyperlink	In computing, a hyperlink, or simply a link, is a reference to data that the reader can directly follow either by clicking, tapping, or hovering.	usoro mbanye kõmputa
intelligent agent	An intelligent agent is software that assists people and act on their behalf	kõmputa mnyemaka

Source: Felix and Okeogu (2018)

From **table 2 and 3**, we can see that interpreting ICT tools, Science signs and symbols into African indigenous languages will encourage African software developers and scientists to develop computer compilers and application software, mathematics, science and technology signs and symbols that are African-language friendly **Figures 1 to 4**. This may be a way of surmounting the language obstacles in the accessing of IT and science signs and symbols in African rural communities and this will contribute to sustainable national development; and among other things will enable us to achieve millennium development goals.

A model of Yoruba word pad



Figure 1: A model of Yoruba Word Pad

A model of Yoruba browser

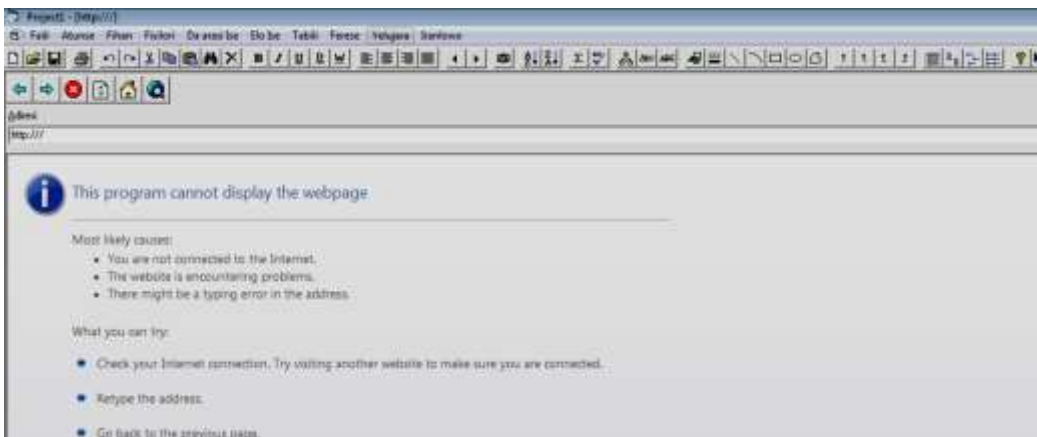


Figure 2: A model of Yoruba Browser

A model of Hausa word pad

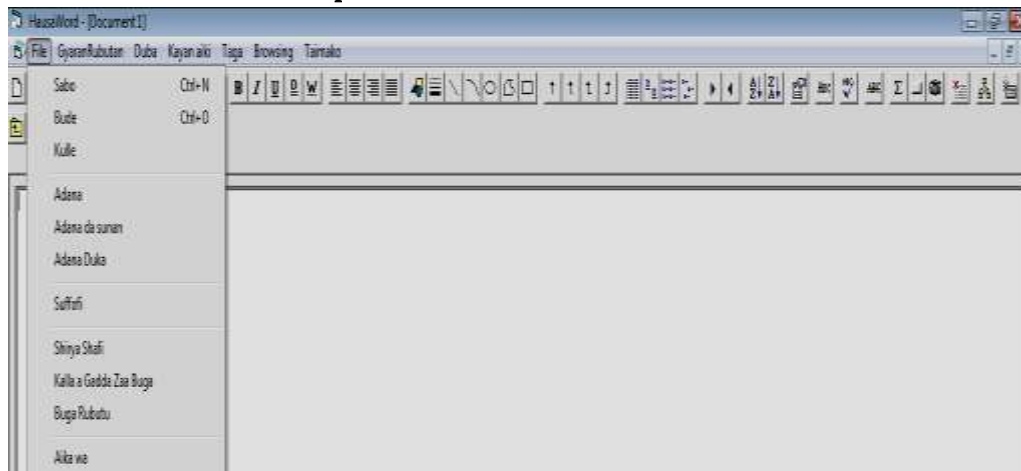


Figure 3: A model of Hausa word pad

A model of Hausa Browser

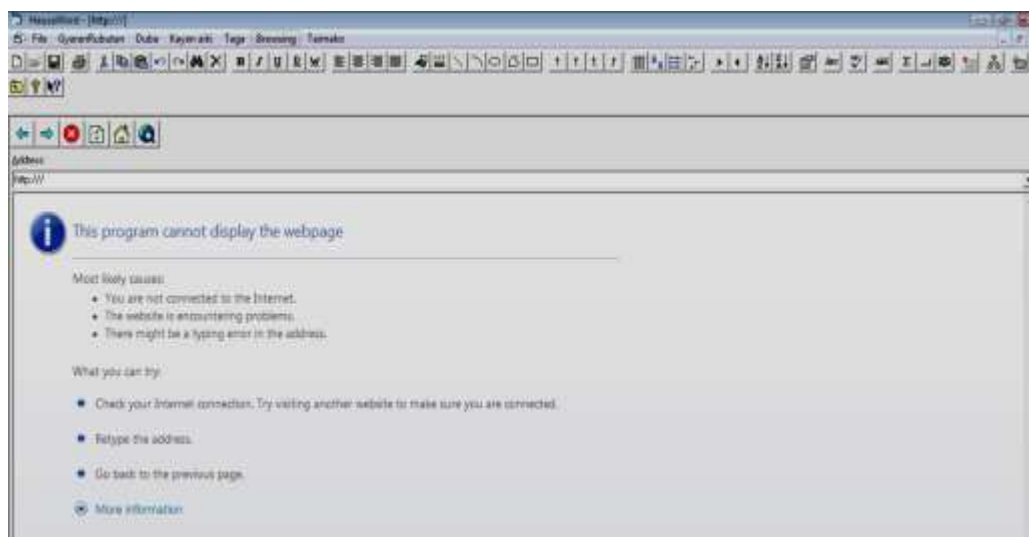


Figure 4: A model of Hausa Browser

Economic and social impact of interpreting ICT, Mathematics, Science and Technology into African Indigenous Languages.

Most Africans living in rural communities have little or no access to ICT, Science and Technology which are the principal resources that drives economy base on:

- a) Inability to learn and comprehend western education.
- b) poor funding
- c) policy instability

- d) lack of commitment
- e) curriculum development and
- f) focusing on resources base economy rather than knowledge base economy.

National Council on Disability (NCD) (2011) submitted that the power of Digital inclusion pave way for high job opportunities in the society and digital barrier has brought about low employment among people with disabilities. Manipulation of information has pave way for job creation for people with disability, it gives opportunity for these category of users to work alongside non-disabled people. Consequently, the job opportunity rate of persons with disability still remains extremely low (fig.1). Development and improvements in assistive technology can go a long way to bridge this gap. Information society is being built on technology, knowledge and intelligence; appropriate use of the knowledge by people with intellectual disability contributes to economic and social development. Information technology facilitates fast, cheap, equitable, and resource efficient; access to information, adequate research for learning opportunities become a support tools for job creation and sustainable development.

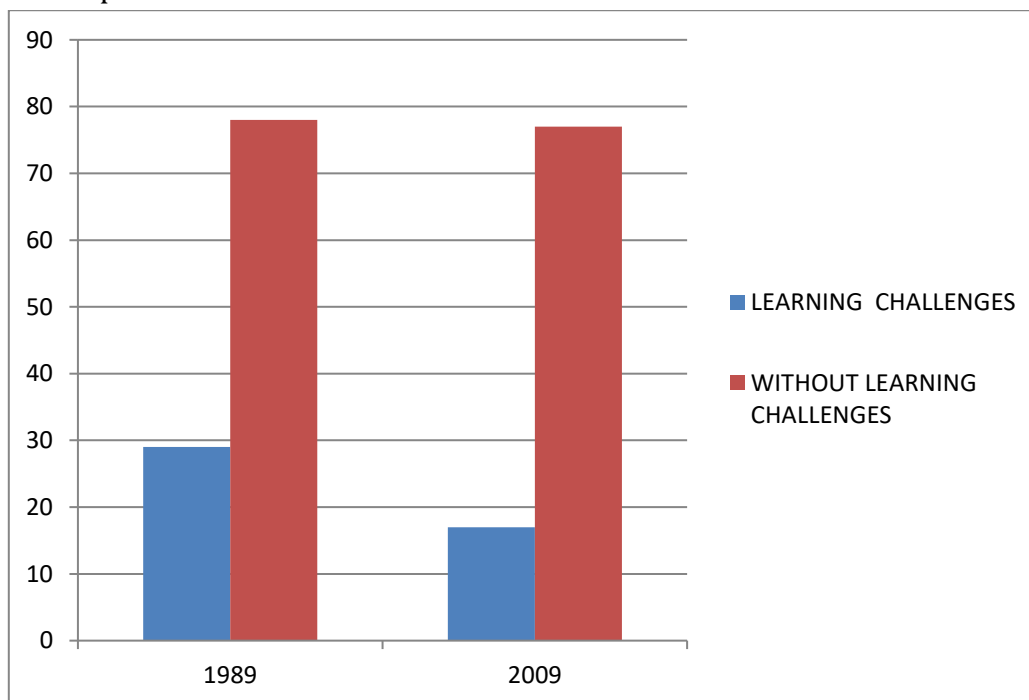


Figure 5: Comparing Employment Rates, 1989 and 2009. Source NCD 2011

From figure 5, it is very clear that lack of formal education affects rate of employment and as well rate of productivity. Therefore the use of African indigenous languages for ICT, Mathematics, Science and Technology becomes highly imperative.

Participants selection

Experienced computer users participated in the test of the appropriateness of the guidelines and some selected staff of Home school for handicapped children, Ijokodo, Ibadan were used. Fourt (4) participants, the educable category of students' of the school were tested. These students cannot read and write in English Language very well but they can read and write in Yoruba Language very well.

Implementation

Implementation is the construction of the new system and the delivery of that system into production (that is day-to-day business or organization operation. It is the process of defining how the information system should be built (i.e., physical system design), ensuring that the information system is operational and used.

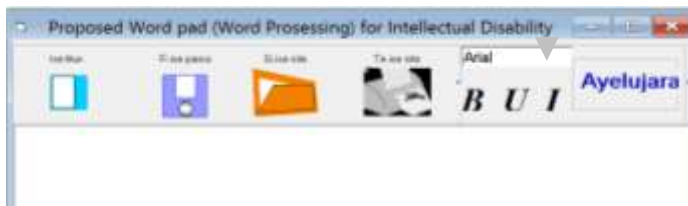


Image 6. Word Pad model in Yoruba Language

The simple word pad has tabs for create new document, save document, open document, print document and browser. From the browser, the user can have access to the web browser. There are also tools like bold, underline, italics and font type.

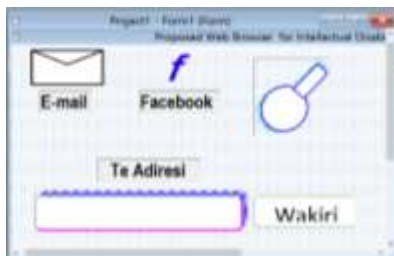


Image 7. Web Browser model in Yoruba Language

The browser has a web Address (Adiresi) where the user can enter the web address to search, and search (Wakiri) tab where the user can click to

start searching. It also has E-mail and Facebook tabs where the users have direct access to sign in and open e-mail and facebook respectively.

System Testing

The test was conducted with the students of Home school for handicapped children, Ijokodo, Ibadan, Oyo State, Nigeria based on the concept of Accessible Website Content Guidelines for Users with Intellectual Disabilities, Joyce Karreman et al (2007). Parametric ANOVAs (Analysis of Variance) were applied, with the use of T-Test. The test assesses whether the means of two groups are statistically different from each other.

Results

Satisfaction with the application

The satisfaction of the participants with the versions of the applications was tested by asking them to express their opinions on a 15-item questionnaire. The mean scores of the participants were taken with the use of a rating scale. The participants used NA Application had mean score of 1.08 and the participants used A Application had the mean score of 4.95 The difference in mean score is 3.87 and the difference in the SD is 0.099. This is statistically significant. The questions were used to compare the satisfaction of the participants with the versions of the applications. The participants used A Applications expressed their 98.6% satisfaction with the applications while the participants used NA Application expressed their 78.4% frustration (Dissatisfaction) with the applications. All the Participants preferred the A Applications.

CONCLUSION

In conclusion, the usability performance metrics used to measure the performance accuracy of the system during the system testing shows that the objective of developing ICT based assistive system in Yoruba Language to promote learning ability of the Intellectually Challenged during the COVID 19 pandemic challenge have been achieved. The degree of efficiency of the system was compared with the Applications developed in English Language it recorded high efficiency. Therefore the use of African indigenous languages for ICT, Mathematics, Science and Technology becomes a necessity.

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