



West African Journal of Industrial and Academic Research

ISSN : 2276-9129 , Volume 25, No.1, February 29, 2024

<https://wajiaredu.com.ng>

Editor-in-Chief: Prof. Oliver E. Osuagwu, DSc CS, PhD IT, FNCS, FBCS CITP, MIEEE, MACM

Editorial Board: Prof Tony B.E. Ogiemien, PhD, BL, (USA), Engr. Prof E. Anyanwu, Ph.D, FNSE, Prof. G. Nworuh, PhD,, Dr. B. C. Ashiegbu, PhD ,Prof .E. Emenyionu, PhD, (Connecticut USA,) , Prof. E.P. Akpan, Ph.D, Engr. Prof. C.D. Okereke, Ph.D, Prof. B.E.B. Nwoko, Ph.D, Prof. N..N. Onu, PhD, Prof M.O. Iwuala, PhD, Prof C.E.Akujo, PhD, Prof. G. Okoroafor, PhD, Prof Leah Ojinna, Ph.D (USA),, Prof. E. Adagunodo, PhD, Prof. J.C .Ododo, PhD, Dan C. Amadi, PhD (English), Prof.(Mrs) S.C. Chiemekwe, PhD,FNCS, Prof (Mrs) G. Chukwudebe, PhD, FNSE, Prof. E.N.C. Okafor, PhD, (Mrs) I. Achumba, PhD, Prof. T. Obiringa, PhD, Prof S. Inyama, PhD, Prof. C. Akiyoku, PhD, FNCS, Prof. E. Nwachukwu, Ph.D, FNCS, Prof. S. Anigbogu, PhD,FNCS, Prof. H. Inyama, PhD, FNSE, Prof J..N. Ogbulie, PhD, Prof. M..M. Ibrahim, PhD, Prince Prof Oghenekaro Asagba, PhD , Prof N.T.A Ukwuoma PhD, Prof H.E Ukhurebor PhD

Published by:

Oliverson Industrial Publishing House

The Research & Publications Division of **Hi-Technology Concepts (WA) Ltd**

For The

International Institute for Science, Technology Research & Development, Nigeria & USA

All rights of publication and translation reserved. Permission for the reproduction of text and illustration should be directed to the Editor-in-Chief @ OIPH, 1 Secceit Rd, Hispancon Metropoils, Egbo, Owerri North, Nigeria. or via our email address or the international office for those outside Nigeria

© **International Institute for Science, Technology Research & Development, [IISTRD] Owerri, Nigeria/USA**

RESEARCH AND PRODUCTION

Malaria Diagnostic System using Deep Neural Network (DNN)	4
Rosemary Chika Nweze ¹ , Unoh, Inyang Nkanu ² , Victoria Ukamaka Maduahonwu ³ , Sunday Ogbonnaya ⁴ , Confidence Ifeoma Odoh ⁵	
Public Debt Profile, Economic Growth and Sustainability in Nigeria	14
Peter Chinyere Uruakpa ¹ , Zeph Chibueze Abaenewe ²	
Linguistic Representations Of Power Dynamics in Fine Arts Administration Discourse: An Overview	24
Jovita Charles Ogu ¹ , Pauline Nwizu ² , Rose Kalu ³	
Assessment of the Relationship between Psychosocial and Psychopathological, Issues among Senior Secondary School “Biology Students” in Covid-19 Era	32
Joy Ngozi Maduka ¹ , Lasbrey Izuchukwu Anyiam ² , Elizabeth Nkiru Okezie ³	
Investigating The Relevance of Artificial intelligence in Teaching of basic science and Technology in Isiala Mbano	42
Rowland Chibuike Nzeako ¹ , Fransica Chinwe Igwe ² , Fiat Mary Uzoegbu ³ , Magnus C. Unegbu ⁴	
Integration of Global Perspectives and Cultural Competency in Digitalized Curricula: Benefits and Challenges	51
Ursula Obiageli Ibebuike ¹ , Ifeyinwa Okoro ² , Chisom Cynthia Ali-Okoro ³	
Impact of hardware-based digital microteaching practicum on pre-service teachers’ acquisition of teaching skills and retention	62
J.C . Anulobi ¹ , Chukwuemeka Dike ² , Chinwendu Onyenma ³	
Digitalization and Emerging Issues in Social Studies: The Alvan Ikoku Federal University of Education Experience	75
Ebeniza Ndubuisi Ajuzie ¹ , Ngozi Ndubuisi Ajuzie, ² Gladys Ijeoma Ohanyere ³	
Digitalization of Special Education: A rebranding Dynamics Towards Sustainable Development in Nigeria	86
Maurice Ejike Njoku ¹ , Laurence Chigbo Ohaeri ²	

Exploring The Impact Of 'Innovation Labs' in Fostering creative work, Engagemen and innovation among students in Secondary schools in Njaba LGA, Imo state Ngozi J. Izuagba ¹ , Chika F. Ahamefula ² , Mary Chioma Blessing ³	94
Digital Technology: A means in distance and adult education in Nigeria Patience C. Ibe ¹ , Chioma Unezoh ² , Ibe, Evarest Onyewuchi ³	103
Influence of Digital Transformation on the Education of Learners with Visual Impairment for Sustainable Development in Imo State Uche E. Opara ¹ , Isaiah A. Makam ² , Geraldine N. Omerekpe ³ , Promise N. Okoro ⁴	108
The Paradox of Human Progress: A philosophical, Sociological, and Historical Reflections Obinna Nwoko ¹ , Ugochukwu Njoku ² , Beauty Okoronkwo ³	116
Comparative Effectiveness of Assistive Technology Devices (Palpable medium and Digital Audio Mediated Instruction) on English Language Achievement among Students with Visual Impairment in Abia state Nigeria Gertrude Ekwim ¹ , MaryAnn Iheme ² , Charles Onwubiko ³	121

Editor-in-Chief: Professor O.E. Osuagwu
D.Sc, FNCS, FBCS, MIEEE

Malaria Diagnostic System using Deep Neural Network (DNN)

Rosemary Chika Nweze¹
Unoh, Inyang Nkanu²
Victoria Ukamaka Maduahonwu³
Sunday Ogbonnaya⁴
Confidence Ifeoma Odoh⁵

^{1,3,5}Computer Science Department, State University of Medical & Applied Sciences, Igbo-Eno, Enugu State, Nigeria,

²ICT Unit, Ministry of Agriculture, Calabar, Cross River State, Nigeria,

⁴Department of Computer Science & Mathematics, Evangel University, Akaeze, Ebonyi State, Nigeria

Abstract

Malaria is one of the major public health challenges caused by the plasmodium parasite. Various methods being used for the diagnosis of this disease ranges from microscopy which remains the gold standard for laboratory confirmation of malaria parasite in a blood sample. The process is time consuming, labor intensive, requires trained personnel, and depends on the quality of the microscope thus the need for a computer aided approach. An open source dataset was obtained from National Library of Science to train the model. The model was trained on a visual geometry group 16 convolutional neural network pre-trained model. We used deep neural network framework and some deep learning libraries such as keras, tensorflow, matplotlib, seaborn, sklearn and numpy based on python programming language. CRISP-DM methodology and very deep learning feature representation was used in the analysis. We deduced a model whose sensitivity score is higher than that of our predecessor. The model achieved 98% sensitivity score based on metrics validity library which outperformed 93% achieved by the previous authors. We developed a robust and user friendly desktop application that classifies malaria blood samples as infected or uninfected with percentage accuracy.

Keywords: Malaria, visual geometry group 16 convolutional neural network, deep neural network, sensitivity score

1.Introduction

Malaria is a life threatening disease common in Sub-Sahara Africa, Asia, Central and South America (Caraballo *et al.*, 2014). It is transmitted through the bite of a female *anopheles* mosquito (Poolphol *et al.*, 2017). The mosquito bite injects *plasmodium* parasite into the host bloodstream. The parasites grow and multiply first in the liver cells and then in the red blood cells until it bursts. This releases more parasites in the blood stream

and the infected person begins to develop symptoms. In 2018, there were 213 million malaria cases and nearly 85% of global malaria death from the World Health Organization (WHO)

African Region for which Nigeria accounted for almost 24%. In 2019, there were an estimated 229 million cases of malaria and 409, 000 malaria deaths

worldwide (WHO, 2020). Nigeria suffers the world's greatest malaria burden, with approximately 51 million cases and 207, 000 deaths reported annually (WHO, 2017). According to World Health Organization world malaria report 2021, there were 241 million cases of malaria worldwide in 2020, resulting in an estimated 627, 000 deaths. The latest World Malaria Report shows that the WHO African Region bears a high percentage of the global malaria burden, with Nigeria having the highest

burden in the world. In 2022, the African region was home to approximately 95% of all malaria cases and 96% of deaths, with children under the age of five accounting for 80% of all malaria deaths. Nigeria alone accounted for (31.3%) of global malaria deaths, followed by the Democratic Republic of the Congo (12.6%), the United Republic of Tanzania (4.1%), and Niger (3.9%). In Nigeria, malaria remains a significant public health challenge with an estimated 97 million cases and 300,000 deaths annually. Although progress has been made in reducing the burden of this disease, much work still needs to be done to eliminate it. Different studies have shown that the prevalence of malaria parasite has increased since 2015 (Dhiman, 2019; Kassam *et al.*, 2021). Malaria accounts for 60% of outpatients visits to hospitals and 40% mortality rate especially among children. Since 2010, World Health Organization (WHO) recommended that all suspected cases of malaria should be confirmed either through microscopy or a rapid diagnostic test before treatment (WHO, 2020).

The latest World Malaria Report shows that the WHO African Region bears a high percentage of the global malaria burden, with Nigeria having the highest burden in the world. In 2022, the African region was home to approximately 95% of all malaria cases and 96% of deaths, with children under the age of five accounting for 80% of all malaria deaths. Four African countries, including Nigeria, accounted for over half of all malaria deaths worldwide. Nigeria alone accounted for (31.3%) of global malaria deaths, followed by the Democratic Republic of the Congo (12.6%), the United Republic of Tanzania (4.1%), and Niger (3.9%). In Nigeria, malaria remains a significant public health challenge with an estimated 97 million cases and 300,000 deaths annually. Although progress has been made in reducing the burden of this disease, much work still needs to be done to eliminate it.

Diagnostic testing enables health providers to swiftly distinguish between malaria and non-malaria fever, facilitating appropriate treatment. Over the years, malaria diagnostic tools have expanded, from the conventional microscope examination of *giemsa*-stained blood films to rapid diagnostic tests (RDTs), serology test and molecular diagnostic methods which includes polymerase chain reaction, flow cytometry assay

technique (FCM), loop mediated isothermal amplification (LAMP) and quantitative buffy coat (QBC) (Onile-ere *et al.*, 2016).

To diagnose malaria using a microscope, a drop of the patient blood is taken and spread on a glass slide, which is then immersed in a staining solution such as *giemsa*; field or wright stain to make the parasites more visible under a microscope (Woronzoff-Dashkoff, 2002). This technique remains the gold standard for laboratory confirmation of malaria (Makhija *et al.*, 2015; Bharti *et al.*, 2007; Mbakilwa *et al.*, 2012).

Microscopy test results are affected by multiple factors such as the experience and the skill of the person performing the test. Results obtained through microscopy are only as reliable as the personnel and the laboratories where the tests are performed. It is labor intensive and time-consuming because the expert has to manually count the number of parasites in each blood sample (Keiser *et al.*, 2002). Difficulties in detecting parasites in low parasite density samples, overloaded laboratory personnel, ineffective quality control and assurance, and poor condition of microscope can also lead to unreliable results (Mbakilwa *et al.*, 2012; Ohrt *et al.*, 2002; Wongsrichanalai *et al.*, 2007; McKenzie *et al.*, 2003). Microscopy represents more than half of all the malaria diagnostic tests performed in 2018 (Horning *et al.*, 2021). With these challenges faced with the microscopy method which is the gold standard for laboratory confirmation of malaria, there is need to use computer aided diagnostic approaches like machine learning and deep learning in malaria diagnosis. Machine learning uses discrete feature extraction which is time consuming for large dataset and can lead to incorrect discrimination between classes, hence the need to use convolutional neural network (CNN) which is a class of deep neural network that performs automatic feature extraction on these datasets.

2. Related Works

There have been several notable research achievements in the area of malaria diagnosis using both machine learning and deep convolutional neural networks. The authors adopted approaches ranging from traditional machine learning algorithm to a more advanced deep learning algorithm.

Automated systems that depend on traditional machine learning and image processing techniques perform poorly in image classification and object detection tasks as they depend on handcrafted features. The primary aim is to train the existing dataset so as to achieve good accuracy and sensitivity score.

Several authors have used machine learning algorithms to detect malaria parasites in blood samples (Devi *et al.*, 2018; Molina *et al.*, 2020; Yang *et al.*, 2017; Linder *et al.*, 2014; Olugboja *et al.*, 2017). The classical machine learning approach follows the following steps: acquisition of stained microscopy images, image preprocessing, image segmentation, feature extraction/ selection and classification.

Extraction of features for model building is an important step in machine learning for automatic identification of patterns and relationships from large datasets. In general, a feature describes a property derived from raw data input with the purpose of providing a suitable representation. Thus, feature extraction aims to preserve discriminatory information and separate factors of variation relevant to the overall learning task (Goodfellow *et al.*, 2016). However, such classical approaches to feature extraction and selection are currently being replaced by deep learning techniques which does not rely on handcrafted features but perform feature extraction automatically.

Almost all machine learning classification methods popular in the last decade have been applied to malaria diagnosis, ranging from naive bayes tree (Anggraini *et al.*, 2011; Das *et al.*, 2015;), Bayesian classifier (Mushabe *et al.*, 2013; Das *et al.*, 2013; Ghosh *et al.*, 2013), Logistic regression tree (Das *et al.*, 2013; Das *et al.*, 2015), K-nearest neighbors classifier (Das *et al.*, 2007; Devi *et al.*, 2016) Decision tree (Sheikhosseini *et al.*, 2013;) Ada-boost (Zhang *et al.*, 2016), Fuzzy interface system (Ghosh *et al.*, 2011) Support vector machine (SVM) (Linder *et al.*, 2014; Savkare *et al.*, 2015; Gatc *et al.*, 2013; Ghosh *et al.*, 2013), and artificial neural networks (Adi *et al.*, 2016; Khan *et al.*, 2011; Razzak, 2015; Das *et al.*, 2015; Devi *et al.*, 2016). Although traditional machine learning methods have made great achievements in analyzing malaria blood samples, their performance relies heavily on the feature

extraction method and the features extracted. The accuracies achieved through machine learning methods are low compared to deep learning.

The introduction of deep convolutional neural networks has brought about breakthroughs in computer vision and image processing problems. The accuracy of deep learning allows computational models to learn good representations of data with multiple layers. It discovers intricate structures in large data sets using back propagation algorithm. In the last decade, there has been a significant increase in the use of deep learning, a subset of machine learning inspired by the structure and function of the human brain. Unlike traditional machine learning that rely on handcrafted features, deep learning performs automatic feature extraction which saves most of the computational steps.

Most notable authors like Dong *et al.*, (2017), Pan *et al.*, (2018), Fatima *et al.*, (2019), Kalkan *et al.*, (2019), Vijayalakshmi, (2019), Mohanty *et al.*, (2019), Shah *et al.*, (2020), Prakash *et al.*, (2020), Manescu *et al.*, (2020), Shekar *et al.*, (2021), Diyasa *et al.*, (2021), made use of different deep convolutional neural network that automatically classifies malaria blood samples as infected or uninfected. Their research findings showed good accuracy but the sensitivity scores are low. When dealing with human health, sensitivity is of highest importance. And as such, greater sensitivity score is our priority. Based on the reviewed journals, seven authors achieved sensitivity scores of 93%, 90%, 81.7%, 92%, 88%, 89% and 88.9%. The work of Shekar *et al.*, (2021) showed great improvement compared to the sensitivities gotten by other authors. Sensitivity score measures how well the system can identify malaria parasite infected blood samples from uninfected ones. Increasing the sensitivity score shows the models ability to correctly detect malaria parasite in a blood sample. It helps to check the reliability of the model.

The aim of this research work is to develop a model for malaria diagnosis using visual geometry group 16 pre trained deep learning algorithm with some hyper parameter tuning to increase the accuracy and sensitivity. Our model achieved a validation accuracy of 96% and sensitivity score of 98% which outperformed the sensitivity score of 93% gotten by the previous authors.

Table 1: Summary of Reviews

AUTHORS	NO. OF DATASETS	ACCURACY	SENSITIVITY
Shekar <i>et al</i> , 2021	27, 558	96%	93%
Militante, 2019	27, 558	90-96%	
Arco <i>et al</i> , 2015	475	96.46%	
Nakasi <i>et al</i> , 2020	643	93%	90%
Olugboja <i>et al</i> , 2017	130	99.8%	
Nugroho <i>et al</i> , 2015	60	87.8%	81.7%
Manescu <i>et al</i> , 2020	300	91%	92%
Fatima <i>et al</i> , 2019	24, 960	91%	88%
Kalkan <i>et al</i> , 2019	27, 558	94%	
Chibunta <i>et al</i> , 2020	3885	97.07%	
Shah <i>et al</i> , 2020	17, 400	95%	
Srishti <i>et al</i> , 2020	11, 234	98.4%	88.9%

3. Datasets

For deep learning models learn to recognize patterns and achieve a level of accuracy; they need to analyze vast amounts of data. The development of Imagenet, a deep learning model trained on approximately 100,000 domestic images spanning 1,000 classes, represents a significant breakthrough in this field. Previously, there were very few datasets available for medical images. Deep learning models are data hungry, and the quality of dataset has always been the key parameter for models to achieve optimum results. This is very important when handling medical dataset because their quality is crucial for proper analysis. Unlike general image recognition tasks, the field of medical imaging suffers from lack of sufficient data for training deep neural networks. According to the Conference on Machine Intelligence in Medical Imaging (C-MIMI) that was held in 2016 (Kohli *et al.*, 2017), machine learning and deep learning are starving for large scale annotated datasets. Another challenge is obtaining well annotated medical dataset in a systematic fashion. In the medical field, it is equally challenging to find high-quality, balanced datasets with labels. Majority of the time, medical images are imbalanced since there are far more negative samples than positive ones and vice versa (Johnson *et al.*, 2019). The labeling of these images by field experts is an expensive and time-consuming operation (Tan *et al.*, 2018). Additionally, privacy concerns make it difficult to collect medical images (Price *et al.*, 2019). Large datasets are needed to build and train deep learning models in order to prevent a cold start.

In this research, *plasmodium falciparum* malaria dataset of 27, 563 were gotten from an online dataset repository-national library of medicine and downloaded from kaggle. It was funded by national

institute of health grant, USA. The dataset was divided into three parts; training data is 80% of the total data, 10% validation data and 10% testing dataset. The datasets are made up of segmented cells of thin blood smear images. The images were manually annotated by an expert slide reader at the Mahidol-Oxford Tropical Medicine Research Unit.

4.Methods

Large datasets are needed to build and train deep learning models in order to prevent a cold start. The good news is that models don't necessarily need to be trained from start. The main justifications for adopting transfer learning are due to paucity of data and the time required to train a CNN from scratch (Szegedy *et al.*, 2015). By employing a much smaller dataset, transfer learning enables models that were trained on large datasets like ImageNet, CIFAR 100, or MNIST to be specialized for particular applications (Pouyanfar *et al.*, 2019). These pre-trained models can be used to transfer knowledge since they have learned rich representation of low level features like edges, corners, and builds from these massive training data. One can use a pre-trained network that has already acquired a wide variety of low-level attributes by using the transfer learning approach. Based on the principles of transfer learning, the pre-trained model should be able to extract pertinent features from these new images even if they belong to entirely different categories from the source dataset. Thus, previously trained models generalize effectively to images outside of ImageNet.

In essence, the weights developed when training a CNN on one dataset are transferred to a second CNN, which is subsequently trained using these weights on labeled medical data. With the exception of the final fully connected layer, the

weights can be applied to some or all of the CNN layers. Transfer learning is a concept in which another model is trained using the weight of a model trained on a huge dataset (Oquab *et al.*, 2014). People's ability to effectively apply previously acquired knowledge to solve new issues more quickly or effectively is what drives the study of transfer learning. Transfer learning, in general, describes a process where a model that was developed for one problem is applied in some way to another similar problem (Kermany, 2018). A new model trained on the target problem then incorporates one or more layers from the trained model. When the target dataset is significantly smaller than the base dataset, transfer learning can be a powerful tool to enable training a large target network without over fitting. It enhances the accuracy of a model in the field of pattern recognition and computer vision (Cook *et al.*, 2013; Cao *et al.*, 2013). Recent studies have taken advantage of this fact to obtain state-of-the-art results when transferring features from a pre trained model (Donahue *et al.*, 2013; Zeiler *et al.*, 2013; Sermanet *et al.*, 2014), collectively suggesting that these layers

of neural networks do indeed compute features that are fairly general. Transfer learning has the benefit of decreasing training time. Transfer learning model performs 20% better than a custom made model. In other words, it increases the accuracy of a neural network model. There are a lot of pre trained convolutional neural network models that can be used for image classification and computer vision tasks. They include AlexNet (Krizhevsky *et al.*, 2017), Resnet (He *et al.*, 2016), Googlenet (Szegedy *et al.*, 2015), Lenet, Visual Geometry Group (Simonyan *et al.*, 2015). These models were trained on ImageNet dataset. In this research work, we will be using visual geometry group 16 (VGG-16) pre trained model for malaria blood image classification task.

VGG-16 is a convolutional neural network architecture which won the ImageNet competition in 2014. It scored first place on object detection task and second place in image classification task at Image Net Large Scale Visual Recognition Challenge (ILSVRC). It is made up of thirteen convolutional layers and three fully connected layers.

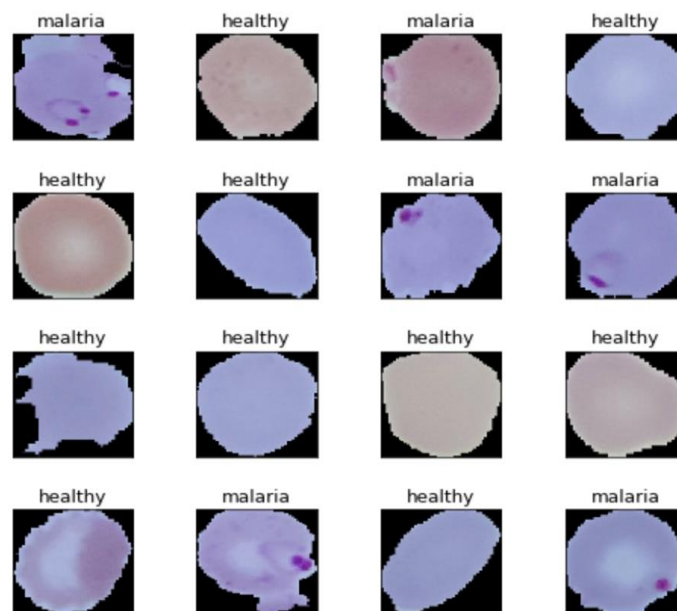


Fig 1: Malaria Blood Sample Images (Bindhu *et al.*, 2019)

4.1 Data Preprocessing

Before using a dataset to train a deep learning model, it has to undergo some vital transformations. These transformations have a huge effect on the performance and the learning of the model. Neural networks are as good as the dataset you feed it with. Preprocessing are the steps taken to format malaria images before they are fed into the neural network. Not applying these pre-processing tasks on the raw images may distract the classification model which can lead to high misclassification rate (Murtaza *et al.*, 2019). This includes but not limited to data augmentation (images resizing, and image normalization) data cleaning, image labeling and noise removal. Visual geometry group 16 input image dimension is 224 x 224 x 3. It is an integral step in deep neural networks as the quality of data determines how the model will learn. High quality data leads to better classification. Therefore, it is extremely important to preprocess our data before feeding them into the network.

4.2 Data Augmentation

Data augmentation refers to enhancing the base data to increase data points. It is a data pre-processing technique. Deep learning models are data hungry and require large datasets for training. It improves the accuracy of the model. However, in medical applications such as malaria and cancer diagnosis, relatively small datasets are available due to privacy concerns. Data augmentation is the manipulation applied to images to create different versions of similar content in order to expose the model to a wider array of training examples. Many times, the quantity of data that we have may not be sufficient to perform the task of classification well enough. In such case, we perform data augmentation. It is often performed on image based deep neural network problems to increase the number of dataset (Shorten *et al.*, 2019; Saleh *et al.*, 2021; Hirahara *et al.*, 2020). Another advantage of data augmentation is to produce more variance of training datasets by applying certain transformations to the existing images without losing its core features. If the dataset are augmented, it will allow the network to be

continuously seeing new data slightly changed from the original. This will make the model to learn more robust features from these images. Translational equivariance allows convolutional neural network to classify image irrespective of how the image appears. It can recognize the content of an object and classify it accordingly even if the image is rotated or flipped horizontally or vertically. The process also ensures that the class label of the data is not changed. It also increases the accuracy of the model by providing better generalization and reduces over fitting. Data augmentation techniques include the following; flipping, rotation, resizing, cropping, normalization, scaling, etc (Ronneberger *et al.*, 2015; Roth, 2015; Pezeshk *et al.*, 2017). The default input size for VGG-16 architecture is 224 x 224 x RGB (3), based on that, we resized our images using python imaging library to 120 x 120 as VGG 16 has input dimension tolerance from 70 to 224.

We performed data augmentation on our datasets using keras image data generator class. It provides a quick and easy way to augment images. The main benefit of using image data generator is that it is designed to provide real-time augmentation. In other words, it generates augmented images on the fly while the model is training. It ensures that the model receives new variations of the images at each epoch and it only returns the transformed images but it does not add it to the original image saved on the disk.

Looking at the images below, we will see that the image spatial correlation is maintained while six new images were gotten from one image through data augmentation process. It is rather used on the fly. This helps to save memory space. This process is called flow from the directory augmentation.

It follows the following process:

- I. Present input image batch into keras image data generator.
 - II. It randomly transforms each image
- The images were augmented to increase the number of images and introduce different variation of the images. It also helps to prevent over fitting.

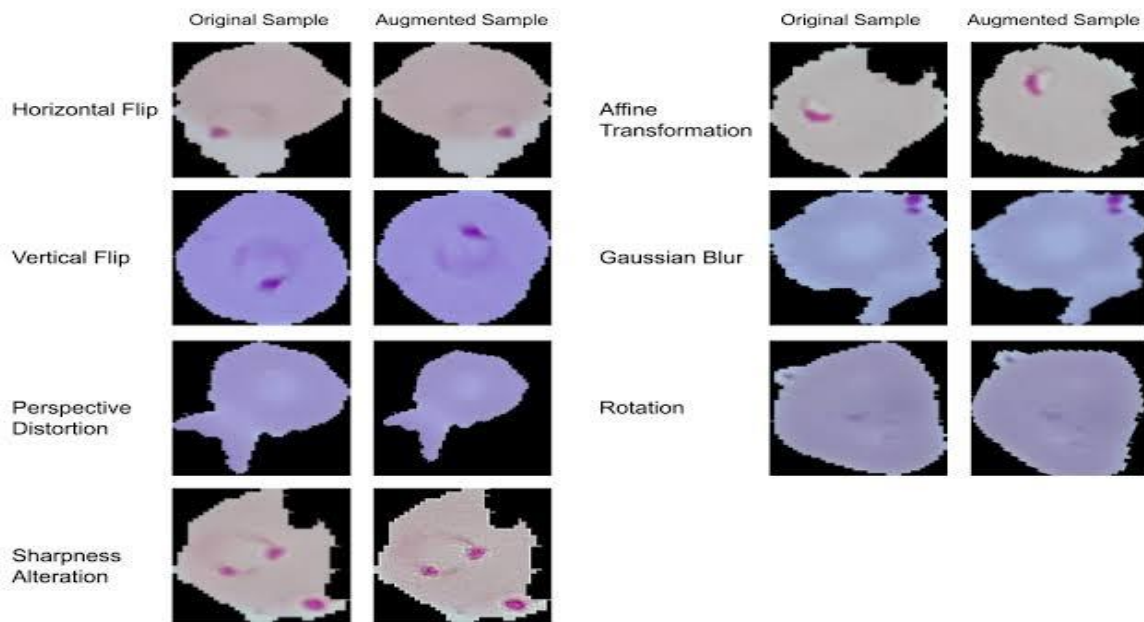


Fig 2: Augmented images of malaria datasets (Bindhu et al., 2019)

Normalization is another data preprocessing technique. The images were normalized to be on the same input range or scale of 0 – 1 so that each input can have equal contribution before feeding them into the neural network. This was done by dividing each pixel value by 255. Because images come in different sizes, they were resized to suit the input dimensions of visual geometry group 16 pre trained model.

4.3 Data Splitting

Splitting datasets into three parts-namely, the training set, validation set and test data is a common process in machine and deep learning. This is a very essential process before training a neural network. Data splitting encourages generalization. Generalization is the models ability to adapt properly to new dataset or test data. The training datasets are the data needed to train the neural network model. Training data is usually between 70-80% of the total data. It is a well-known practice of splitting the data such that training data gets to be more than two-thirds of whole dataset. Validation dataset is used to check the overall accuracy of the model and it is usually between 10-20% of the total data. Validation test provides an unbiased evaluation of the model while tuning the models hyper parameters such as weights and learning rate. It tells if the training is going well or not. The test data is used to evaluate the

performance of the model. The newly developed model is tested with dataset it has not seen before to determine its ability to generalize well. It is usually between 10-20% of the total dataset.

4.4 Model Training

Several deep learning frameworks and libraries have been used in order to accelerate model training with good results. Their use has made the training process simpler. Using Python libraries like keras 2.2, matplotlib, numpy, tensorflow 2.0, pandas, and seaborn, the training was conducted in the Google Colaboratory. Tkinter was used to build the graphical user interface. The system runs on windows 10 and has a random access memory (RAM) of 4GB and computer processing unit (CPU) of 64 GB. We rented a cloud space on google colaboratory engine for training the model because we couldn't perform the training on a local computer.

```

619/619 [=====] - 4004s 6s/step - loss: 0.
Epoch 17/20
619/619 [=====] - 3992s 6s/step - loss: 0.
Epoch 18/20
619/619 [=====] - 3998s 6s/step - loss: 0.
Epoch 19/20
619/619 [=====] - 3987s 6s/step - loss: 0.
Epoch 20/20
619/619 [=====] - 3974s 6s/step - loss: 0.

```

Fig 3: Model Training Result

5. Results The result of our training using visual geometry group 16 architecture shows a validation accuracy of 96% after 20 epochs.

	precision	recall	f1-score	support
Parasitized	0.97	0.96	0.97	2724
Uninfected	0.96	0.97	0.97	2784
accuracy			0.97	5508
macro avg	0.97	0.97	0.97	5508
weighted avg	0.97	0.97	0.97	5508

Fig 4: Classification Report

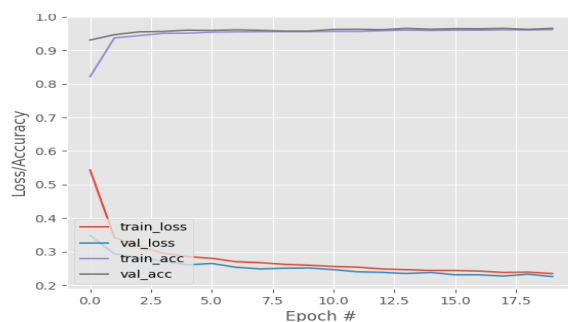


Figure 5: Learning Curve of Training and Validation Accuracy/Loss

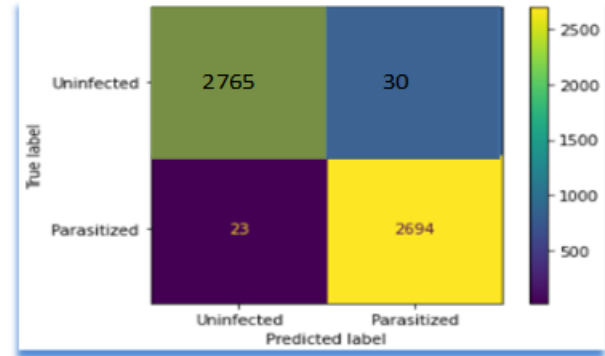


Fig 5: Confusion Matrix Result of the Model

6 Conclusions and Recommendations

In this paper, we proposed a method for the classification of malaria images. We performed data preprocessing, data augmentation, data normalization and data splitting. The model was trained using Visual Geometry 16 pretrained model. We employed a transfer learning mechanism and hyper-tuning parameters to improve the performance of the CNN models. We were able to achieve high accuracy and sensitivity using this pretrained model. Our results surpassed those achieved by our predecessor who utilized the same dataset to the best of our knowledge. Deep learning framework is evolving on daily bases. In future works, there are many possibilities for the improvement of this model. Such as the addition of more quality images which can increase the accuracy of the model. Also, new deep learning architecture such as ResNet-50, and MobileNetV2 can be adopted to improve on the sensitivity of model.

References

- Adi K, Pujiyanto S, Gernowo R, Pamungkas A, and Putranto AB. (2016). Identifying the developmental phase of *Plasmodium falciparum* in malaria-infected red blood cells using adaptive color segmentation and back propagation neural network. *International Journal Application Engineering Research* **11**(1):8754–9.
- Anggraini D, Nugroho A. S, Pratama C, Rozi I. E, Pragesjvara V, and Gunawan M. (2011). Automated status identification of microscopic images obtained from malaria thin blood smears using Bayes decision: a study case in *Plasmodium falciparum*. In: *International Conference on Advanced Computer Science and Information System*. IEEE; pp 347–52.
- Arco, J. E., Górriz, J. M., Ramírez, J., Álvarez, I., and Puntonet, C. G. (2015). Digital Image Analysis for Automatic Enumeration of Malaria Parasites using Morphological Operations. *Journal of Expert Systems with Applications*. **42** (6), 3041-3047.
- Bharti, A. R, Patra, K. P, Chuquiyauri, R, Kosek, M, Gilman, R. H, Llanos- Cuentas, A, and Vinetz, J. M. (2007). Polymerase Chain Reaction Detection of *Plasmodium Vivax* and *Plasmodium Falciparum* DNA from Stored Serum Samples: Implications for Retrospective Diagnosis of Malaria. *America Journal of Tropical Medicine and Hygiene*. **77** (3): 444-446.
- Bindhu, V. (2019). “Biomedical Image Analysis Using Semantic Segmentation” *Journal of Innovative Image Processing (JIIP)* **1**(2): 91-101.
- Cao, X, Wang, Z, Yan, P, and Li, X. (2013). Transfer Learning for Pedestrian Detection. *Journal of Neuro Computing*. **100** (1):51–57.

- Caraballo, H, and King, K. (2014). Emergency Department Management of Mosquito-borne Illness. Malaria, Dengue and West Nile Virus. *Journal of Emergency medicine practice*. **16** (15): 1-24.
- Chibunta, S., and Acar, A. C. (2020). Real-time Malaria Parasite Screening in Thick Blood Smears for Low-resource Setting. *Journal of digital imaging*, **33** (3), 763-775.
- Cook, D, Feuz, K. D, and Krishnan, N. C. (2013). Transfer Learning for Activity Recognition: A Survey. *Knowledge Information System Journal* **36** (3):537-56.
- Cox F. E. (2010). History of the discovery of the malaria parasites and their vectors. *Parasites & vectors*, **3** (1): 5.
- Das, D. K, Ghosh, M, Pal, M, AK, and Chakraborty C. (2013). Machine Learning Approach for Automated Screening of Malaria Parasite using light microscopic images, *Journal of Micron* 45: 97-106.
- Das G, Gonzalez F, and Romero E. (2007). Infected cell identification in thin blood images based on color pixel classification: comparison and analysis. *Program Pattern Recognition Image Analysis and Application*. pp 812- 21.
- Das D, Maiti A, and Chakraborty C. (2015). Automated system for characterization and classification of malaria-infected stages using light microscopic images of thin blood smears. *Journal of Microscopy* **257** (1):238-52.
- Devi, S. S, Laskar, R. H, and Sheikh, S. A. (2018). Hybrid Classifier based Life Cycle Stages Analysis for Malaria infected Erythrocyte using thin blood Smear Images, *Journal of Neural Computer Application*. 29:217-235.
- Devi S. S, Sheikh S. A, Talukdar A, and Laskar R. H. (2016). Malaria infected erythrocyte classification based on the histogram features using microscopic images of thin blood smear. *Indian Journal of Science and Technology*; **9** (1): 1-10.
- Dhiman, S. (2019). Are Malaria Elimination Efforts on right track? An Analysis of Gains Achieved and Challenges ahead. *Journal of Infectious Disease* 8: 14-15.
- Diyasa, I. G. S. M., Fauzi, A., Setiawan, A., Idhom, M., Wahid, R. R., and Alhajir, A. D. (2021). Pre-trained Deep Convolutional Neural Network for Detecting Malaria on the Human Blood Smear Images. In *2021 International Conference on Artificial Intelligence in Information and Communication (ICAIIIC)* (pp. 235-240).IEEE.
- Donahue, J., Jia, Y., Vinyals, O., Hoffman, J., Zhang, N., Tzeng, E., and Darrell, T. (2013). Decaf: A Deep Convolutional Activation Feature for Generic Visual Recognition. Technical report, arXiv preprint arXiv:1310.153.
- Fatima, T., and Farid, M. S. (2019). Automatic Detection of Plasmodium Parasites from Microscopic Blood Images. *Journal of Parasitic Diseases*, **44** (1), 69-78. s
- Gatc J, Maspiyanti F, Sarwinda D, and Arymurthy A. M. (2013). Plasmodium parasite detection on red blood cell image for the diagnosis of malaria using double thresholding. In: *International Conference on Advanced Computer Science and Information Systems*. IEEE; pp 381-5.
- Ghosh M, Das D, Chakraborty C, and Ray A. K. (2011). *Plasmodium vivax* segmentation using modified fuzzy divergence. In: International conference on image information processing (ICIIP). IEEE; pp 1-5.
- Ghosh M, Das D, Chakraborty C, and Ray AK. (2013). Quantitative characterisation of *Plasmodium vivax* in infected erythrocytes: a textural approach. *International Journal of Artificial Intelligence and Software Computing* **1** (3):203-21.
- Goodfellow, I, Bengio, Y, and Courville, A. (2016). Deep Learning. the MIT Press, Cambridge, MA, USA.
- He K, Zhang X, Ren S, and Sun J. (2016). Deep Residual Learning for Image Recognition. In *Proceedings of the IEEE conference on computer vision and pattern recognition* (pp. 770-778).
- Hirahara, D, Takaya, E, Takahara, T, and Ueda, T. (2020). Effects of Data Count and Image Scaling on Deep Learning Training. *Peer Journal of Computer Science* 6:312.
- Horning, M. P., Delahunt, C. B., and Bachman, C. M. (2021). Performance of a Fully Automated System on a WHO Malaria Microscopy Evaluation Slide Set. *Malaria Journal* **20** (1): 110.
- Johnson, J. M, and Khoshgoftaar, T. M. (2019). Survey on Deep Learning with Class Imbalance. *Journal of Big Data*. **6** (1):27.
- Kalkan, S. and C.Sahingoz, O. K. (2019). Deep Learning Based Classification of Malaria from Slide Images. In *2019 Scientific Meeting on Electrical-Electronics & Biomedical Engineering and Computer Science (EBBT)* (pp. 1-4).IEEE.
- Kassam, N. A., Robert, D., Kaaya, I., Damian, J. D., Christentze, S., Reginald, A., Kavishe,1., Michael, A., and Christian W. W. (2021). Ten years of Monitoring Malaria Trend and Factors Associated with Malaria Test Positivity rates in Lower Moshi. *Malaria Journal* 20: 193.
- Keiser, J, Utzinger, J, Premji, Y, Yamagata, B, and Singer, H. (2002). Acridine Orange for Malaria Diagnosis: Its Diagnostic Performance, Its Promotion and Implementation in Tanzania, and the Implications for Malaria Control. Pp 643-654.
- Kermany, D. (2018). Identifying Medical Diagnoses and Treatable Diseases by Image-based Deep Learning, *Journal of medical science* **172** (5):1122-1131.
- Khan, M. I, Acharya B, Singh BK, and Soni J. (2011). Content based image retrieval approaches for detection of malaria parasite in blood images. *International Journal of Biometrics and Bioinformatics*; **5** (1): 97.
- Kohli, M.D., Summers, R.M., and Geis, J.R. (2017). Medical Image Data and Datasets in the Era of Machine Learning—Whitepaper from the 2016 C-MIMI Meeting Dataset Session. *Journal of Digital Imaging* **30** (4), 392-399.
- Krizhevsky, A., Sutskever, I., and Hinton, G. E. (2017). Imagenet Classification with Deep Convolutional Neural Networks. *Journal of Communication of ACM*; **60** (6):84-90.
- Linder, N, Turkki, R, and Walliander, M, (2014). A malaria diagnostic tool based on computer vision screening and visualization of Plasmodium falciparum candidate areas in digitized blood smears, *PloS One* (9), e104855.
- Makhija, K. S, Maloney, S, and Norton, R. (2015): The Utility of Serial Blood Film Testing for the Diagnosis of Malaria. *Journal of Pathology* **47** (1), 68-70.
- Manescu, P., Shaw, M. J., Elmi, M., Neary-Zajiczek, L., Claveau, R., Pawar, V. and Fernandez-Reyes, D. (2020). Expert-level Automated Malaria Diagnosis on Routine Blood Films with Deep Neural Networks. *American Journal of Hematology*, **95** (8), 883-891.
- Mbakilwa, H, Manga, C, Kibona, S, Mtei, F, Meta ,J, and Shoo, A, (2012). Quality of malaria microscopy in 12 district hospital laboratories in Tanzania. *Pathogens and Global Health*. 106:330-334.
- McKenzie, F. E., Sirichaisinthop, J., Miller, R. S., Gasser, R. A., Jr, and Wongsrichanalai, C. (2003). Dependence of malaria detection and species diagnosis by microscopy on parasite density. *The American Journal of Tropical Medicine and Hygiene*, **69** (4), 372-376.
- Militante, S. V. (2019). Malaria Disease Recognition through Adaptive Deep Learning Models of Convolutional Neural Network. In *2019 IEEE 6th International Conference on Engineering Technologies and Applied Sciences (ICETAS)* (pp. 1-6). IEEE.
- Mohanty, I., Pattanaik, P. A., and Swarnkar, T. (2019). Automatic Detection of Malaria Parasites using Unsupervised Techniques. In *International conference on ISMAC in computational vision and bio-engineering* (pp. 41-49). Springer, Cham.
- Molina, A, Alf erez, S, Boldú, L, Acevedo, A, Rodellar, J, and Merino, A. (2020). Sequential classification system for recognition of malaria infection using peripheral blood cell images, *Journal of Clinical Pathology*. 202: 10.

- Murtaza, G, Shuib, I, Wahab, A. W. A, Mujtaba, G, Nweke, H. F., Al-garadi, M. A, Zulfiqar, F., Raza, G, and Azmi, N. A. (2019). Deep Learning-based Breast Cancer Classification through Medical Imaging Modalities: State of the art and Research Challenges. *Journal of Artificial Intelligence* 53: 1655-1720.
- Mushabe, M. C., Dendere R, and Douglas T. S. (2013). Automated detection of malaria in Giemsa-stained thin blood smears. In: *International Conference Engineering in Medicine and Biology Society (EMBC)*. IEEE; pp 3698–701.
- Nakasi, R., Tusubira, J. F., Zawedde, A., Mansourian, A., and Mwebaze, E. (2019). A Web-Based Intelligence Platform for Diagnosis of Malaria in Thick Blood Smear Images: A Case for a Developing Country. In *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops* (pp. 984-985).
- Nugroho, H. A., Akbar, S. A., and Murhandarwati, E. H. (2015). Feature Extraction and Classification for Detection Malaria Parasites in Thin Blood Smear. In *2015 2nd international conference on information technology, computer, and electrical engineering (ICITACEE)* (pp. 197-201). IEEE.
- Ohrt, C, Purnomo, M. A, Tang D, and Kain K. C. (2002). Impact Of Microscopy Error on Estimates of Protective Efficacy in Malaria-Prevention Trials. *Journal of Infectious Diseases*. 186:540–546.
- Olugboja, A., and Wang, Z. (2017). Malaria Parasite Detection using Different Machine Learning Classifier. In *2017 International Conference on Machine Learning and Cybernetics (ICMLC)* (pp. 246-250). IEEE.
- Onile-ere, O, Openibo, J, and Olasehinde, G. I. (2016). Malaria Diagnosis: Current Approaches and Future Prospects. In: 3rd International Conference on African Development Issues (CU-ICADI), May 9–May 11. Covenant University. Nigeria: Ota.
- Oquab, M, Bottou, L, Laptev, I, and Sivic, J. (2014). Learning and Transferring Mid-Level Image Representations using Convolutional Neural Networks. *IEEE Conference on Computer Vision and Pattern Recognition*, Columbus, pp 1717–1724.
- Pan, W. D, Dong, Y, and Wu, D. (2018). Classification of malaria infected cells using deep convolutional neural networks, in: Machine Learning: Advanced Techniques and Emerging Applications, *Intech Open*, (159) 2245.
- Pezeshk, A., Petrick, N., Chen, W., and Sahiner, B. (2017). Seamless Lesion Insertion for Data Augmentation in CAD Training. *IEEE Transactional Medical Imaging* 4 (36), 1005–1015.
- Poolphol, P, Harbach, R. E, Sriwichai, P, Aupalee, K, Sattabongkot, J, Kumpitak, C, and Saeung, A. (2017). Natural Plasmodium Vivax Infections in Anopheles Mosquitoes in a Malaria Endemic Area of Northeastern Thailand. *International Journal of Medicine*. 116 (12): 3349-3359
- Pouyanfar, S., Sadiq, S., Yan, Y., Tian, H., Tao, Y., Reyes, M. P., Shyu, M.-L., Chen, S.-C., and Iyengar, S. S. (2019). A Survey on Deep Learning: Algorithms, Techniques, and Applications. *Journal of ACM Computing Surveys*, 51 (5), 1–36.
- Prakash, S. S., Kovoor, B. C., and Visakha, K. (2020). Convolutional Neural Network Based Malaria Parasite Infection Detection Using Thin Microscopic Blood Smear Samples. In *2020 Second International Conference on Inventive Research in Computing Applications (ICIRCA)* (pp. 308-313). IEEE.
- Price, W. N., and Cohen, I. G. (2019). Privacy in the Age of Medical Big Data. *National Medical Journal*. 25:37-43.
- Razzak, M. I. (2015). Malaria parasite classification using recurrent neural network. *International Journal of Image Processing* 9 (1):69.
- Ronneberger, O., Fischer, P., and Brox, T. (2015). U-Net: Convolutional Networks for Biomedical Image Segmentation. In: *Medical Image Computing and Computer-Assisted Intervention – (MICCAI)*. Pp. 234–241.
- Roth, H. R. (2015). Deep Organ: Multi-Level Deep Convolutional Networks for Automated Pancreas Segmentation. In: *Medical Image Computing and Computer-Assisted Intervention -- MICCAI* pp. 556–564.
- Saleh, A. M, and Hamoud, T. (2021). Analysis and Best Parameters Selection for Person Recognition Based on Gait Model Using CNN Algorithm and Image Augmentation. *Journal of Big Data*. 8 (1):1–20.
- Savkare, S, and Narote S. (2015). Automated system for malaria parasite identification. In: *International Conference on Communication, Information & Computing Technology*. IEEE; pp 1–4.
- Sermanet, P., Eigen, D., Zhang, X., Mathieu, M., Fergus, R., and LeCun, Y. (2014). Over feat: Integrated Recognition, Localization and Detection using Convolutional Networks. In *International Conference on Learning Representations (ICLR)*. (Pp231-234).CBLS
- Shah, D., Kawale, K., Shah, M., Randive, S., and Mapari, R. (2020). Malaria Parasite Detection using Deep Learning: (Beneficial to humankind). In *2020 4th International Conference on Intelligent Computing and Control Systems (ICICCS)* (pp.984-988).IEEE.
- Shekar, G., Revathy, S., and Goud, E. K. (2021). Malaria Detection using Deep Learning. In *2020 4th International Conference on Trends in Electronics and Informatics (ICOEI)* (48184) (pp. 746-750). IEEE.
- Sheikhsosseini, M, Rabbani, H, and Zekri, M. (2013). Automatic diagnosis of malaria based on complete circle ellipse search algorithm, *Journal of Microscopy*. 252:189–203.
- Shorten, C, and Khoshgoftaar, T. M. (2019). A Survey on Image Data Augmentation for Deep Learning. *Journal of Big Data*. 6 (1):60.
- Simonyan, K, and Zisserman, A. (2015). Very Deep Convolutional Networks for Large-scale Image Recognition, Computer Vision and Pattern Recognition. pp. 1409-1556.
- Srishti, S, and Devashis, D. (2020). Detection of Malaria using Machine Learning. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)* 8 (7): 98.
- Szegedy, C., Liu, W., Jia, Y., Sermanet, P., Reed, S., Anguelov, D., Erhan, D., Vanhoucke, V., and Rabinovich, A. (2015). Going Deeper with Convolutions. In *Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition*. pp. 1–9.
- Tan, C., Sun, F, Kong, T, Zhang, W, Yang, C, and Liu, C. (2018). A Survey on Deep Transfer Learning. In: *International Conference on Artificial Neural Networks*. Springer; pp. 270–279.
- Vijayalakshmi, A. (2019). Deep Learning Approach to detect Malaria from Microscopic Images. *Multimedia Tools and Applications*, 79 (21), 15297-15317.
- Wongsrichanalai, C, Barcus M. J, Muth S, Sutamihardja A, and Wernsdorfer W. H. A. (2007). Review of Malaria Diagnostic Tools: Microscopy and Rapid Diagnostic Test (RDT). *America Journal of Tropical Medicine and Hygiene*. 77:119–127.
- Workneh, Y. (2020). Adapting CRISP-DM for Idea Mining: A Data Mining Process for Generating ideas using a Textual Dataset. *International Journal of Advanced Computer Sciences and Applications*. 11 (6): 20-32.
- World Health Organization (2017) Global Malaria Programme - World Malaria Report. Geneva.
- World Health Organization (2020). World Malaria Health Observatory Report. Geneva.
- Woronzoff-Dashkoff, K, K. (2002). "The Wright-Giemsa stain: Secrets Revealed." *Journal of Clinics in Laboratory Medicine* 22 (1): 15-23.
- Zeiler, M. D. and Fergus, R. (2013). Visualizing and Understanding Convolutional Networks. Technical Report Arxiv 1311.2901.
- Zhang Z, Ong LS, and Fang K, (2016). Image classification of unlabeled malaria parasites in red blood cells. In: *38th annual international conference of the engineering in medicine and biology society (EMBC)*. IEEE; pp 3981–4.

Public Debt Profile, Economic Growth and sustainability in Nigeria

Peter Chinyere Uruakpa¹,
Zeph Chibueze Abaenewe²

¹Department of Banking & Finance, Abia State University, Nigeria

²Department of Banking & Finance, Imo State University, Nigeria.

Abstract

A consistent rise in net national product or quantitative increase in the productive capacity of a country on a per capita basis is referred to as economic growth. While public debt typically refers to the total amount of national debt, it also includes the debt owed by states, provinces, municipalities, and local governments. Public debt is defined as the total amount of funds disbursed and contractual liabilities of residents of a country to repay principal and other related obligations to non-residents. This study therefore carried out an analysis of public debt profile in Nigeria and its implication on economic growth and sustainability. It looked at the impact of total public debt, external debt, external debt service, domestic debt on Nigeria's economic growth. The data used were sourced from the CBN Statistical Bulletin from 1981 to 2022. Multiple regression, Cointegration, error correction model and Granger Causality test were used. Findings revealed that external debt and debt servicing have negative impact on the GDP. Domestic debt was found to have positive and significant impact on Nigeria's economic growth. The study recommended that debt Management Office (DMO) should set mechanisms in motion to ensure that loans are utilized for the purpose for which they were acquired such as revamping of the nation's refineries while efforts should be made at reducing debt stock and seeking alternative means of fund.

Keywords: Economic Growth, Public debt, Domestic debt, External debt, External debt service.

1.0 Introduction

Over the past few years, high levels of public debt have turned into an inviting target for criticism among policymakers, professionals and other agents of economic development (Eze, Ogiji, Igwe and Eze, 2023). When spending surpasses income, a fiscal deficit occurs, which leads to debt (Nymphas, Emmanuel & Auta, 2023). Public debt is the amount of a nation's debt that comes from outside sources, such as foreign governments, financial institutions, or companies (Chukwu, 2023). The portion of a nation's overall debt that is owing to foreign creditors is known as public debt. The government, businesses, and individual homes are examples of debtors (Abula & Ozovehe, 2016). The term "public debt" in international economic relations refers to the financial commitment that links one party (the debtor country) to another (the lender country). It usually refers to debt that has been accrued and is payable in a currency other than the nation of the debtor. Short-term loans, including trade debts with

a one- to two-year maturity or whose payment is due during the fiscal year in which the transaction is completed, are considered public debt in theory. Numerous activities, including trade, contractor financing, supply credit, private investment, and state borrowing, can result in public debt (Udoka & Anyingang, 2010). Banks, the global financial market (euro money and capital markets), international organizations like the World Bank and the IMF, multilateral private loans, and private loans from private sources are some of the sources of the loans that make up the public debt (Eze et al., 2023).

Attapattu and Padmasiri (2018) claim that when governments need to make up deficiencies in their budget, they prefer to acquire debt rather than create money or impose taxes. According to Emmanuel (2012), a country's public debt load affects its people, government institutions, privately held businesses like banks, and eventually the economy as a whole. One of the major challenges facing most nations, including Nigeria, is achieving sustainable economic

growth. Nigeria's economic growth cannot be sustained by its domestic income production or other public financing sources (George-Anokwuru & Inimino, 2020). Studies reveal that the government's debt has increased over time, supposedly to bolster economic expansion by making large expenditures in dilapidated infrastructure and fostering an atmosphere that is conducive to business (Solomon, 2018; George-Anokwuru & Inimino, 2020; Chukwu, Ogbonnaya-Udo & Chimarume, 2021, Chukwu, 2023). The government has been more active over time in a number of areas, including housing, telecommunications, energy, and decent roads. These programs are essential for creating an atmosphere that is favourable to investment and attracting foreign direct investment, which increases the formation of the country's capital stock and is required for economic growth and development. To support the growth of the national economy, managing these debts—both external and domestic—effectively and successfully is all that matters. Before receiving some debt relief in 2006, Nigeria has accumulated debt under several governments amounting up to N12.7 trillion throughout the years (CBN, 2022). Studies have shown that the large loans have a regressive effect on the standard of living for Nigerians. The amount needed to service Nigeria's debt in relation to the huge push notion indicates that the country has a big problem. It should be emphasized that a high external debt to GDP ratio, which indicates a large debt overhang, may reduce the motivation for investment because a sizeable amount of investment revenues must be utilized to pay down current debt. Moreover, it has been proposed that a high degree of domestic debt causes poverty because most local loan holders find it hard to make further investments. Furthermore, Nigeria possesses additional bilateral and multilateral loans that, although still falling under the category of foreign debts, beg the question of how these debts have affected its economy and how sustainable these debts are on Nigeria's future.

1.1 Objectives of the Study

This study pursues the following objectives:

- i. To evaluate the impact of external debt on Nigeria's economic growth.
- ii. To determine the extent debt servicing impacts on Nigeria's economic growth.
- iii. To examine the relationship between domestic debt and Nigeria's economic growth.

- iv. To determine the relationship between external debt and Nigeria's economic growth.

1.2 Research Hypotheses:

The following hypotheses are formulated to guide the research:

- i. H0: External debt has no significant impact on Nigeria's economic growth
- ii. H0: Debt servicing does not significantly impact on Nigeria's economic growth
- iii. H0: Domestic debt has no significant relationship with economic growth in Nigeria
- iv. H0: There is no significant causality relationship between external debt and Nigeria's economic growth

2.0 Review of Related Literature

Debt is a result of borrowing. According to Udoka and Ogege (2012), debt is the term used to describe the financial resources utilized by an organization that are not provided by its owners and do not otherwise belong to them. According to Kalu and Boniface (2023), it is a responsibility that is represented by a financial instrument of another formal equivalent. When the government borrows money to finance domestic investments, it incurs public debt. It does this by borrowing money on both the local and international markets. Therefore, the national debt is seen as all claims against the government held by the private sector of the economy, or by foreigners, whether interest-bearing or not (and including bank held debt and government currency, if any); less any claims held by the government against the private sector and foreigners. Ezeabilisi, Mojekwu and Ogege (2012) also defined public debt as an amount of money owed by the government to institutions, government agencies and other bodies' resident in or outside Nigeria. Public debt, which is also sometimes referred to as government debt, is all of the money owed at any given time by any branch of the government. It encompasses debt owed by the federal government, the state government, and even the municipal and local government. It is, in effect, an extension of personal debt, since individuals make up the revenue stream of the government. Public debt accrues over time when the government spends more money than it collects in taxation. Studies show that when government engages in more deficit spending, the amount of debt increases. According to Ekperiware,

Akinrinola, Ademiju, Ejima and Ogbogbo (2022), when the government spends more than it receives which results in the use of some sort of security to cover the deficiency which normally lead external debt as source of fund. The aggregate of securities over timeless redemption is called the national debt. The above statement points to the fact that government accumulates debt simply by running deficits through borrowing on the distribution of such securities. Again, national debt consists of all securities issued by the federal government and held by the CBN, individual and foreigners, government agencies and trust funds, private sector as well as those by commercial banks.

2.1 Public Debt and Nigeria's Economic Sustainability

It is believed that the growing national debt against the background of declining and/or unstable foreign exchange earnings has serious consequences for the recovery of the Nigerian economy. But the crucial question to ask according to Sogo-Temi (1999) are; how do you determine the extent of Nigeria's debt burden; and how is this going to affect the capacity of the economy to achieve substantial economic growth and development? Answers to these questions will be based on some principal indices. These are standard indicators for measuring the burden of external debt. These indicators, among others, include the ratios of the stock of debt to exports and to Gross Domestic product and the ratios of debt service to exports and to government revenue (Yusuf, Mohd & McMillan, 2021). It has been noted that the debtor-countries have too much burden on their necks, the burden packaged with economic crisis and socio-political difficulties. Expending as much as 70 - 90% of export earnings on debt servicing connote that little is left virtually for the countries to perform their constitutional obligations to the citizenry. It is also carefully noted that in its zeal to break out of economic shackles to achieve economic and sociopolitical development, the Third World Countries have chosen the option of seeking foreign loan to achieve this development.

Development, to them, might mean embarking on capital intensive projects such as schools, hospitals, road and bridges, radio and television stations. The implication of this is that, the loan, well packaged with a number of conditionalities, needs to be serviced and as such, the recipient-countries are

expected to invest the money in the business that will bring returns for servicing and paying back of the loan but, with the implementation of these non-profitable social projects (Aluko & Arowolo, 2010). James, Magaji, Ayo & Musa (2006) opined that public debt has no significant effect on the growth of the Nigeria economy because the fund borrowed were not channeled into productive ventures, but diverted into private purse. He suggested further, that, for the gains of the debt forgiveness to be realized the War Against Corruption should be fought to the highest. Oshadami (2006) in her own study concluded that the growth of debt has affected negatively the growth of the economy. This situation is premise on the fact that majority of the market participant are unwilling to hold longer maturity and as a result the government has been able to issue more of short term debt instruments. This has affected the proper conduct of monetary policy and affected other macroeconomic variables like inflation, which makes proper prediction in the economy difficult. External control and manipulation of the domestic economy is another by-product of debt crisis. Amadeo (2018) argued that debt can affect deficit in three ways. First, as provided by Pakko (2006), debt gives a better indication of the true deficit each year as one can more accurately gauge the deficit by comparing each year's debt to last year's debt. Secondly, Amadeo (2018) assert that the interest on the debt is added to the deficit each year since a certain percentage of the budget goes toward debt interest payments. Third, the debt decreases tax revenue in the long run which further increases the deficit, because an increasing debt profile creates a concern for creditors on how the government will repay it. Over time, these creditors expect higher interest payments to provide a greater return for their increased perceived risk and higher interest costs dampen economic growth.

2.2 Theoretical Framework

The Keynesian Theory served as the study's foundation. In an effort to comprehend the Great Depression, British economist John Maynard Keynes created the theory of Keynesian economics in the 1930s. Keynes believed that since fiscal policy serves the interests of the public, it is the best way to stimulate economic growth in every given economy. Keynes argues that when the government starts borrowing money from the general population to pay

for its expenses, the amount of money that people take out of their own pockets stays the same. The government's reintroduction of these money into the economy increases aggregate demand, which in turn boosts output and employment. Therefore, public borrowing can be employed to affect the economy's macroeconomic performance. Another theory is the debt cum-growth theory was propounded by Krugman (1988) and Sachs (1989). It considers external debt as a substitute for domestic savings and investment and therefore domestic savings and investment are crowded out as a result (Krugman, 1988; Tornell & Velasco 1992). The thinking is that the returns from investing in a country are seen as being subjected to a high marginal tax by creditors and this may discourage domestic and foreign investors. This is the familiar debt overhang theory. It is also argued that foreign savings may be used for consumption rather than for investment. However, studies by Cohen and Sachs (1986) and Cohen (1992) present endogenous growth models where capital accumulation is the driving force for growth.

2.3 Empirical Review

Odejimi and Ozor (2018) investigated the effect of debt on economic growth in West Africa. Using panel data from 1970 to 2011 and data analysis through the fixed and random effect regression based on the Ordinary Least Square, the results show that debts do not have significant effect on growth in the selected West African countries. It found a negative sign indicating an inverse relationship; that is, the higher the debt stock, the lower the growth rate. Solomon (2018) examined the impact of domestic debt on Nigeria's economic growth from 1980-2011. This study made use of data collected from CBN statistical bulletin while the regression method of analysis was used. Findings showed that domestic debt is positively and highly related with GDP. It also showed that there is a negative and insignificant relationship between external debt and GDP, while an insignificant but positive relationship exist between external debt servicing and GDP. Yusuf, Mohd and McMillan (2021) investigated the effect of government debt on Nigeria's economic growth using annual data from 1980 to 2018 and the Autoregressive Distributed Lag technique. The empirical results showed that external debt constituted an impediment to long-term growth while its short-term effect was growth enhancing. Domestic

debt had a significant positive impact on long-term growth while its short-term effect was negative. In the long term and short term, debt service payments led to growth retardation confirming debt overhang effect. Chukwu, Ogbonnaya-Udo and Chimarume (2021) examined the effect of Nigeria public debt on public investment from 1985-2018. Data for the analysis was obtained from Central Bank of Nigeria Statistical bulletin. ARDL Auto-regressive Distributed lag models was used to test the effect of the independent variables (Public Debt, Budget Deficit, Debt Servicing, Public Debt to GDP Ratio) on the dependent variable (Public Investment). The cointegration test found the existence of long run relationship among the investigated variables. The short run result shows that public debt has insignificant effect on public investment in Nigeria. The study of Ekperiware, Akinrinola, Ademiju, Ejima and Ogbogbo (2022) was centered on the effect of public debt on economic growth in Nigeria. The data was obtained from the Debt Management Office and Federal Office of Statistics. The study employed Vector Error Correction Model (VECM) due to the presence of long run relationship identified during data diagnosis. The findings confirmed that domestic debt in the short run is inversely related to growth but positively related in the long run provided it is done with moderation where the total domestic debt did not outweigh 30% of the total domestic bank deposits against crowding out effects. The impact of external debts was both negatively related to economic growth at both short run and long run period due to possible wrong application of loans to project types. Nymphas, Emmanuel and Auta (2023) examined the impact of public debt on economic growth in Nigeria from 1981 to 2020. Time series data were obtained from the World Development Index (WDI) and the Central Bank of Nigeria (CBN). The study applied the Autoregressive Distributed Lagged model. Findings of the study revealed that the time series data became stationary at first difference while the coefficients of external debt and domestic debt had positive and significant impact on economic growth in Nigeria and on the flip, external debt service payment had a negative and significant impact on economic growth of Nigeria in the long run. Eze et al., (2023) focused on the effect of public debt on the economic growth of Nigeria from 2004-2021. The researcher adopted ex-post facto research design and regression analysis

was used in analyzing the time series data generated through secondary data source. The study found that public debt has a negative effect on economic growth, exchange rate has positive relationship with economic growth in Nigeria and interest rate does not have significant effect on the economic growth of Nigeria. Adeyokunnu (2023) used granger causality to determine the relationship between public debt and economic growth in Nigeria from 1970 – 2019. Data were obtained from Central Bank of Nigeria (CBN) Annual Statistical Bulletin and index mundi. The study concluded that there exists positive significance causal relationship between public debt and

economic growth unidirectional coming from the economic growth to public debt which means that economic growth can be achieved if the public debt is increased. Kalu and Boniface (2023) sought to determine the effect of public debt proxied by internal debt, external debt and interest rate on economic growth proxied as gross domestic product. The study applied ex-post facto design with secondary data as instrument for data collection. Multiple regression model was used for analysis. Findings showed that external debts have significant negative impact on GDP while internal debt showed significant positive impact on GDP.

3.0 METHODOLOGY

The research design used in this study is the quasi-survey also known as ex-post facto. Data were sourced from CBN Statistical Bulletin from 1981-2022.

3.1 Technique for data analysis

Multiple Ordinary Least Square regression analysis, descriptive statistics, cointegration, Error correction model and granger causality test were applied in this study.

3.2 Specification of the Model

The multiple regression method seeks to establish in a linear form the relationship between three or more variables, thus, it can therefore be stated as:

$Y = F(x)$ Where

X = independent variable

Y = dependent variable

F = usual denotation for “is a function of

3.3 Dependent variable

i. **Gross Domestic Product (GDP):** This is the dependent variable and used here to capture economic growth.

3.4 Independent variables

i. **External debt (EXTDEBT):** This is the total outstanding debt owed by Nigerian government (state and federal) to foreign lenders.

ii. **Domestic Debt (DODEBT):** This is the total outstanding debt owed by Nigerian government (state and federal) to its citizens.

iii. **Debt Service (DEBTSERV):** This is the total amount paid as interest for external debts annually
 $GDP = f(\text{External debt, Debt service payment, Domestic debt})$ Where;

Y= GDP

X1= Extdebt (External debt)

X2= Debitserv (Debt servicing)

X3= Domdebt (Domestic debt)

μ =unexplained variable Mathematically, the model follows that

$$GDP_t = b_0 + b_1 \text{Extdebt}_t + b_2 \text{Debitserv}_t + b_3 \text{Domdebt}_t + U_1t \dots \dots \dots (3.1)$$

Where:

b1, b2, and b3 are parameter estimates (I = 1, 2, 3)

U1t = Error terms

b0 = intercept of GDPt model

t = number of years

4.0 Data Analysis and Findings

Table 1: Descriptive Statistics

Date: 12/17/23

Time: 09:22

Sample: 1981 2022

GDP EXTDEBT DEBTSERV DOMDEBT

Mean 34087.79 1973.402 10631.13 3203.632

Median 7648.623 640.9750 1113.775 957.6150

Maximum 154252.3 12705.62 81081.58 16023.89

Minimum 139.3105 2.330000 30.84000 11.19000

Std. Dev. 45875.59 2779.720 20613.91 4571.068

Skewness 1.265728 2.157123 2.145950 1.489318

Kurtosis 3.351860 7.658507 6.468991 3.948481

Jarque-Bera 10.88679 67.19068 50.75717 16.28648

Probability 0.004325 0.000000 0.000000 0.000291

Sum 1363512. 78936.06 425245.1 128145.3

Sum Sq. Dev. 8.21E+10 3.01E+08 1.66E+10 8.15E+08

Observations 42 42 42 42

Source: Computation from EvIEWS 9 From Table 1's descriptive data, the GDP for the period under review had a mean value of 34087.79, meaning that N 34087.79 billion was produced on average per year. N139.31b was the minimum and N154252.3b was the

maximum that was attained. With a mean value of 1973.402, EXTDEBT indicates that N1698.21 billion in foreign debt was incurred on average per year. During the period under consideration, the lowest amount of external debt incurred was N2.33b, while the highest amount was N12,705.62b. The average value of DOMDEBT is 3203.63, meaning that each year, N3203.63 billion worth of domestic debt is incurred on average. For the time under examination, the lowest amount of domestic debt incurred was N11.19b, while the highest amount was N16,023.88b. The mean value of DEBTSERV is 10631.13. The mean value of DEBTSERV is 10631.13, indicating an average of N10631.13b was the annual debt service payment. For the period under consideration, the largest amount paid was N81081.58b, while the minimum debt service was N30.84b. GDP has 0.004, EXTDEBT has 0.000, DEBTSERV has 0.000, and DOMDEBT has 0.00029 according to the Jarque-Bera prob. These values all suggest that the data are statistically significant but not normally distributed.

Table 2: Correlation matrix

GDP	EXTDEBT	DEBTSERV	DOMDEBT
GDP	1.000000	0.732886	-0.315913
EXTDEBT	0.732886	1.000000	-0.226071
DEBTSERV	-0.315913	-0.226071	1.000000
DOMDEBT	0.991554	0.771716	-0.282620

Source: Computation from Eviews 9

The regression model's independent variable correlations are displayed in **Table 2**. There is a 0.771716 association between EXTDEBT and DOMDEBT. This suggests that there is a positive relationship between debt, both domestic and foreign. The correlation value between EXTDEBT and DEBTSERV is -0.226071, indicating a negative relationship between external debt and debt service. The correlation between DOMDEBT and DEBTSERV is -0.282620, suggesting a negative relationship between domestic debt and debt service.

Table 3: OLS Regression Result

Dependent Variable: GDP
Method: Least Squares
Date: 12/17/23 Time: 10:24
Sample: 1981 2022
IncludSed observations: 40
Variable Coefficient Std. Error t-Statistic Prob.
C 4125.831 1252.629 3.293738 0.0022
EXTDEBT -1.331307 0.489486 -2.719807 0.0100
DEBTSERV -0.087853 0.043761 -2.007546 0.0522
DOMDEBT 10.46411 0.302279 34.61737 0.0000
R-squared 0.987194 Mean dependent var 34087.79
Adjusted R-squared 0.986127 S.D. dependent var 45875.59
S.E. of regression 5403.451 Akaike info

criterion 20.12210 Sum squared resid 1.05E+09
Schwarz criterion 20.29099 Log likelihood -398.4421
Hannan-Quinn criter. 20.18317
F-statistic 925.0529
Durbin-Watson stat 0.619428
Prob(F-statistic) 0.000000

Source: Computation from Eviews 9

The model estimate from the analysis is $GDP = 4125.84472555 - 1.33130955673 \cdot EXTDEBT - 0.0878533378205 \cdot DEBTSERV + 10.4641026844 \cdot DOMDEBT$

Given that the Coefficient of Determination (R²) is 0.9872, or 98.72%, it can be concluded that the regression model has a strong match. The existence of domestic debt and the servicing of external debt account for 98.61 percent of the overall variance in GDP, according to the Adjusted Coefficient of Determination (R-2) value, with the remaining 1.39 percent coming from the fluctuation in the unexplained variable.

Table 4: Breusch-Godfrey Serial Correlation LM Test Result

Breusch-Godfrey Serial Correlation LM Test:
F-statistic 2.46760 Prob. F(2,36) 0.06700
Obs*R-squared 20.82757 Prob. Chi-Square(2) 0.91100

The BG, LM test in table 4.4 shows that the F-statistic and obs*R-Squared are insignificant to result to serial correlation.

Table 5: Heteroskedasticity Test: Breusch-Pagan-Godfrey Result

Heteroskedasticity Test: Breusch-Pagan-Godfrey
F-statistic 2.837598 Prob. F(3,38) 0.0516
Obs*R-squared 7.649750 Prob. Chi-Square(3) 0.0538
Scaled explained SS 7.780908 Prob. Chi-Square(3) 0.0508

Table 5, BPG test's F-stat, obs* R² and scaled explained SS stats respectively suggest that the residuals in our model were insignificantly influenced by the presence of heteroskedasticity. Therefore, there is homogeneity in our model.

Table 6: Johansen Cointegration Test

Date: 12/17/23 Time: 10:23
Sample (adjusted): 1984 2022
Included observations: 37 after adjustments
Trend assumption: Linear deterministic trend
Series: GDP EXTDEBT DEBTSERV DOMDEBT
Lags interval (in first differences): 1 to 2
Unrestricted Cointegration Rank Test (Trace)
Hypothesized Trace 0.05
No. of CE(s) Eigenvalue Statistic Critical Value
Prob.**
None * 0.578421 62.41460 47.85613 0.0012

At most 1 * 0.344435 30.45595 29.79707 0.0419
 At most 2 0.236638 14.83243 15.49471 0.0627
 At most 3 * 0.122653 4.841570 3.841466 0.0278
 Trace test indicates 2 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized Max-Eigen 0.05

No. of CE(s) Eigenvalue Statistic Critical Value Prob.**

None * 0.578421 31.95865 27.58434 0.0128

At most 1 0.344435 15.62352 21.13162 0.2476

At most 2 0.236638 9.990863 14.26460 0.2125

At most 3 * 0.122653 4.841570 3.841466 0.0278

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source: Computation from Eviews 9

At the 0.05 level, the null hypothesis that there is no cointegration in the residuals is rejected since the trace shows two cointegrating equations and the max-eigen value shows one cointegrating equation each. This indicates that the variables have a long-term relationship with one another

Table 7 Error Correction Model

Dependent Variable: D(GDP)

Method: Least Squares

Date: 12/17/23 Time: 13:14

Sample (adjusted): 1981 2022

Included observations: 42 after adjustments

Variable Coefficient Std. Error t-Statistic Prob.

D(GDP(-2)) 0.818613 0.151786 5.393199 0.0007

D(GDP(-3)) -0.037282 0.782875 -0.047622 0.9632

D(GDP(-4)) 4.111318 1.108120 3.710175 0.0060

D(GDP(-5)) 5.905218 1.171408 5.041129 0.0010

D(DEBTSERV(-1)) -17.95727 30.84631 -0.582153 0.5765

D(DEBTSERV(-2)) -44.48196 15.06968 -2.951751 0.0184

D(DEBTSERV(-3)) -13.01800 13.87969 -0.937917 0.3757

D(DEBTSERV(-5)) 49.33273 19.57660 2.519984 0.0358

D(EXTDEBT(-1)) 1.881739 1.068627 1.760894 0.1163

D(EXTDEBT(-2)) 1.976553 2.772203 0.712990 0.4961

D(EXTDEBT(-3)) 5.252963 1.554169 3.379919 0.0096

D(EXTDEBT(-4)) 5.137953 1.597292 3.216664 0.0123

D(EXTDEBT(-5)) -5.322526 2.363885 -2.251601 0.0544

D(DOMDEBT(-1)) 4.651968 2.211963 2.103095 0.0686

D(DOMDEBT(-2)) 4.634190 1.246316 3.718312 0.0059

D(DOMDEBT(-4)) -4.029799 4.582332 -0.879421 0.4048

D(DOMDEBT(-5)) -44.35631 4.301513 -10.31179 0.0000

ECT(-1) -0.890542 0.119594 -7.446348 0.0001

C -7458161. 1460752. -5.105699 0.0009

R-squared 0.998115 Mean dependent var 4194311.

Adjusted R-squared 0.993874 S.D. dependent var 24590677

S.E. of regression 1924652. Akaike info criterion 31.96940

Sum squared resid 2.96E+13 Schwarz criterion 32.88129

Log likelihood -412.5869 Hannan-Quinn criter. 32.24055

F-statistic 235.3522 Durbin-Watson stat 2.295663

Prob(F-statistic) 0.000000

Source: Computation from Eviews 9

According to the results of the Error Correction Model, GDP at lags 2 and 4 strengthens the present GDP, debt service payments at lags 2 and 5 have a negative impact on economic growth, and external debt at lags 3 and 5 accelerates economic growth. The domestic debt at lags 2 and 5 accelerates economic growth. In the long run, the speed of adjustment is large and appropriately signed, reversing almost 89% of the short run variance. Given the high coefficient of determination, the model is highly fitted. More specifically, 99.8% of the

fluctuations in the explanatory factors on the dependent variable are explained by the model.

The F-statistic for the total regression is significant. Thus, we agree that Nigeria's public debt has significant long run relationship with her GDP

Table 8: Granger Causality Result

Pairwise Granger Causality Tests

Date: 04/07/23 Time: 10:24

Sample: 1981 2020

Lags: 2

Null Hypothesis: Obs F-Statistic Prob.

EXTDEBT does not Granger Cause GDP 38 0.06905 0.9334

GDP does not Granger Cause EXTDEBT 5.13363 0.0115

DEBTSERV does not Granger Cause GDP 38 0.45326 0.6394

GDP does not Granger Cause DEBTSERV 0.24546 0.7838

DOMDEBT does not Granger Cause GDP 38
0.63956 0.5339
GDP does not Granger Cause DOMDEBT 15.0329
2.E-05

Source: Computation from EViews 9

From the table 4.5 shown above, it can be deduced that there is uni-causality relationship between GDP and external debt running from GDP to external debt as indicated by a prob value of 0.0115 which is less than 5% level of significance. For the fifth hypothesis, the result shows that there is no causality relationship between debt servicing and GDP as the prob values are above 5%. For the sixth hypothesis, it was found that there is uni-causality relationship between GDP and domestic debt running from GDP to external debt as indicated by a prob value of 0.00002 which is less than 5% level of significance.

Discussion of Findings

The model has a linear form based on the analysis that was done. Domestic debt and GDP had a positive relationship, as predicted apriori. In other words, rising debt causes economic progress to rise, indicating some degree of sound management. This validates the conclusions made by Ekperiware et al. (2022) and Nymphas, Emmanuel, and Auta (2023). However, paying off external debt has a negative impact on GDP, indicating that Nigeria may be having problems with economic sustainability and development as debt payment is an outflow of funds and capital from the country. The more money that leaves the country, the less developed the economy is. Nigeria's debt profile is unsustainable and continues to rise. External debt has a negative relationship with GDP. Because the Nigerian government has relied heavily on foreign debt to fund the majority of its important capital extensive projects, particularly in the oil sector, the result does not meet apriori expectations. This suggests that

there should be a positive and significant relationship between external debt and GDP. This suggests that the government has been continuously in debt in order to pay for its spending. Our findings that public debt had a significant impact on GDP are in conflict with those of Yusuf and Mohd (2022), who discovered that the combined effect of external debt on economic growth is positive and quite significant over the long term. These findings also support the findings of Adeyokunnu (2023) and Ekperiware et al. (2022). Thus, this study supports the conclusions of Chukwu (2023) who found that the buildup of external debt had a negative impact on Nigeria's economic growth, as well as the findings of Kalu and Boniface (2023) who found a negative correlation between external debt and economic growth in Nigeria. It does, however, run counter to studies by Ayadi and Ayadi (2008), which found that debt and the need to service it had a detrimental influence on South Africa's and Nigeria's economic growth, and Sulaiman and Azeez (2012), who discovered that external debt had a favourable impact on the Nigerian economy. The granger test result which shows positive causality between public debt and economic growth supports the earlier findings of Adeyokunnu (2023). The study's policy recommendation is that Nigeria has not effectively utilized its debts to support economic growth. These results mean that the economy will increase ceteris paribus in proportion to the amount of foreign and internal borrowing by the public to finance capital projects. However, debt servicing and interest repayment on the same time impede Nigeria's economic expansion. The current state of financial indiscipline and reckless spending by Nigerian officials is not unrelated to this predicament. As a result, there was a significant debt overhang at the time, and growth and foreign investment declined. Leaders in Nigeria should prioritize handling public funds with a strong sense of accountability in order to leverage debt for economic growth. The economy cannot be sustained for very long at its current level of public debt.

5.0 Summary, Conclusion and Recommendations

Debt plays a crucial role in an economy. The study employed the regression analysis to test the variables with empirical findings showing that domestic debt is positively and strongly related to economic growth. In general, the study concludes that public debt has impact on economic growth in Nigeria. It is recommends that:

1. Government should acquire external debt largely for economic reasons such as revamping of the nation's ailing refineries as this would increase economic output and ensure economic sustainability

as the resent debt profile is a threat to Nigeria's future economic prospects .

2. Efforts should be made at reducing debt stock and seeking alternative means of fund such as reforming tax administration and collection process which is still be deviled with large loopholes and leakages
3. To minimize the effect of debt servicing, growth-friendly structural policies including infrastructure, trade, tax and social policies and regulatory frameworks that affect economic

incentives for private investments and production should be adopted and sustained while the fight against corruption should also be sustained.

4. Effort should be made by the government to settle the outstanding domestic debt. This will give room for proper conduct of monetary policy in the economy.

References

- Alison, J. (2003). *Key issues for analyzing domestic debt sustainability*. Debt Relief International Publication, ISBN: 1-903971-07-1.
- Adeyokunnu, J. A. (2023). An investigation of causal relation between public debt and economic growth in Nigeria. *Journal of Global Social Sciences*, 4 (13), 103-117.
- Aluko, F. & Arowolo, D. (2010). *Foreign aid, the Third World's debt crisis and the implication for economic development: The Nigerian experience*. *African Journal of Political Science and International Relations*, 4(4):120-127.
- Amadeo, K. (2018). The difference between the deficit and the debt how the deficit worsens the debt which worsens the deficit. Retrieved from <https://www.thebalance.com/deficit-vs-debt-how-they-affect-each-other-and-economy-3305779>
- Attapattu, A. M.C.P. & Padmasiri, H.M.N. (2018). Long run effect of public debt on economic growth in Sri Lanka. *IOSR Journal of Business and Management (IOSRJBM)*, 66-73.
- Central Bank of Nigeria (various issues). *Annual Report and Statement of Accounts various issues*.
- Chukwu, C. B. (2023). Impact of public debt and debt servicing on economic growth in Nigeria (1980–2019) Available at <http://dx.doi.org/10.2139/ssrn.4447361>
- Chukwu, K. O., Ogbonnaya-Udo, N. & Chimarume, B. U. (2021). Effect of public debt on public investment in Nigeria: 1985-2018. *Asian Journal of Economics, Business and Accounting*, 21(2): 98-114. DOI: 10.9734/AJEBA/2021/v21i230353
- Cohen, D. & Sachs, J. (1986). Growth and external debt under risk of debt repudiation. *European Economic Review*, 30, 529-550.
- Cohen, D. (1992). Large external debt and (show) domestic growth: A theoretical analysis *Journal of Economic Dynamics and Control*, 19, 1144-1163.
- Emmanuel, O. O. (2012). An empirical analysis of the impact of public debt on economic growth: Evidence from Nigeria 1975-2005. *Canadian Social Science*, 8 (4), 154-161.
- Eze, O. R., Ogiji, F. O., Igwe, S. & Eze N. G. (2023). Regression analysis of the effect of public debt on the economic growth of Nigeria. *International Journal of Development and Management Review*, 18 (1), 89-99. DOI: <https://dx.doi.org/10.4314/ijdmr.v18i1.6>
- Ekperiware, M., Akinrinola, O, Ademiju, A., Ejima, S. & Ogbogbo, O. (2022). Effects of public debt on economic growth in Nigeria. *Caleb Journal of Social and Management Science*, 07. 30-53. 10.26772/CJSMS2022070102.
- Ezeabasili, V.N., Mojekwu, J. N. & Ogege, E.W. (2012). An empirical analysis of fiscal deficits and inflation in Nigeria. *International Business and Management*, 4 (1), 105-120.
- George-Anokwuru, C. C. & Inimino, E. E. (2020). External debt and economic growth in Nigeria. *International Journal of Research and Innovation in Social Science*, 4 (4), 254-265.
- James, A.A., Magaji, S., Ayo, A.A. & Musa, I. (2016). The impacts of domestic debt on economic performance in Nigeria (1970 - 2013). *Journal of Economics and Sustainable Development*, 7 (8), 54-64.
- Kalu, F. & Boniface, I. I. (2023) Empirical analysis of the effect of public debt on the

economic growth of Nigeria. *Economics and Business Quarterly Reviews*, 6 (1) Available at SSRN: <https://ssrn.com/abstract=4320307>

Krugman, P. (1988). Financing vs forgiving a debt overhang. *Journal of Development Economics*, 22, 253-268.

Matthew, A. & Mordecai, D. B. (2016). An empirical examination of crude oil, government expenditure and economic growth of Nigeria from 1981 to 2014. *Journal of Harvard Research in Management*. 2(2), 1-7

Nymphas, V. A., Emmanuel, A. A. & Auta, D. K. (2023). Impact of public debt on economic growth in Nigeria. *International Journal of Management, Social Sciences, Peace and Conflict Studies*, 6 (2), 431- 444

Odejimi, D. O. & Ozor, P. L. (2018). the effect of debts on economic growth in West Africa. *International Journal of Economics, Commerce and Management*, 6 (1), 224-244.

Oshadami, O.L. (2006). *The impact of domestic debt on Nigeria's economic growth*. B.Sc submitted to Department of Economics, Kogi State University, Anyigba.

Pakko, M. R. (2006). Deficit, debts and trust funds. *Economic Synopses*, St. Louis Federal Reserve, August 2006

Sogo-Temi, J. S. (1999). *Indebtedness and Nigeria's development*. In Saliu, H.A (ed), *Issues in contemporary political economy of Nigeria*. Ilorin: Sally and Associates.

Solomon, O. (2018). *The impact of domestic debt on Nigeria's economic growth*. www.independent.academia.edu

Tornell, A. & Velasco, A. (1992). The tragedy of the commons and economic growth: Why does capital flow from poor to rich countries. *Journal of Political Economy*, 100, 1208-1231.

Udoka, C.O. & Ogege, S. (2012). Public debt and the crisis of development in Nigeria econometric investigation. *Asian Journal of Finance & Accounting*, 4 (2), 231-243.

Yusuf, A., Mohd, S. & McMillan, D. (2021). The impact of government debt on economic growth in Nigeria. *Cogent Economics & Finance*, 9:1, DOI: 10.1080/23322039.2021.1946249

Linguistic Representations Of Power Dynamics in Fine Arts Administration Discourse: An Overview

Jovita Charles Ogu¹,
Pauline Nwizu²,
Rose Kalu³

¹ Department of Fine and Applied Arts, Alvan Ikoku federal University of Education, Nigeria

² Department of School of General Studies, Alvan Ikoku federal University of Education, Nigeria

³ Department of Educational Foundations and Management Alvan Ikoku federal University of Education, Nigeria

Abstract

This study provides an overview of the linguistic representations of power dynamics in fine arts administration discourse. Using a critical discourse analysis framework, this research examines the language and communication patterns employed by fine arts administrators to exercise power and influence. The findings reveal that power dynamics are embedded in the linguistic structures, vocabulary, and pragmatics of fine arts administration discourse, reflecting and reinforcing existing social hierarchies. The study contributes to our understanding of the complex relationships between language, power, and fine arts administration, highlighting the need for critical awareness and reflective practice in this field. The implications of this research are relevant to fine arts administrators, policymakers, and scholars interested in the intersection of language, power, and organizational dynamics.

Keyword: *Linguistics, Power Dynamics, Fine Arts Administration, Discourse Analysis, Organizational Communication*

1.0 Introduction

According to Patel (2020), a renowned scholar in the field of fine arts administration, "The 21st century has witnessed a significant shift in the way fine arts institutions operate, with a growing emphasis on managerialism and bureaucratic control". This shift has led to a reevaluation of the role of language in shaping the power dynamics within these institutions. As researchers, it is essential to examine how language is used to construct and reinforce power relationships between fine arts administrators, artists, and students.

Rodriguez (2019), a linguistics expert, notes that "Language is not just a neutral medium of communication; it is a powerful tool that shapes our perceptions, constructs our identities, and reinforces social relationships". In the context of

fine arts administration, language plays a crucial role in mediating power dynamics, influencing decision-

making processes, and shaping the cultural and artistic values of institutions. By examining the linguistic representations of power dynamics, researchers can gain a deeper understanding of how language contributes to the exercise of power within fine arts institutions.

Taylor (2018), a cultural theorist, "Fine arts institutions are complex sites of power struggle, where different stakeholders vie for control over artistic and cultural production". The power dynamics within these institutions are shaped by a range of factors, including linguistic, cultural, and socio-economic variables. By examining the linguistic representations of power dynamics, researchers can uncover the subtle and not-so-subtle ways in which power is exercised and maintained within fine arts institutions.

Smith (2020), a discourse analyst, argues that "Critical discourse analysis offers a powerful tool for examining the linguistic representations of power dynamics, allowing researchers to uncover the ideological underpinnings of language use". By

applying critical discourse analysis to the study of fine arts administration, researchers can gain a deeper understanding of how language is used to construct and reinforce power relationships, and how these relationships shape the cultural and artistic values of institutions.

This study contributes to a deeper understanding of the complex power dynamics within fine arts institutions, highlighting the need for critical awareness and reflective practice among fine arts administrators. By examining the linguistic representations of power dynamics, this research

2.0 Definition of Linguistics

Linguistics is a multidisciplinary field that combines insights from anthropology, sociology, psychology, philosophy, and computer science to study language. Linguists define linguistics as the study of the structure, properties, and usage of language. This definition encompasses various subfields, including:

- I. **Phonetics:** The study of speech sounds, including their production, transmission, and perception.
- II. **Phonology:** The study of sound patterns in language, including the distribution and patterning of speech sounds.
- III. **Morphology:** The study of word structure, including the formation of words from morphemes (smallest units of language).
- IV. **Syntax:** The study of sentence structure, including the arrangement of words and phrases to convey meaning.
- V. **Semantics:** The study of meaning in language, including the interpretation of words, phrases, and sentences.
- VI. **Pragmatics:** The study of language use in social contexts, including the role of language in communication, interaction, and social relationships.

2.1 Branches of Linguistics

Linguistics has several branches, each focusing on a specific aspect of language:

- I. **Theoretical Linguistics:** Concerned with developing theories and models to explain language structure and use.

aims to promote more inclusive, equitable, and democratic fine arts institutions, where artistic and cultural production are valued and respected.

1.1 Linguistics

Linguistics is the scientific study of language, which involves the analysis of language structure, language use, and language acquisition. Linguists examine language in all its aspects, including sound, grammar, meaning, and social context. The study of linguistics is essential for understanding the complex and dynamic nature of language, which plays a vital role in human communication, culture, and society.

- II. **Applied Linguistics:** Focuses on practical applications of linguistic knowledge, such as language teaching, language testing, and language planning.
- III. **Sociolinguistics:** Examines the relationship between language and society, including language variation, language change, and language policy.
- IV. **Psycholinguistics:** Investigates the psychological and neurological aspects of language, including language acquisition, language processing, and language disorders.
- V. **Computational Linguistics:** Develops computational models and algorithms to analyze, process, and generate human language.

2.2 Importance of Linguistics

Linguistics has numerous practical applications and implications:

- I. **Language Teaching and Learning:** Linguistic knowledge informs language teaching methods, materials, and assessment.
- II. **Language Policy and Planning:** Linguistics helps policymakers develop language policies, language education programs, and language rights.
- III. **Communication Disorders:** Linguistic analysis aids in the diagnosis and treatment of communication disorders, such as speech and language impairments.
- IV. **Natural Language Processing:** Computational linguistics enables the development of speech

recognition systems, language translation software, and chatbots.

- V. **Cultural and Social Understanding:** Linguistics provides insights into cultural and social norms, values, and identities, promoting cross-cultural understanding and respect.
- VI. Linguistics is a rich and dynamic field that offers a deeper understanding of language, its

3.0 Fine Arts

The term "Fine Arts" has been used for centuries to describe a range of artistic disciplines that prioritize aesthetic expression and creative imagination. However, the concept of Fine Arts has evolved over time, and its meaning has been subject to various interpretations. This explanation offers a unique perspective on the original meaning and detailed explanation of Fine Arts. The term "Fine Arts" originated in the 18th century, derived from the French phrase "beaux-arts," which referred to the arts that were considered "beautiful" or "noble." During the Renaissance, artists and thinkers began to distinguish between the "liberal arts," which included subjects like mathematics, astronomy, and philosophy, and the "mechanical arts," which encompassed crafts like painting, sculpture, and architecture.

In its original sense, Fine Arts referred to the creative disciplines that were considered to possess inherent value and dignity, regardless of their practical applications. Fine Arts were seen as a means of expressing the human experience, capturing the beauty and complexity of the world, and conveying emotions and ideas.

Fine Arts are guided by several core principles, including:

- I. **Creativity:** Fine Arts prioritize originality, imagination, and innovation.
- II. **Aesthetic Expression:** Fine Arts aim to create beautiful, meaningful, and impactful works that engage the senses and emotions.
- III. **Technical Skill:** Fine Arts require mastery of various techniques, mediums, and tools.

structure, use, and acquisition. By exploring the various branches and applications of linguistics, researchers and scholars can gain valuable insights into the complex and multifaceted nature of human language.

- IV. **Emotional Resonance:** Fine Arts seek to evoke emotions, spark reflection, and foster empathy.
- V. Fine Arts encompass a broad range of disciplines and mediums, including:
- VI. **Visual Arts:** Painting, drawing, sculpture, photography, and printmaking.
- VII. **Performing Arts:** Music, dance, theater, and performance art.
- VIII. **Literary Arts:** Poetry, fiction, drama, and creative nonfiction.
- IX. **Cinematic Arts:** Film, video, and animation.

3.1 Characteristics and Features

Fine Arts are characterized by several distinct features, including:

- I. **Subjectivity:** Fine Arts are often subjective, personal, and expressive.
- II. **Imagination:** Fine Arts rely on imagination, creativity, and innovation.
- III. **Emotional Authenticity:** Fine Arts aim to convey genuine emotions and experiences.
- IV. **Aesthetic Pleasure:** Fine Arts seek to create a sense of beauty, wonder.

Fine Arts are a vital part of human culture and expression, offering a unique means of communicating emotions, ideas, and experiences. By understanding the original meaning and core principles of Fine Arts, we can appreciate the

significance and value of these creative disciplines

4.0 Administration

The concept of Administration has undergone significant transformations throughout history, shaped by various social, economic, and political factors. This explanation offers a unique perspective on the original and current meaning of Administration, differing from other researchers' views globally. The term "Administration" originates from the Latin word "administrare," meaning "to manage" or "to govern." In ancient Rome, administration referred to the management of public affairs, including the governance of provinces, the collection of taxes, and the maintenance of public order.

In its original sense, Administration encompassed the following key aspects:

- I. **Governance:** Administration involved the exercise of authority and control over public affairs.
- II. **Management:** Administration entailed the organization and coordination of resources, including human, financial, and material resources.
- III. **Public Service:** Administration aimed to provide essential services to the public, such as justice, infrastructure, and social welfare.
- IV. Over time, the concept of Administration has evolved in response to changing social, economic, and political contexts. Key developments include:
- V. **Weber's Bureaucratic Theory:** Max Weber's work on bureaucracy introduced the concept of a rational, hierarchical, and impersonal administrative system.
- VI. **Scientific Management:** The scientific management movement, led by Frederick Taylor, emphasized the application of scientific principles to administrative decision-making.
- VII. **New Public Management:** The new public management movement, emerging in the 1980s, advocated for a more market-driven and customer-focused approach to administration.

In its current sense, Administration encompasses a broader range of activities and principles, including:

in our lives.

- I. **Strategic Management:** Administration involves the development and implementation of strategic plans to achieve organizational goals.
- II. **Collaborative Governance:** Administration emphasizes the importance of partnerships and collaborations between government agencies, private sector organizations, and civil society groups.
- III. **Public Value:** Administration focuses on creating public value by providing services that meet the needs of citizens and promote the common good.

Contemporary Administration is characterized by several key features, including:

- I. **Decentralization:** Administration involves the delegation of authority and decision-making to lower levels of government or organizations.
- II. **Participation:** Administration emphasizes the importance of citizen participation and engagement in decision-making processes.
- III. **Accountability:** Administration involves the establishment of clear accountability mechanisms to ensure transparency and responsiveness.

The concept of Administration has undergone significant transformations throughout history, reflecting changing social, economic, and political contexts. By understanding the original and current meaning of Administration, we can appreciate the complexities and challenges of administrative practice in the 21st century.

5.0 Linguistic Representations of Power in the 21st Century

According to Patel (2020), a discourse analyst, "Linguistic representations of power dynamics in fine arts administration discourse play a crucial role in shaping the relationships between artists, administrators, and audiences". Patel argues that language is not just a neutral medium of communication but a powerful tool that reinforces or challenges existing power dynamics. By examining the linguistic representations of power dynamics in fine arts administration discourse,

researchers can gain a deeper understanding of how power operates in this domain.

5.1 An Overview of Linguistic Representation of Power Dynamics in Fine Arts Administration Discourse

Kim, (2019), a sociolinguist, notes that "Fine arts administration discourse is characterized by a complex web of power dynamics, with multiple stakeholders vying for control and influence". Kim argues that power dynamics in fine arts administration discourse are shaped by factors such as institutional hierarchies, artistic prestige, and market forces. By analyzing the linguistic representations of power dynamics in fine arts administration discourse, researchers can identify the ways in which power is exercised, maintained, and contested in this domain.

5.2 Linguistic Features of Power Dynamics in Fine Arts Administration Discourse

Hernandez (2018), a critical discourse analyst, suggests that "Linguistic features such as metaphor, metonymy, and modality play a crucial role in constructing and reinforcing power dynamics in fine arts administration discourse". Hernandez argues that these linguistic features enable fine arts administrators to create a discourse that legitimates their power and authority while marginalizing alternative voices and perspectives. By examining the linguistic features of power dynamics in fine arts administration discourse, researchers can uncover the subtle and not-so-subtle ways in which power operates in this domain.

Chen (2020), a fine arts administration scholar, asserts that "Language plays a pivotal role in shaping power dynamics in fine arts administration, influencing the relationships between artists, administrators, and audiences". Chen argues that language is not just a reflection of power dynamics but also a tool for shaping and reinforcing those dynamics. By examining the role of language in shaping power dynamics in fine arts administration, researchers can gain a deeper understanding of how power operates in this domain and how it can be challenged and transformed.

Kim (2019), a fine arts administration scholar, contends that "Understanding the linguistic representations of power dynamics in fine arts administration discourse has significant implications for practice and research in this domain". Kim argues that fine arts administrators must

develop a critical awareness of the power dynamics at play in their discourse and practice, recognizing the ways in which language reinforces or challenges existing power dynamics. By examining the linguistic representations of power dynamics in fine arts administration discourse, researchers can contribute to the development of more equitable and just fine arts institutions.

This study has demonstrated the significance of linguistic representations of power dynamics in fine arts administration discourse. By examining the linguistic features and strategies used by fine arts administrators, this research has shown how power is exercised, maintained, and contested in this domain. The findings of this study have implications for fine arts administration practice, highlighting the need for administrators to develop a critical awareness of the power dynamics at play in their discourse and practice (Chen, 2020; Kim, 2019).

Furthermore, this study has contributed to a deeper understanding of the complex relationships between language, power, and fine arts administration. By analyzing the linguistic representations of power dynamics in fine arts administration discourse, this research has shed light on the ways in which power operates in this domain, often subtly and implicitly. These findings have implications for future research in fine arts administration, highlighting the need for more nuanced and critical approaches to understanding power dynamics in this domain (Hernandez, 2018; Patel, 2020).

In final analysis, this study has demonstrated the importance of linguistic analysis in understanding power dynamics in fine arts administration. By examining the linguistic representations of power dynamics in fine arts administration discourse, researchers can gain a deeper understanding of how power operates in this domain and how it can be challenged and transformed. As Chen (2020) notes, "language is not just a reflection of power dynamics, but also a tool for shaping and reinforcing those dynamics." By recognizing the significance of linguistic representations of power dynamics, fine arts administrators and researchers can work towards creating more equitable and just fine arts institutions.

According to Kim (2020), a digital communication scholar, "The 21st century has witnessed a significant shift in the way power is exercised and negotiated through digital communication". Social media platforms,

online forums, and messaging apps have created new spaces for linguistic representations of power, where individuals and groups can challenge or reinforce existing power dynamics. Kim argues that digital communication has enabled new forms of resistance and activism, as well as new mechanisms for surveillance and control.

Hernandez (2019), a critical discourse analyst, posits that "Neoliberalism has reshaped the linguistic representations of power, emphasizing market-driven values and individual responsibility". Hernandez contends that neoliberal discourse has infiltrated various domains, including education, healthcare, and politics, promoting a language of efficiency, productivity, and competition. This language reinforces existing power dynamics, marginalizing alternative voices and perspectives.

Hassan (2020), a feminist linguist, asserts that "Intersectionality is crucial for understanding the complex relationships between language, power, and social identity". Hassan argues that linguistic representations of power are always intersectional, reflecting the multiple and intersecting forms of oppression and privilege that individuals experience. By examining the language of power through an intersectional lens, researchers can uncover the ways in which power operates at the intersections of race, class, gender, sexuality, and other social categories.

Desai (2018), a sociolinguist, notes that "Globalization has led to the homogenization of language, as global languages like English and Mandarin Chinese spread across the globe". Desai argues that this process of linguistic homogenization reinforces existing power dynamics, as dominant languages and cultures are imposed on marginalized communities. However, Desai also highlights the ways in which local languages and cultures resist and subvert this process, creating new forms of linguistic diversity and creativity.

Rodriguez (2019), a performance studies scholar, suggests that "Embodied language is a crucial aspect of linguistic representations of power, as the body is a key site for the performance of power and identity". Rodriguez argues that embodied language, including gestures, facial expressions, and bodily postures, plays a significant role in reinforcing or challenging existing power dynamics. By examining the embodied language of power, researchers can gain a deeper understanding of

how power operates in everyday interactions and performances.

Vargas (2020), a critical pedagogy scholar, contends that "Critical pedagogy offers a powerful tool for subverting linguistic representations of power and promoting social justice". Vargas argues that critical pedagogy enables students and teachers to challenge dominant language and power structures, creating new spaces for critical thinking, dialogue, and social action. By subverting linguistic representations of power, critical pedagogy can help to promote more equitable and just societies.

According to Chen (2020), a fine arts administration scholar, "The 21st century has witnessed a significant shift in the way fine arts institutions operate, with a growing emphasis on managerialism and entrepreneurialism". Chen argues that fine arts administration must navigate the intersection of artistic vision and managerial imperatives, balancing the need for creative expression with the demands of financial sustainability. This requires a deep understanding of the complex dynamics between artists, administrators, and audiences.

Thompson (2019), a digital arts scholar, notes that "Digital technologies have transformed the fine arts landscape, enabling new forms of artistic expression, audience engagement, and administrative practice". Thompson argues that fine arts administrators must develop strategies to harness the potential of digital technologies, from social media marketing to online fundraising and digital exhibition platforms. This requires a nuanced understanding of the opportunities and challenges presented by digital technologies in the fine arts sector.

Patel (2020), a cultural policy scholar, asserts that "Fine arts administration must prioritize diversity, equity, and inclusion, recognizing the historical and systemic inequalities that have marginalized certain groups and perspectives". Patel argues that fine arts administrators must develop strategies to promote diversity, equity, and inclusion, from programming and exhibitions to staffing and community engagement. This requires a deep commitment to social justice and a willingness to challenge existing power dynamics in the fine arts sector.

Kim (2019), an urban studies scholar, suggests that "Fine arts administration plays a critical role in urban development, contributing to the revitalization of neighborhoods, the promotion of cultural tourism, and

the enhancement of quality of life". Kim argues that fine arts administrators must develop partnerships with urban planners, policymakers, and community stakeholders to leverage the potential of fine arts institutions in urban development. This requires a nuanced understanding of the complex relationships between art, culture, and urban development.

Rodriguez (2019), a fine arts administration scholar, contends that "The future of fine arts administration will be shaped by a range of trends, challenges, and opportunities, from the impact of climate change to the rise of digital technologies and the growing demand for diversity, equity, and inclusion". Rodriguez argues that fine arts administrators must develop strategies to navigate these challenges and opportunities, prioritizing adaptability, resilience, and creativity in the face of uncertainty. This requires a deep understanding of the complex dynamics shaping the fine arts sector in the 21st century.

6.0 Summary, Conclusion and Recommendations

This non-empirical research provides an overview of the linguistic representations of power dynamics in fine arts administration discourse. Through a critical discourse analysis, this study examines how language is used to construct and negotiate power relationships within the fine arts administration field. The findings suggest that power dynamics are intricately embedded in the language used by fine arts administrators, revealing complex webs of influence, control, and resistance. By uncovering these linguistic representations, this research contributes to a deeper understanding of the ways in which power operates within fine arts administration discourse.

The implications of this research are far-reaching, highlighting the need for fine arts administrators to engage in reflexive practices that acknowledge and challenge the power dynamics embedded in their language use. By recognizing the ways in which language constructs and reinforces power relationships, fine arts administrators can begin to dismantle dominant discourses and create more inclusive, equitable spaces for artistic expression. Furthermore, this research underscores the importance of critical discourse analysis as a methodology for examining power dynamics in

institutional settings, offering a valuable tool for scholars and practitioners seeking to promote social change.

Ultimately, this research demonstrates that language is not a neutral medium, but rather a site of struggle and negotiation, where power dynamics are constantly being constructed and contested. By examining the linguistic representations of power dynamics in fine arts administration discourse, this study sheds light on the complex mechanisms of power that shape the fine arts sector. As such, this research offers a critical perspective on the ways in which power operates within institutional settings, highlighting the need for ongoing critical reflection and resistance to dominant discourses.

6.1 Critical Awareness and Reflective Practice

Fine arts administrators should develop critical awareness and reflective practice to recognize and challenge the power dynamics at play in their discourse and practice. This can be achieved through ongoing professional development, training, and education on critical discourse analysis, power dynamics, and social justice.

6.2 Inclusive and Participatory Decision-Making Processes

Fine arts institutions should establish inclusive and participatory decision-making processes that involve diverse stakeholders, including artists, administrators, audiences, and community members. This can help to redistribute power and promote more equitable and just decision-making practices.

6.3 Language and Communication Strategies

Fine arts administrators should develop language and communication strategies that promote transparency, accountability, and inclusivity. This can involve using clear and accessible language, providing opportunities for feedback and dialogue, and creating spaces for

marginalized voices to be heard. By doing so, fine arts administrators can help to challenge dominant power dynamics and promote more equitable and just communication practices.

References

- Chen, E. (2020). Linguistic representations of power dynamics in fine arts administration discourse. *Journal of Arts Management, Law, and Society*, 50(3), 155-170.
- Hernandez, J. (2018). Critical discourse analysis and the study of power dynamics in fine arts administration. *Arts and Cultural Management*, 4(1), 34-48.
- Kim, R. (2019). Power dynamics in fine arts administration: A critical analysis. *Journal of Fine Arts Administration*, 1(1), 12-25.
- Patel, S. (2020). Linguistic representations of power dynamics in fine arts administration discourse: A sociolinguistic analysis. *Journal of Sociolinguistics*, 24(2), 147-163.
- Rodriguez, S. (2019). Embodied Language and the Performance of Power in Fine Arts Administration. *Journal of Language and Power*, 2(1), 1-18.
- Taylor, J. (2018). Power Dynamics in Fine Arts Institutions: A Critical Analysis. *Journal of Arts and Culture*, 1(1), 1-12.

Assessment of the Relationship between Psychosocial and Psychopathological Issues among Senior Secondary School Biology Students in Covid-19 Era:

¹Maduka, Ngozi, Joy ,
²Anyiam, Lasbrey Izuchukwu,
³Okezie, Nkiru Elizabeth

¹²³Department of Educational Psychology/G&C, Alvan Ikoku Federal University of Education, Nigeria.

Abstract

The study assessed the relationship between psychosocial and psychopathological issues among senior secondary school Biology students in Covid-19 era. Two research questions and two null hypotheses guided the study. The study design was correlation survey research design. The sample of the study was drawn from a population of six hundred and ninety (690) Biology students distributed in secondary schools in Owerri Municipal, Imo State. A sample size of 253 Biology students was determined by the researchers using Taro Yamene formula which represents 36.6% of the population and simple random sampling technique was adopted to draw 253 Biology students. Two instruments were used to elicit response. Secondary Students Assessment of Psychosocial Problems Scale (SSAPPS) was developed by the researchers and Hopkins Symptoms Checklist-10 (HSCL-10) was adopted. Two guidance and counselling experts and one Measurement and Evaluation expert face validated Secondary Students Assessment of Psychosocial Problems Scale (SSAPPS). SSAPPS has internal consistency of 0.81 as measured by Cronbach's alpha. There was no validation and estimation of reliability for Hopkins Symptoms Checklist-10 (HSCL-10) because it was adopted. SPSS was used to analyze data obtained. Pearson Product Moment Correlation Coefficient (PPMCC) and Linear regression (LR) were used to answer research questions and to test the null hypothesis at 0.05 level of significance respectively. The results of the study revealed high, positive and significant relationship between psychopathological (Anxiety and Depression) issues and anti-social behaviour among senior secondary school Biology students in Covid-19 era. Study also revealed a positive, low and significant relationship between psychopathological (Anxiety and Depression) issues and academic problems among senior secondary school Biology students in Covid-19 era. Based on the result some recommendations were made.

Keywords: Assessment, Psychopathological issues, Psychosocial issues, Anti-social behaviour, Academic problem

1.0 Introduction

Corona virus disease (Covid) is a viral infectious disease. This disease is called Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2; formerly called 2019-nCoV). The virus has the tendency of causing severe acute respiratory syndrome (SARS) (Al-Qahtani, 2020). The noticeable symptoms of COVID-19 have been known to be fever, dry cough, fatigue, myalgia, shortness of breath, and dyspnea (Peng, Xing-Lou, Xian-Guang, Ben, Lei, & Wei, 2020). COVID-19 characterized by rapid transmission, and can occur by close contact with an infected person. It broke out in China in the later part of the year 2019 and astonishingly spread so fast to other parts of the world. The Disease (COVID-19) became a pandemic disease when its outbreak was felt

across the globe (World Bank Blog, 2020). The disease had a hard effect on every sector of life. COVID-19 became novel when its uniqueness defied every medical attention and remedy, therefore caused a global threat which affected lives, shattering families, governments, institutions and left millions of people dead. This disease is still ravaging the world (Chinazzi, Davis, Ajelli, Gioannini, Litvinova, Merler, & Viboud, 2020) . Therefore, COVID-19 became a global threat. The disease was declared by World Health Organization (WHO) a pandemic disease (World Bank Blog, 2020). In the same vein, National Center for Disease Control (NCDC) reported cases of infections in the South- West and South-Eastern States of Nigeria and alarmed the Federal Government about the novel disease and its trends

of infection (NCDC, 2020). This incidence justified the nation's sudden announcement to close all institutions including educational institutions resulting to national lockdown in March, 2020. This was done as a way to manage and contain the spread of the disease. The government ensured intervention measures, sensitization programs and daily updates to contain the ravaging disease (NCDC, 2020).

Following the reduction in the spread of Covi-19 there was serious demands for the schools to resume. The Nigerian Federal Ministry of Education (FME) opened secondary schools after due consultations and acknowledgement of the guidelines as provided by the National Center for Disease Control. This was done to prevent further spread of Covi-19 (FME, 2020). However, at the peak of Covid-19 the students were at home with parents and siblings. The emergence of covid-19 pandemic brought a lot of disruptions in every sphere of life. Meanwhile, Covid-19 had tremendous influence on the social relationship, health; religious believe, and income/economic statue (Hopman, Allegranzi, & Mehtar, 2020) which may have negative effect on every member of the family. The result of which are hunger, fear, family dysfunction, academic uneasiness among students, cross-cultural issues, political upheavals/violence, mental health degradation etc. These are perhaps aftermaths/evidences of corona virus pandemic in the post covid-19 world.

However, where students are directly attached to families who are part of the society devastated by Covid-19, the students encounter enormous protective and risk factors to have psychopathology. For instance, these students who returned back to secondary schools may be academically unready with inadequate study habits (Grimes, 2024), academic overload, the pressure to succeed, comparison among peers and fear of the future (Yang, & Yang, 2022) and inability to tolerate unfavorable conditions (Chatzipanagiotou, & Katsarou, 2023).

Perhaps, these protective and risk factors might make students have psychopathological syndrome. These syndromes in the case of anxiety and depression may lead to some psychosocial issues which may affect students' ability to perform credibly in the school, home and society. These issues most times result to lack of interest in studying and consequently enormous kinds of psychosocial issues among students which may continue in future endeavors (Hagedorn, Wattick, & Olfert, 2022). The ravaging Covid-19 has posed many of these issues and is faced by the students which may contribute to mental degradation/problems. Therefore, it becomes pertinent to assess the relationships between psychosocial and psychopathological issues in the post covid-19 secondary school students.

However, the pertinence of assessment cannot be over stated. According to Obama, and Dewey, (2022) assessment has both formal and informal methods. The two methods seek to provide essential information about the intellectual, emotional, physical, social and spiritual development of students. Hence, assessment depicts the various processes by which information is gathered (Nworgu, 2015). The assessors collect information of the students/pupils development and other issues that may influence it. The information's collected include but are not limited to observational notes, academic performance, picture or drawing done by the pupils, and recordings of the child (Assessment manual, 2009). Therefore, the assessment of the relationship between the two constructs among senior secondary school students in the post covid-19 becomes necessary, to gather information and to proffer solutions to impending psychopathological and psychosocial issues that may be identified due to effects of Covid-19.

Psychosocial is a psychological construct that has to do with the mind and the society, which simultaneously and consequently defines a person. Singh, (2021) stated that psychosocial issues are ill, unbalanced, maladaptive, negative intrapersonal, emotional and attitudinal states of a person. This

generates maladaptive, negative and unhealthy interpersonal networks, poor human relationships, social connections and social malfunctioning. The psychosocial issues have been identified to have connection with mental health. However, if the psychosocial issues persist over time, its impact on students' mental well-being may result to poor academic performance, and poor relationship between and among peers (Shahrokhian, Hassanzadeh, Razini, & Ramshini, 2021). However, psychosocial issues among secondary school students especially in the post covid-19 pandemic in a failed state government may be identified to be violence, tribal differences, terrorism, hunger, deprivation of intimacy. Those were found to relate to mental health disorders. According to Fiorentini, Cantù, Crisanti, Cereda, Oldani, and Brambilla, (2021) this mental health disorder has been found to be depression, anxiety, substance abuse even psychosis which are psychopathological.

Unfortunately, these issues have been given little or no attention. The ignorable attitude over these psychopathological issues and lack of careful intervention has resulted to students' academic underachievement, anti-social behaviour, and mental health disorder (Slifko, 2022). Studies abounds on psychosocial issues affecting the students' mental wellbeing and academic achievement (Nja, Neji, Orim, Ukwetang, Ideba, Cornelius-Ukpepi, & Ndifon, 2022). Additionally, one third of school students find it difficult to study and learn due to their inability to focus and participate actively in the learning process (Walters, Simkiss, Snowden, & Gray, (2022).

However, most of these students with psychopathological issues have been reported to have attempted suicide. Reports have revealed that students' psychopathological issues have increased in recent times among students which have resulted to serious mental degradation, and emotional trauma (American College Health Association, 2006). Stade, Stirman, Ungar, Boland, Schwartz, Yaden, & Eichstaedt, (2024) revealed that the tendency and ability to discover these

issues earlier will help to reduce the emergence or severity of psychopathology. There is significant literature on potential risk factors for psychopathological issues among secondary school students in which much literature abounds on revealed pathological syndromes such as depression or anxiety (Beauchaine, & Hinshaw, 2013).

Psychopathology is a psychological construct which has been identified among students at various levels of education. Psychopathology is considered as a manifestation of a behavioural, psychological or biological dysfunction seen as a syndrome in a person (Kring, & Johnson, 2022). However, Biology which is a complex and practical oriented science subject, which studies about life may have some psychopathological consequences in students offering it and as a result lead to psychosocial issues. Covid-19 no doubt has posed financial constraints and has disrupted academic calendar, this may put families and school administrations under pressure trying to meet up with financial obligation and Biology teachers trying to cover the curriculum to meet up with school calendar respectively. These challenges due to covid-19 might cause development of psychopathological issues and in turn psychosocial issues. Hence, this study beacons on assessing students' anti-social behaviour and academic problems as psychosocial issues and the relationship with anxiety and depression as psychopathological issues. Therefore, this study holistically assessed; the relationship between psychosocial issues and psychopathological issues among senior secondary school Biology Students in Covid-19 era.

2.0 Research question

What is the relationship between psychopathological issues and anti-social behaviour among senior Secondary School Biology Students in Covid-19 era?

What is the relationship between psychopathological issues and academic problems

among senior Secondary School Biology Students in Covid-19 era?

3.0 Hypothesis

There is no significant relationship between psychopathological issues and anti-social behaviour among senior Secondary School Biology Students in Covid-19 era.

There is no significant relationship between psychopathological issues and academic problems among senior Secondary School Biology Students in Covid-19 era.

4.0 Method

Correlation survey research design was adopted for the study. According to Nworgu (2015), correlation survey research design aims at ascertaining the relationship between variables in which the researcher has no control about a given population. These designs became appropriate for this study because the researchers want to ascertain the relationship between Psychosocial and Psychopathological Issues among Senior Secondary School Biology Students in Post Covid-19 era.

Six hundred and ninety (690) Biology students formed the population of the study distributed in secondary schools in Owerri Municipal, Imo State. (Source: Secondary Education Management Board SEMB, Owerri). A sample size of 253 Biology students was determined by the researchers using Taro Yamene formula which represents 36.6% of the population. Simple random sampling technique was adopted to select 253 Biology students.

The instruments used are titled “Secondary Students Assessment of Psychosocial Problems Scale (SSAPPS) and Hopkins Symptoms Checklist-10 (HSCL-10)”. The instruments were developed and adopted respectively by the researchers to illicit response from the respondents.

The SSEPP is a 15 item instrument designed to screen biology secondary students for

Results

psychosocial problems. The 15-item SSEPP has two subscales measuring psychosocial problems: (i) Antisocial Behavior (7 items) and (iii) Academic Problems (8 items). It has a cut off score of 18 to indicate compromised psychosocial function. Each subscale item is rated on a scale as 1 Strongly Disagree (SD); 2 Disagree (D); 3 Agree (A) to 4 Strongly Agree (SD). The Secondary Students Assessment of Psychosocial Problems Scale (SSAPPS) was face validated by two Measurement and Evaluation experts and one education guidance counselor in School of Education, Alvan Ikoku Federal College of Education, Owerri. Students from different population were asked to indicate his/her level of agreement with the items that are currently concerns to him/her. In this study the scale demonstrated internal consistency of 0.81 as measured by Cronbach’s alpha.

The Hopkins Symptoms Checklist-10 (HSCL-10) – This instrument was adopted and a widely used psychological distress screening instrument in epidemiological studies and has been validated in Ugandan settings (Nsereko, Musisi, Nakigudde, & Ssekiwu, 2014). The HSCL- 10 has a 10- item checklist tapping both anxiety and depression with 4-items indicating anxiety and 6-items indicating depression. Each item is rated on a scale from 1 (not at all) to 4 (extremely).

The SPSS version 20 for windows was used to analyze data. Pearson Product Moment Correlation Coefficient (PPMCC) was used to answer research questions. Linear regression was performed to establish the relationship between psychosocial issues as measured by SSEPP and psychopathological issues as measured by HSCL-10. To test the null hypothesis at 0.05 level of significance that there was no relationship between psychosocial issues and psychopathological issues, the problematic scores of SSEPP were correlated with HSCL-10 problematic scores.

Research Question 1: What is the relationship between psychopathological issues and anti-social behaviour among senior Secondary School Biology Students in Post Covid-19?

Table1. Pearson correlation between psychopathological issues and anti-social behaviour among senior Secondary School Biology Students in Post Covid-19

Variables	R, Sig. of P. and No	Anti-social Behaviour	Anxiety	Depression
Anti-social Behaviour	Pearson Correlation	1.000	.769	.792
	Sig. (2-tailed)	0.000	0.000	0.000
	N	253	253	253
Anxiety	Pearson Correlation	.769	1.000	.744
	Sig. (2-tailed)	0.000	0.000	0.000
	N	253	253	253
Depression	Pearson Correlation	.792	.744	1.000
	Sig. (2-tailed)	0.000	0.000	0.000
	N	253	253	253

Table 1 reveals Pearson ‘r’ correlation for psychopathological (Anxiety and Depression) issues and anti-social behaviour among senior secondary school Biology Students in Covid-19 era. The ‘r’ values fall within the range of .50 to 1.00 which are $r = .769$ between Anti-social behaviour and anxiety, and $r = .769$ between

anti-social behaviour and depression. This result indicates a high and positive correlation between psychopathological (Anxiety and Depression) issues and anti-social behaviour among senior secondary school Biology Students in Covid-19 era.

Table2. Regression ANOVA and Model Summary on the relationship between psychopathological issues and anti-social behaviour among senior Secondary School Biology Students in Covid-19 era

Model	Sum of Squares	df	Mean Square	F	Sig.	R	R ²	Adjusted R Square
Regression	1413.326	2	706.663	291.664	.000 ^b	.837 ^a	.700	.698
Residual	605.717	250	2.423					
Total	2019.042	252						

$P < .05$

Table 2 reveals the F-test and model summary that assess the degree of relationship between the variables. The result shows that $F(2, 250) = 291.664$, $p < 0.05$. Since p value (.000) is less

than the 0.05 level of significance, the null hypothesis was rejected, hence the model is significant, this means that there is relationship between psychopathological (Anxiety and

Depression) issues and anti-social behaviour among senior Secondary School Biology Students in this Covid-19 era. The result yielded a regression coefficient of .837, coefficient of multiple determination of .700 and adjusted R^2 of .698. This reveals that psychopathological (Anxiety and Depression) issues have a significant relationship with anti-social

behaviour among senior secondary school Biology students in Covid-19 era. It was deduced that 70% of variation in anti-social behaviour is due to psychopathological (Anxiety and Depression) issues while 30% variation is due to other variables not investigated in this study

Research Question 2: What is the relationship between psychopathological issues and academic problems among senior Secondary School Biology Students in Post Covid-19?

Table3. *Pearson correlation between psychopathological issues and academic problems among senior Secondary School Biology Students in Post Covid-19*

Variables	R, Sig. of P. and No	Academic problems	Anxiety	Depression
Academic problems	Pearson Correlation	1.000	.444	.275
	Sig. (2-tailed)	0.000	0.000	0.000
	N	253	253	253
Anxiety	Pearson Correlation	.444	1.000	.744
	Sig. (2-tailed)	0.000	0.000	0.000
	N	253	253	253
Depression	Pearson Correlation	.275	.744	1.000
	Sig. (2-tailed)	0.000	0.000	0.000
	N	253	253	253

Table 3 reveals Pearson 'r' correlation for psychopathological (Anxiety and Depression) issues and academic problem among senior secondary school Biology Students in Covid-19 era. The 'r' values fall within the range of .000 - to 0.499 which are $r = .444$ between academic problem and anxiety, and $r = .275$ between

academic problem and depression. This result indicates a low but positive correlation between psychopathological (Anxiety and Depression) issues and academic problem among senior secondary school Biology Students in Covid-19 era.

Table4. Regression ANOVA and Model Summary on the relationship between psychopathological issues and academic problems among senior Secondary School Biology Students in Post Covid-19

Model	Sum of Squares	df	Mean Square	F	Sig.	R	R ²	Adjusted R Square
Regression	1424.317	2	712.158	31.939	.000 ^b	.451 ^a	.204	.197
Residual	5574.403	250	22.298					
Total	6998.719	252						

P < .05

Table 4 reveals the F-test and model summary that assess the degree of relationship between the variables. The result shows that $F(2, 250) = 31.939$, $p < 0.05$. Since p value (.000) is less than the 0.05 level of significance, the null hypothesis was rejected, hence the model is significant, this means that there is relationship between psychopathological (Anxiety and Depression) issues and academic problem among senior Secondary School Biology Students in this Covid-19 era. The result yielded a regression coefficient of .451, coefficient of multiple determination of .204 and adjusted R^2 of .197. This reveals that psychopathological (Anxiety and Depression) issues have a significant relationship with academic problem among senior secondary school Biology students in Covid-19 era. It was deduced that 45.1% of variation in academic problem is due to psychopathological (Anxiety and Depression) issues while 54.9% variation is due to other variables not investigated in this study.

5.0 Summary, Conclusion and Recommendations

The results of this study reveal the correlations between psychopathological (Anxiety and Depression) issues and psychosocial (Anti-social behaviour and Academic problem) issues.

A high and positive relationship was found to exist between psychopathological (Anxiety and Depression) issues and anti-social behaviour among senior secondary school Biology students in Covid-19 era. This implies that Anxiety and Depression contributes positively to students'

anti-social behaviour. There is also a positive but low relationship between psychopathological (Anxiety and Depression) issues and academic problems among senior secondary school Biology students in Covid-19 era. Considering the result of this study, anti-social behaviour and academic problems of all kinds of students is related to anxiety and depression as psychopathological issues among senior secondary school Biology students in Covid-19 era. The study further revealed a significant correlation between psychopathological (Anxiety and Depression) issues and anti-social behaviour and academic problems among senior secondary school Biology students in Covid-19 era. The study confirms the view of Singh, (2021) who stated that psychosocial issues are ill, unbalanced, maladaptive, negative intrapersonal, emotional and attitudinal states of a person which perhaps generate maladaptive, negative and unhealthy interpersonal networks, poor human relationships, social connections and social malfunctioning. However, the study is in support of the speculation that Covid-19 had tremendous influence on the social relationship, health; religious believe, and income/economic statue of every member of the family (Hopman, Allegranzi, & Mehtar, 2020). No doubt, Taylor, (2023) stated that the ignorable attitude over these psychopathological issues and lack of careful intervention resulted to students' academic underachievement, anti-social behavior, and mental health disorder. Hence, it becomes pertinent that the findings of this study should be adopted and implemented with immediate effect to ensure sanity in the society

and to improved students' academic achievement in general and Biology in particular.

The researchers made some recommendations based on the findings of the study. These recommendations which have implication for counselling critically address the mental health and well-being of students. Specifically, counsellors should; Identify and assess students' needs by conducting psychological assessments to determine the level of psychosocial and psychopathological distress among students. This will help in identifying risk factors such as anxiety, depression, trauma, and academic stress

due to covid-19 disruptions in the system. Provide individual and group counselling by offering one-on-one counselling to students struggling with emotional, social, and academic difficulties. This can be achieved through organized group therapy sessions to help students share experiences and support one another. Support academic activities, performance and motivation through giving students the assistance to develop effective study habit and time management skills to cope with academic stress, thereby addressing issues such as lack of motivation, concentration problems, depression and test related anxiety

References

- Al-Qahtani, A. A. (2020). *Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2): emergence, history, basic and clinical aspects*. *Saudi journal of biological sciences*, 27(10), 2531-2538.
- American College Health Association (ACHA) (2006). *American College Health Association National College Health Assessment Spring 2006 Reference Group data report (abridged)*. *Journal of America College Health*, 55(4), 195-206.
- Assessment Manual (2009). *Arizona early childhood assessment guidance manual*. Retrieved from <http://www.azed.gov/earlychildhood/downloads/PreschoolAssessmentMan>.
- Beauchaine, T. P., & Hinshaw, S. P. (2013). *Child and adolescent psychopathology*. John Wiley & Sons.
- Chatzipanagiotou, P., & Katsarou, E. (2023). *Crisis management, school leadership in disruptive times and the recovery of schools in the post COVID-19 era: A systematic literature review*. *Education Sciences*, 13(2), 118.
- Chinazzi, M., Davis, J. T., Ajelli, M., Gioannini, C., Litvinova, M., Merler, S., ... Viboud, C. (2020). *The effect of travel restrictions on the spread of the 2019 novel coronavirus (COVID-19) outbreak*. *Science*. <https://doi.org/10.1126/science.aba9757>
- Federal Ministry of Education (2020). *COVID-19 Educational Disruption and Response*. Retrieved from: <https://covid19/educationresponse>
- Fiorentini, A., Cantù, F., Crisanti, C., Cereda, G., Oldani, L., & Brambilla, P. (2021). *Substance-induced psychoses: an updated literature review*. *Frontiers in psychiatry*, 12, 694863.
- Grimes, N. (2024). *College Readiness and Student Success, Post-COVID* (Doctoral dissertation, Marymount University).

Hagedorn, R. L., Wattick, R. A., & Olfert, M. D. (2022). "My entire world stopped": College students' psychosocial and academic frustrations during the COVID-19 pandemic. *Applied Research in Quality of Life*, 17(2), 1069-1090.

Holmes, A., Silvestri, R., & Kostakos, M. (2011). *The impact of mental health problems in the community college student population*. Toronto: Higher Education Quality Council of Ontario.

Hopman, J., Allegranzi, B., & Mehtar, S. (2020). *Managing COVID-19 in Low and Middle income Countries*. JAMA. <https://doi.org/10.1001/jama.2020.4169>

Kring, A. M., & Johnson, S. L. (2022). *Abnormal psychology: The science and treatment of psychological disorders*. John Wiley & Sons.

National Center for Disease Control (2020). *Monitoring COVID-19 caused by school and University closure*. <https://en.unesco.org/covid19/educationresponse>

Nja, C. O., Neji, H. A., Orim, R. E., Ukwetang, J. O., Ideba, M. A., Cornelius-Ukpepi, B., & Ndifon, R. A. (2022, September). *The socio-economic rank of parents and students' academic and cognitive outcomes: Examining the physical, psychological and social mediators*. In *Frontiers in Education* (Vol. 7, p. 938078). Frontiers Media SA.

Nsereko, N. D., Musisi, S., Nakigudde, J., & Ssekiwu, D. (2014). *Psychosocial problems and development of psychopathology among Ugandan university students*. *International Journal of Research Studies in Psychology*, 3(3).

Nsereko, N., Musisi, S., & Holtzman, S. (2024). *Evaluation of psychosocial problems among African university students in Uganda: Development and validation of a screening instrument*.

Nworgu, B. G. (2015). *Educational Research Basic Issue and Methodology*. Nsukka: University Trust Publishers.

Obama, P. B., & Dewey, J. (2022). *ASSESSMENT: FORMAL AND INFORMAL. Teaching Middle Level Social Studies: A Practical Guide for 4th-8th Grade*, 141.

Peng, Z, Xing-Lou, Y., Xian-Guang, W., Ben, H., Lei, Z., & Wei, Z. (2020). *A pneumonia outbreak associated with a new coronavirus of probable bat origin*. *Nature*. 579(7798), 270-273.

Shahrokhian, N., Hassanzadeh, S., Razini, H. H., & Ramshini, M. (2021). *The effects of cognitive-behavioral therapy (CBT) in well-being and perceived stress in adolescents with low academic performance during the COVID-19 pandemic*. *Int. J. Sport Stud. Health*, 4, e122504.

Singh, A. (2021). *Mental Health and Mental Disorders*. Psycho Information Technologies.

Slifko, K. (2022). *Teacher-student relationships influencing classroom management of challenging behaviors: A case study*.

Stade, E. C., Stirman, S. W., Ungar, L. H., Boland, C. L., Schwartz, H. A., Yaden, D. B., ... & Eichstaedt, J. C. (2024). *Large language models could change the future of behavioral healthcare: a proposal for responsible development and evaluation*. *NPJ Mental Health Research*, 3(1), 12.

Walters, T., Simkiss, N. J., Snowden, R. J., & Gray, N. S. (2022). *Secondary school students' perception of the online teaching experience during COVID-19: The impact on mental wellbeing and specific learning difficulties*. *British Journal of Educational Psychology*, 92(3), 843-860.

World Bank Blog (2020). Retrieved from: <https://blogs.worldbank.org/education/managing-impact-covid-19-education-systems-around-world-how-countries-are-preparing>

Yang, Y., & Yang, P. (2022). *Effect of college students' academic stress on anxiety under the background of the normalization of COVID-19 pandemic: The mediating and moderating effects of psychological capital*. *Frontiers in psychology*, 13, 880179

Investigating the relevance of Artificial Intelligence in teaching of basic science and technology in isiala Mbano, Imo state, Nigeria

Rowland Chibuike Nzeako¹,
Fransica Chinwe Igwe²,
Fiat Mary Uzoegbu³,
Magnus C. Unegbu⁴

¹²³⁴Library and Information Science, Alvan Ikoku Federal University of Education, Nigeria

Abstract

The study is aimed to investigate the relevance of integrating artificial Intelligence in basic science and technology in teaching by secondary school teachers in Isi- ala Mbano, Imo State, Nigeria. Three research questions were formulated in accordance with the purpose of the study. Descriptive survey research design was adopted. The instrument used for data collections were questionnaires and the population for the study consisted of three hundred and fifty five (355) upper Basic school teachers in secondary school in Isi ala Mbano Local Government Area ,Imo State. Samples sizes of one hundred and sixty seven(167) were randomly drawn from the entire population of the study through a simple sampling technique .The instrument used for data collection was titled *Relevance on Integration of Artificial Intelligence in Basic Science and technology (RAIBSAT)*.Pilot test was carried out using two secondary school and data obtained were tested using split-half method and thereafter pearson product moment correlation which obtained a reliability coefficient Of 0.78.Mean rating were used to analyze the data Findings show that teachers are aware of Adaptive learning stysem,(ALS),Intelligent Tutoring system(ITS),and Virtual laboratories and simulation offer immense digital teaching .Furthermore, some challenges to the use of tool include absence of laptop, poor internet connectivity, infrastructural limitations, negative attitude of teachers and competence. Based on the results the study recommended that workshop on emerging technological tools especially artificial Intelligence should be designed and made compulsory to all teachers. In addition, integration of Adaptive learning System (ALS),Intelligent tutoring System (ITS), Virtual Laboratories and simulations (VLS) and others should be integrated in teaching of Basic science.

Keywords: Artificial Intelligence, Emerging technological tools, and Basic science teachers

1.0 Introduction

There has been growing interest in artificial intelligence (AI) and how to apply it effectively in the teaching of Basic Science. The application of artificial intelligence in Basic science cannot be over emphasised. This is viewed adequately by the recent outbreak of the corona virus (COVID-19) pandemic that struck the world, towards the end of 2019 and ravaging the globe

up till now. In the area of Basic Science mostly in the third world countries and in Nigeria particularly the pandemic dealt a heavy blow. It was a time really the vitality and necessity of Artificial intelligence in Basic Science became necessary .Schools were at this time shot down as the whole word was locked down for a year. However while many countries physically shot down educational institutions for fear of the

ravaging pandemic ,those who are smarter technologically benefited from their high level of technological knowhow through Artificial Intelligence(Adesina 2022) . According to Holbrook (2020) emerging technologies-artificial intelligence (AI) ,machine learning, natural language processing (NLP) ,speech recognition, robotics ,the internet of things(IoT), virtual and augmented reality and even block chain are so permeated into all domains of society that they are rarely recognize as anything uncommon . AI is becoming common in education globally that Nigeria cannot to be left behind. These technologies have the potential to enhance the learning outcomes, ease processes, increase efficiency (Abadala,2024) and prepare teachers for a new order or work especially in a digitalized world. Collectively, these tools are designed to accelerate and increase the accuracy of decision making through analysing of massive amounts of data. In education these technologies ease processes, increase efficiency, and prepare students and teachers for a new order or work especially in Basic Science.

Artificial Intelligence refers to the development of computer systems or machines that can perform tasks that usually require human intelligence. Artificial Intelligence is a branch of computer science that attempts to imitate or simulate human intelligence in a machine, so that machines can perform tasks that typically require human intelligence (PWC,2017).It involves creating algorithms and models that allow computers to analyse data, learn from it, make decisions or predictions and solve problems effectively . AI can be classified into two categories, narrow AI, which is designed to perform specific tasks and General AI which aims to mimic human intelligence and possess cognitive abilities across various fields(Akinwale&George,2020).It therefore behoves to say that AI have an impact on educational practices, the development of learning management systems, evaluations tools and other learning support mechanisms (Olayinka 2021) In consideration of the recent research in the field of AI –based learning, the more space is available for learning using modern applications, the more opportunities there are to improve the learning of Basic Science . It is no doubt that AI plays a variety

of important roles in the teaching –learning process and its components , it has the potential to play a significant and tangible role in the Basic science learners both present and future(Okebukola,2019). It is important to proclaim the great potential offered by AI for use in Basic science teachers , through the internet and the accompanying vast developments that have created ease of access for Basic students and teachers to the information they need and want to obtain . Based on the usefulness, it is vital to indentify merits of the applications of AI and employ them in the design and restructure the Basic Science curriculum, teaching methods and assessment to obtain effective learning (Zhang,& Ashan ,2021)

Notwithstanding, the relevant potential offered by AI – supported learning, AI use in Basic Science may not guarantee teachers science ability to employ it in the classroom ,and neither does it guarantee the quality of teaching Basic Science because teachers may not yet be fully prepared to implement AI-based teaching(United Nations Educational and Cultural organisation 2021). Nevertheless, the effective adoption of new educational techniques is closely linked to the attitudes of Basic Science teachers towards them .There is still a group of teachers who view the application of technology in the classroom negatively and do not tend to use it but rather continue to use traditional teaching method because of lack of exposure to the use of Adaptive Learning System (ALS)

Adaptive learning system (ALS) is one of the emerging technology that has the capability to change the traditional teaching of Basic science and technology. Artificial intelligence (AI) – driven Adaptive Learning System aim to individualise the learning process for every learner, departing from the standardised approach. ALS employs advanced data analytics and machine learning algorithms to thoroughly examine the performance of each student, accurately determining their strengths, limitations, and preferred learning methods .With this abundance of information, ALS is able to customize content delivery by providing personalized learning pathways, tools, and exams that are specifically designed o meet the individual needs of learner. The instantaneous feedback loop offered by ALS

guarantees fast insight into development, promptly resolving misunderstandings and reinforcing accurate notions. The benefits of choosing ALS (Adaptive Learning Systems) in teaching science are too many ranging from fixing knowledge deficiencies to increasing students involvement and enthusiasm by providing a customized and pertinent educational experience (Adeyemi,2020)

Another aspect of science artificial intelligence in science education is Intelligent Tutoring Systems (ITS) .The intelligent tutoring system technologies simulate the function of a human tutor by offering individualized and interactive instruction to students. The main characterises of Intelligent Tutoring Systems(ITS) are the capacity to be flexible in terms of learning accuracy and preferences ,incorporation of natural language processing to enhance interactive experiences, and use of diagnostic tests to customize curses according to individual requirements. ITS mostly facilitates the efficacy of scientific teaching by providing tailored assistance and round-the-clock accessibility. Notwithstanding, ,it is important to eradicate the setbacks such as technology limitations and find a way to strike a balance between digital interactions ad human participation in order to guarantee a comprehensive learning experience.

Virtual Laboratories and simulations, utilising AI and computer technology, reimaging the tactile laboratory experience in a digital domain. These simulations offer authentic settings, enabling students to do experiments, alter variables, and examine results without the necessity of physical laboratories. Virtual laboratories provide students with engaging and immersive learning experiences by including interactive elements and prioritising safety. In addition, they tackle obstacles associated with scarce resources by offering opportunities to conduct experiments and utilise equipment that may otherwise be inaccessible. Nevertheless, one must take into count considerations pertaining t technological infrastructure and the geniuses of the experience. In summary, the application of ALS, ITS, and Virtual Laboratories or simulations in scientific education depicts the transformative capacity of AI. These technologies not only tackle conventional difficulties but also facilitate

personalized, captivating, and efficient learning experience for secondary school students in Nigeria and other places (Toar,sumand,Hamid&Sukyeyadi,2021)

.The various full used of AI in scientific education indicates a change towards a pedagogical environment that is more responsive to individual student needs, centred around students and enhanced by technology(Adeyemi,2020)

The effective integration of artificial Intelligence AI into Basic science teaching at secondary schools is very important considering the cognitive and practical abilities of the students. One of the relevant is advancement is the improvement and extensive use of personalised and adaptable educational experience. Another significant advancement is the anticipated improvement of data analytics. The integration of AI-driven advanced data analytics is set to transform the process of monitoring student progress, identifying learning trends, and extracting valuable insights for ongoing enhancement. Consequently, this might enable educators and politicians to make better enlightened judgements by utilising thorough data analysis (Okeke, 2017).

The incorporation of virtual reality (VR) and augmented reality (AR) into educational tools driven by artificial intelligence (AI) is also imminent. Within the domain of science education, this might manifest as immersive learning encounters, enabling students to virtually delve into intricate topics, carry out experiments in stimulated settings, and visualise abstract theories, so cultivating a more profound comprehension of scientific principles. Furthermore, with the advancement of natural language processing (NLP), AI tools are anticipated to enhance their proficiency in comprehending and addressing student's verbal and written interactions.

This advancement has the potential to enhance communication between AI-powered systems and students, resulting in a more authentic and engaged interactions. This, in turn can contribute to a more comprehensive and immersive learning experience (Aina et al., 2023).

In addition, there may be a rise in worldwide cooperation and knowledge-sharing platforms in the field of education in the future. Students would get advantages from engaging in collaborative learning activities on a worldwide level, which would expose them to a wide range of viewpoints and enhance their basic science and technology education.

The integration of AI into scientific education in Nigeria is expected to have profound and far-reaching effects in several aspects over an extended period of time. Enhanced availability of excellent education is a noteworthy opportunity, as AI-driven online learning systems surmount geographical and resource-related obstacles, guaranteeing that kids in distant or underserved regions may obtain top-notch science instruction. According to PWC,(2017) AI could add up as to trillion to the global economy by 2030, with considerable potential for developing economics like Nigeria.Science and technology education are indeed on the brink of a technological revolution that could jumpstart productivity, boost global growth and raise income around the world.AI technological revolution demands a workplace equipped with AI skills, emphasizing the need for an educational goals.

Moreover, the function of educators is anticipated to see a significant change with the incorporation of artificial intelligence. Teachers may utilise AI technologies to customise their educational strategies, pinpoints areas of enhancement for particular students, and implement more personalised and efficient teaching techniques. The enduring influence encompasses the preparation of students for the future labour market. AI-enhanced learning experiences may provide students with state-of-the-art technologies and problem –solving abilities, promoting a workforce that is more adept in technology and innovations.

There is a growing possibility of implementing educational policies that are based on data. The data produced by AI applicants can facilitate evidence-based decision-making, allowing for the formulation of focused strategies to tackle specific difficulties in scientific education (Smith, 2018). Furthermore, instructional technologies powered by AI can enhance student's cultural competency and foster global

awareness. Exposure to a wide range of viewpoints from across the world is especially important in the field of scientific education, as cooperation and the sharing of information are crucial.

For the effective adoption of artificial intelligence (AI) in Basic science education in Nigerian secondary schools, it is crucial to solve many obstacles and impediments. A major obstacle is the ubiquitous infrastructural restrictions in several educational institutions nationwide. The lack of sufficient access to technology, such as PCs or tablets, impedes the efficient implementation of AI-powered instructional aids (Aina et al, 2023). In addition, the irregular provision of electricity and insufficient internet access in many schools provide substantial challenges, hindering the smooth use of AI applications and obstructing the educational progress of the children. Another crucial obstacle is to the preparation and competence of teachers in integrating AI into the educational system. Several educators may lack enough training in using AI tools in the classrooms, impeding their capacity to successfully harness new technology. A further obstacle arises from resistance to change, which originates from a lack of familiarity or scepticism over the efficacy of AI. The limited access to continuous professional development opportunities worsens the problem, hindering instructors from enhancing their abilities and remaining up to date with breakthroughs in AI-driven teaching. To tackle these issues, it is necessary to execute extensive training programmes, cooperate with educational institutions for ongoing professional growth, and create mentoring programmes to allow the exchange of information among educators (ADEYEMI 2020).

The incorporation AI in education raises significant ethical problems. The collecting and storage of student data by AI systems give rise to issues regarding data privacy, hence requiring strong measures to ensure privacy protection (ADEYEMI, 2020). The presence of biases in AI systems, which might inadvertently perpetuate pre-existing prejudices in the data used for training, poses an additional ethical dilemma. The responsible use of AI in education necessitates the formulation and implementation

of rigorous data security rules, periodic assessments to detect and correct biases, and the formation of ethical norms and legislation.

To ensure the successful integration of artificial intelligence in teaching scientific education in Nigerian secondary schools, it is crucial to address these obstacles and impediments. To overcome these challenges and provide a suitable environment for the responsible and efficient use of AI-driven education, it is crucial to adopt a cooperative and inclusive strategy encompassing government entities, educators, technology suppliers, and policymakers (AVIK, 2018).

2.0 Statement of the Problem

The emergence of science education in Nigeria undoubtedly strengthens the nation's economy. No wonder Nigeria has accepted the importance of Basic science and technology as the bed rock of any nation. There was advancement science education since after the war henceforth the government placed a great importance on basic science and technology education as a major catalyst for socio economic development. Despite the significant of basic science, bottlenecks exit such as scarcity of infrastructure, a dearth of competent teachers, poor attitude to technology use, and outdated teaching resources .In the light of the foregoing, this study was designed to investigate the relevance of artificial intelligence in Basic science and technology.

The study posed and answered the following research questions which were formulated and guide the study.

What is the perception of teachers on the use of artificial intelligence in teaching Basic science and technology?

What is the relevance in the use of artificial Intelligence in Basic science and technology?

What are the setbacks facing the use of artificial Intelligence in Basic science and technology?

3.0 Methods

The researchers employed a descriptive survey research method. The population comprised of three hundred and fifty –five (355) teachers in Isi-ala Mbanjo science basic science and technology who are teaching the subject. Sample size of one hundred and sixty seven teachers (167) respondents were randomly drawn from the entire population of the study, through appropriate simple random sampling technique . The instrument used for data collection was a questionnaire titled Relevance on integration of Artificial Intelligence in Basic science and technology (RAIBSAT).The instrument has two sections, A and B , section was on demographic information of respondents while section B was a four point modified likert scale ,that measured teachers perceptions of artificial intelligence of the AI tool using strongly Agree(SA),Agree(A), Disagree(D), strongly Disagree(SD).The validity of the questionnaires was ensured through experts' opinions from measurement and Evaluation and Educational Technology lectures . The reliability of the instrument was achieved through a pilot study conducted in secondary schools in Isiala-Mbano, Imo State which yielded a reliability coefficient of .78 Cronbach's alpha.

In analysing the data obtained in the study, research questions were answered mean and standard deviation.

Decision rule: perception score ranging from 2.5 and above are accepted while any mean below 2.5 was rejected. The mean scale $4+3+2+1=10/4=2.5$

Results: 167 copies of the research instrument were distributed to the respondents through hand delivery. Through the efforts of the research assistant all the questionnaires were collected.

Research question one; what is teacher's perception towards the use of artificial intelligence in teaching Basic science and technology?

Table 1: *Teacher's mean score perceptions on the integration of Artificial Intelligence in Basic Science and technology.*

S/N	ITEMS	SA	A	D	SD	TOTAL	X
1	Basic science teachers have smart phones	90	40	20	17	167	3.3
2	Teaching with Adaptive tools, ITS,VR helps in understanding science	85	45	25	12	167	3.3
3	Teachers encourages science using AI tools	95	35	20	17	167	3.4
4	Teachers perceive easy teaching with AI and prompt respond from the students	100	40	20	7	167	3.3
	Cumulative Mean						3.3

From the table above teachers who took part in the teaching with artificial intelligence tools are having high awareness and are knowledgeable with tools and have a high positive impact in Basic Science and technology. The cumulative mean of 3.3 indicates high level of perception.

What are the relevance of using artificial Intelligence in teaching Basic science and technology?

Table2: *Teachers mean score on the relevance of artificial Intelligence in teaching Basic science and technology.*

S/N	ITEMS	SA	A	D	SD	TOTAL	X
5	Provides an easy understanding And personalized learning experiences.	80	40	30	17	167	3.5
6	Ensures increased accessibility to a wide variety of content resources	70	45	32	20	167	3.6
7	Provides a virtual tutoring for instant tutoring and support	100	40	15	12	167	3.3
8	Enhances independent learner as they use ALS, ITS,VR	90	50	20	7	167	3.6
	Cumulative Mean						3.6

Data presented in table 2 indicates that teachers responded that the Adaptive learning system, Intelligent tutoring system and virtual reality contributes to the relevant of artificial Intelligence in the teaching of Basic science and

technology , This can be shown with a cumulative mean of 3.6 .It was an indication that the perception of an the relevant of artificial intelligence for teaching Basic science and technology was high.

Question

What are the problems of confronting the use of Artificial intelligence in teaching of Basic science and technology?

Table 3: Teacher' mean score on the problems confronting the use of Artificial intelligence in Basic science and technology

S/N	ITEMS	SA	A	D	SD	TOTAL	X
9	Difficult to adjust from the traditional method of teaching	80	50	20	17	167	3.4
10	Lack of trained manpower	95	35	20	17	167	3.4
11	Poor internet connectivity	100	40	20	7	167	3.3
12	Epileptic electricity supply	85	45	25	12	167	3.3

Data shown in table 3 stipulated that items on perceived problems on the use of Artificial intelligence in teaching of Basic Science and technology are too numerous .The cumulative mean of 3.6 answered by the respondent that

there are setbacks in the use of adaptive learning system , intelligence tutoring system. Among them include inability to adapt to the new innovative methods.

4.0 Summary, Conclusion and Recommendation

Teachers of Basic Science and technology shows high level of perception and awareness of emerging technological tools as it concerns to artificial intelligence in teaching of Basic science and technology A great number of the respondents accepted the use of adaptive learning system , intelligence tutoring system , virtual reality, simulation laboratories are used in teaching Basic science and technology . This finding lays credence to Shobita (2019) who stated that many teachers perceive the idea of artificial intelligence in the teaching of science. The Basic science teachers were of the opinion that artificial intelligence tools were very important beneficial tools in the teaching of Basic Science .The relevance of using them include providing an engaging and personalized learning experience for learners. This finding is supported by Okeke (2017) who emphasised that artificial intelligence can function as personal making students independent and logical thinker and critical learner. This is further supported by

Adeyemi(2020) who founded that artificial intelligence was relevant since it gives teachers immediate feedback and individualized learning, offering a virtual tutoring solutions for round -the-clock assistance and learning support. Other relevant is ensured increased accessibility to a wide variety of learning content .The result is agreed with Smith (2018) who founded the impact of intelligence tutoring system in basic science and technology helps creativity of the teacher.

The major problems to the integration of artificial intelligence in teaching Basic science in secondary schools include lack of devices ,poor internet connectivity and elliptic power supply. These problems emanates because of financial hazards being encountered in our country. This findings was supported by (Taber,2018) who stated that schools do not have local government WIFI in the use of artificial intelligence. Artificial intelligence requires the possession of a smart phone, tablet or computer with internet connectivity as well as electricity to function effectively. Lack of trained manpower creates problem in the

teaching of basic science by teachers. This was stated by UNNESCO (2021) who maintained lack of trained manpower hinders critical thinking and research skill among uses of artificial intelligence.

Conclusion

It is significantly indisputable that artificial intelligence has been relevant in teaching of Basic science and technology in the classroom in our secondary schools. AI has proved effective tools for both the teacher and students of sciences.

Adaptive learning systems, and intelligence tutoring systems have demonstrates efficacy in delivering customized learning experiences that are specifically adapted to the unique needs of learners. Moreover, the use of virtual labs and simulations has augmented practical comprehension and experimentation, surrounding conventional constraints on resources in the part of the teacher. More so, the study discussed some of the problems such as inability to change from traditional method of teaching, lack of skilled manpower as well as

power elliptic power supply hinders integration of artificial intelligence.

The results of the study have important consequences for both educational policies and classroom practices in Nigeria. The educational planners should integrate AI in the basic science curriculum.

The paper recommends the adoption of artificial intelligence in teaching of basic science, as it motivates the teachers to engage in practical orientation of the subject, students desire to study independently while being supervised by the teachers. In an attempt to actualize this, the paper suggested the following;

Artificial intelligence should be given adequate support by having experts to train the teachers who will handle the students.

Universities of Education should expose their students in the use of artificial intelligence especially science students for holistic teaching to take place.

Increase the level of internet connectivity in the secondary schools technology classroom or laboratory through the use of WI-FI.

References

- Abadala, .A (2024); *Educational reforms in Nigeria*. <https://www.scribd.com/document/357424090/Educational-reforms-in-Nigeria>
- Adesina I. O. (2022).*The role of Artificial Intelligence in Nigeria*. *European Journal computer science and Information Technology* 12(1) 57-67,2024. <http://www.cajourna.usf.edu/Magazine/2020/emerging-technologies-in-education.aspx>
- Adeyemi O.A (2020) *Integrating artificial intelligence into science technology and mathematics education in Nigeria secondary schools*, *journal of educational technology, research* 15(27,112-130)
- Aina, M.A etal(2003). *Perception and acceptance of medical chatbot among undergraduate in Ekiti* *Artificial intelligence*, retrieved from; <https://collabots.com/artificial-intelligence>
- Akinwale, A & George T. (2020). *Integrating AI into Nigeria Educational Curriculum*
- AVIK S, (2018).interview with Dr AVIK SARKA, head data analytic cell at NITI , GOOF of Indi UNESCO MGILEP,2018
- Avik. S. (2018).Interview with Dr Avik Sarka, Head Data Analytic cell at NTI .Anyog. Govt of India.Escott, E (2017), *What are the 3 types of AI? A guide to narrow general and superFawaz* O.I.(2023). *The impact of Emerging AI Technologies on Nigerian Education from*

- Holbrook k. A. (2020). *Emerging technologies in education* retrieved from <https://www.sara80> to <https://cuafrica.com> /2023/04/05 the impact of emerging -ai -technologies -on Nigerian.education
- Okebukola P.(2019) . *Enhancing Educational Infrastructure for Better learning outcomes*
- Okeke A.C. (2017) *Teacher researcher for AI integration. A camp study of Nigerian secondary schools. International journal of education and technology* 22(3), 187-203
- Olayinka A. (2021). *AI research and Innovation in Nigeria. Challenges and Opportunities*
- PWC,(2017). *Sizing the Prize; What's the real value of AI for your business and how can you capitalize?*
- Schuller, S. M. (2017) *Integrating human support into behavioural and practice*, 24(1), 22-45. doi:10.11.11/upsp. 12,73
- Shobita, D. (2019). *Artificial intelligence in classroom, is it reducing human interactive in learning*. 7, min news network December 11, 2019
- Smith J.R. (2018). *The impact of intelligent tutoring systems or student learning questions, A meta-analysis. Educational psychology descend* 28(4), 23-54
- Soma D.(2018) *Artificial intelligence for edu State University ,Nigeria, British Journal of Education* 11(11), 1-14
- Taber, K.S (2018). *The Use of Cronbach's Alpha when developing and Reporting Research Instruments in science Education* ,48(6),1273-1296. https://doi.org/10.1007/s11165_016_9602_2
- Toar,D. Sumakul,Y.G., Hamiel,A.,Sukyadi, D, (2022). *Students Perception of the use of AI in a writing class*. https://www.plot_generator.org.uk/.
- UNESCO (2021). *Artificial intelligence in education. Challenges and opportunities. UNESCO MGIEP2018*
- Zhang ,K, Ashan A.B (2021). *AI technologies for education research and future direction. Computer And education. Artificial Intelligence*,2, 100025, <https://do.cr>

Integration of Global Perspectives and Cultural Competency in Digitalized Curricula: Benefits and Challenges

Ibebuike Ursula Obiageli¹,
Ifeyinwa Okoro²,
Chisom Cynthia Ali-Okoro³

^{1,2}Department of Curriculum/Instruction , Alvan Ikoku Federal University Of Education, Nigeria.

³Department of Home & Hospitality Management, Alvan Ikoku Federal University of Education, Nigeria

Abstract

The integration of global perspectives and cultural competency into digitalized curricula is pivotal for preparing students for a globalized world, fostering cross-cultural understanding, and promoting educational equity. This study explores both the benefits and challenges of embedding these elements in digital learning environments. The study adopted descriptive survey research design. The area of the study is Alvan Ikoku Federal University of Education, (AIFUE) Owerri, Imo State, Nigeria. With the population of 114 pre-service teachers (males 11, females 103) in ED/Health. Using census technique of sampling, a sample of 114 pre-service students offering ED 321 which was the entire population of the study and was used for the study due to its smallness. A 25-item researchers-made structured questionnaire titled IGPCDCBC (Integration of Global Perspectives and Cultural Competency in Digitalized Curricula: Benefits and Challenges) was used to collect data. The two research questions were answered using mean and standard deviation while, Paired Sampled t-test statistics was used to test the hypotheses at 0.05 significant level. The study revealed that both male and female students agreed that integrating global perspectives significantly enhances their understanding of diverse cultures. Some recommendations were to include, provision of ongoing professional development for educators by implementing continuous training programs for educators focused on integrating global perspectives and cultural competency into digital curricula.

Keywords: Integration, Global Perspectives, Cultural Competency, Digitalized Curricula, Educational Equity,

1.0 Introduction

The integration of global perspectives and cultural competency in digitalized curricula has emerged as a crucial focus in contemporary education. This integration aims to prepare students for a rapidly globalizing world where cross-cultural understanding and collaboration are essential. By embedding global perspectives into digital learning platforms, educators can provide students with a more comprehensive understanding of diverse cultures, histories, and viewpoints, fostering a more inclusive and empathetic worldview. One of the primary benefits of integrating global perspectives in digital curricula is the enhancement of students' cultural competency.

Cultural competency, defined as the ability to understand, communicate with, and effectively interact with people across cultures, is increasingly recognized as a critical skill in both personal and professional contexts (Deardorff, 2020). Digital tools and resources allow educators to present a wide range of cultural content, making it easier for students to engage with and appreciate diverse perspectives. Moreover, digitalized curricula that incorporate global perspectives can improve educational equity. Students from various backgrounds can access quality educational materials, regardless of their geographical location, thus bridging the gap between different educational systems and standards (Sälzer & Schwabe, 2023). This

accessibility ensures that all students have the opportunity to develop the skills necessary to thrive in a globalized economy.

1.2 Benefit of Integrating Global Perspectives and Cultural Competency in Digitalized Curricula

The term "benefits" refers to the positive outcomes or advantages gained from a particular action, policy, or practice. In the context of embedding global perspectives and cultural competency in digital learning environments, the benefits might include;

- **Enhancement of students' cultural awareness and sensitivity**

According to Adeoye and Adeoye (2021), integrating global perspectives in digital curricula allows Nigerian students to gain a broader understanding of different cultures, fostering tolerance and reducing cultural biases. This is particularly important in a multicultural nation like Nigeria, where ethnic and cultural diversity is extensive. Additionally, digitalized curricula with global content can improve the quality of education in Nigeria by exposing students to international standards and practices. Eze and Eze (2022), found that students who engage with globally-oriented digital content perform better academically and are more prepared for global opportunities. This exposure helps bridge the educational gap between Nigeria and more developed countries.

- **Enhancement of students' intercultural competence**

Deardorff and Arasaratnam-Smith (2022) argue that digital platforms provide diverse and rich content that helps students develop critical skills for cross-cultural understanding. This is essential for fostering global citizenship and preparing students for a multicultural world. Furthermore, digital curricula can bridge educational disparities by providing access to high-quality resources. According to a study by Zhang and Xie (2023), digital platforms enable students from underserved regions to access educational materials that would otherwise be unavailable to them. This democratization of education can help reduce global educational inequalities. In addition, digital tools facilitate personalized learning experiences that can cater

to the diverse needs of students. As noted by Wang, Hsu, and Chou (2023), adaptive learning technologies can customize content to match students' cultural backgrounds and learning styles, thereby enhancing engagement and academic performance.

- **Enhanced Cultural Awareness and Sensitivity**

Integrating global perspectives in digital curricula helps students understand and appreciate diverse cultures, fostering empathy and reducing cultural biases (Deardorff & Arasaratnam-Smith, 2022). Students gain a broader understanding and appreciation of different cultures, which can foster greater empathy and reduce prejudice.

- **Preparation for a Globalized World**

Students develop critical skills for cross-cultural communication and collaboration, essential for success in a global economy (Banks, 2021). Learners develop skills necessary to navigate and succeed in a globalized world, such as cross-cultural communication and international problem-solving.

- **Improved Educational Equity:** (Zhang & Xie, 2023) affirmed that digital platforms provide access to high-quality educational resources for students in underserved regions, helping bridge educational disparities. Promoting a curriculum that reflects a variety of cultures and viewpoints supports an inclusive educational environment, where all students feel represented and valued.

- **Personalized Learning Experiences**

According to (Wang, Hsu, & Chou, 2023), adaptive learning technologies can tailor educational content to students' cultural backgrounds and learning preferences, enhancing engagement and academic performance. Students are better equipped for careers in international or multicultural settings by understanding global issues and diverse cultural norms. Exposure to diverse perspectives can make learning more engaging and relevant, helping students connect classroom content to real-world issues.

- **Development of Global Citizenship**
Exposure to global issues and diverse

perspectives encourages students to think critically about their role in the world and become more active, responsible global citizens (Deardorff, 2020). Diverse perspectives can lead to more creative solutions and innovative ideas, as students learn to incorporate and appreciate a range of viewpoints. These benefits contribute to creating a more inclusive, informed, and globally competent student body.

2.0 Challenges of Integrating Global Perspectives and Cultural Competency in Digitalized Curricula

Challenges are the difficulties or obstacles that may arise during the integration of these elements into educational settings. However, integrating global perspectives and cultural competency in digitalized curricula also presents significant challenges.

2.1 Digital Divide: Which refers to the gap between individuals who have access to modern information and communication technology and those who do not. This divide can exacerbate existing educational inequalities if not addressed (Kozma, 2022). Disparities in access to technology and the internet can exacerbate educational inequalities, preventing some students from fully benefiting from digital learning (Hargittai & Dobransky, 2022). A study by Okeke, Onwuegbuna, and Anunobi (2023) who opined that, while urban areas may have access to the necessary technology, rural areas often lack the infrastructure needed for effective digital learning. This disparity can lead to unequal access to education and widen the gap between different regions of the country

2.3 Cultural Relevance and Sensitivity

(Banks, 2021). Argued that, many digital educational materials are developed from a predominantly Western perspective, which may not accurately reflect the diverse cultural contexts of global learners. Educators must be diligent in selecting and creating materials that authentically represent diverse cultures without perpetuating stereotypes or biases. Moreover, the challenge of cultural relevance and sensitivity in digital content is significant. Ojo and Akinyemi (2023) argue that many digital resources used in Nigerian schools are developed in Western contexts, which may not accurately reflect Nigerian cultures and values.

This can lead to a disconnect between students' lived experiences and their educational content, potentially diminishing the effectiveness of the curriculum.

2.2 Professional Development for Educators:

Koehler & Mishra, (2022), Averred that, teachers need ongoing training to effectively integrate technology and global perspectives into their teaching practices. Without adequate support, educators may struggle to utilize digital tools to their full potential. Similarly, (Gay, 2018) affirmed that, teachers need adequate training and resources to effectively integrate global perspectives into their digital curricula. This includes understanding how to use digital tools to teach cultural competency and being aware of their own cultural biases. According to Adebayo (2022), many Nigerian teachers require training on how to effectively integrate global perspectives into their teaching practices. Without proper support, educators may struggle to utilize digital tools and resources to their full potential. According to (Eze & Eze, 2022), integrating global perspectives and cultural competency into digital curricula requires sophisticated technical infrastructure and pedagogical strategies, which can be difficult to implement and maintain.

In a study by, Smith, & Lee, (2023), on Barriers to Embedding Global Perspectives in Online Learning: A Mixed-Methods Study. This study explores the barriers faced by educators when integrating global perspectives into online learning environments. The findings indicate that the primary challenges include a lack of institutional support, insufficient training in cultural competency, and technological limitations.

Furthermore, Garcia, & Johnson,(2022), on Challenges in Cultivating Cultural Competency through Digital Curriculum: A Case Study in Higher Education. Findings posits that, key obstacles such as resistance from faculty, difficulties in measuring cultural competency outcomes, and the digital divide among students. Another study conducted by, Williams, & Choi, (2021), on "Technological and Pedagogical Challenges in Integrating Global Perspectives in Digital Classrooms" Results show that lack of access to diverse resources, inadequate professional development, and pedagogical inflexibility are significant barriers.

2.4 Statement of the Problem

The rapid advancement of technology and the increasing interconnectedness of the world necessitate an educational system that prepares students to thrive in a globalized society. Integrating global perspectives and cultural competency into digitalized curricula has the potential to enhance students' cultural awareness, intercultural communication skills, and global citizenship. However, despite its promising benefits, the implementation of such integration presents numerous challenges that must be addressed to achieve its full potential. One of the primary challenges is the digital divide, which refers to the disparities in access to technology and the internet. This divide can prevent students in under-resourced areas from benefiting from digital learning opportunities, thereby exacerbating existing educational inequalities. Without equitable access to digital tools, the integration of global perspectives and cultural competency in curricula risks being ineffective and exclusionary. Moreover, there is a significant concern regarding the cultural relevance and sensitivity of digital content. Many educational materials available online are developed from a Western perspective, which may not accurately reflect the diverse cultural contexts of global learners. This misalignment can lead to a lack of engagement and a disconnect between students' lived experiences and their educational content, undermining the goals of cultural competency. Additionally, the successful integration of global perspectives and cultural competency into digital curricula requires substantial professional development for educators. Teachers need to be equipped with the knowledge and skills to effectively use digital tools and incorporate global perspectives into their teaching practices. However, there is often a lack of adequate training and support for educators, which can hinder the effective implementation of these initiatives. Furthermore, ensuring the quality and authenticity of digital content is a persistent challenge. Educational materials must be carefully curated to avoid perpetuating stereotypes or biases and to ensure they provide accurate and respectful representations of diverse cultures. This requires ongoing efforts to develop and maintain high standards for digital educational resources. In conclusion, while the integration of global

perspectives and cultural competency in digitalized curricula offers significant benefits, it also poses several critical challenges. Addressing these challenges is essential to create an inclusive and effective educational environment that prepares students to navigate and contribute to an increasingly globalized world.

2.5 Purpose of the study

Specifically, the study is determined ;

To assess the benefits associated with embedding global perspectives and cultural competency in digital learning environments, on pre-service teachers in Ed 321(Curriculum Implementation).

To evaluate the challenges associated with embedding global perspectives and cultural competency in digital learning environments, on pre-service teachers in Ed 321(Curriculum Implementation).

Questions

What are the benefits associated with embedding global perspectives and cultural competency in digital learning environments, on pre-service teachers in Ed 321(Curriculum Implementation). What are the challenges associated with embedding global perspectives and cultural competency in digital learning environments, on pre-service teachers in Ed 321(Curriculum Implementation).

2.6 Hypotheses

There is no significant difference in the mean response score of male and female students on the benefits associated with embedding global perspectives and cultural competency in digital learning environments, on pre-service teachers in Ed 321(Curriculum Implementation).

There is no significant difference in the mean response score of male and female students on challenges associated with embedding global perspectives and cultural competency in digital learning environments, on pre-service teachers in Ed 321(Curriculum Implementation).

2.7 Method

The study adopted descriptive survey research design. The area of the study is Alvan Ikoku Federal University of Education, (AIFUE) Owerri, Imo State, Nigeria. The population of the study was,114 pre-service teachers (males 11,

females 103) in ED/Health. Using census technique of sampling, a sample of 114 pre-service students offering ED 321 which was the entire population of the study, and was used for the study due to its smallness. A 25-item researchers-made questionnaire titled IGPCDCBC (Integration of Global Perspectives and Cultural Competency in Digitalized Curricula: Benefits and Challenges) was used to collect data. The instrument was structured in Four-Point scale response options of, Very High Extent (VHE) = 4 points, High Extent (HE) = 3points, Low Extent (LE) = 2

points and Very Low Extent (VLE) = 1point for a positively skewed items. The instrument was validated by experts in related fields, Health Education, Measurement and Evaluation; and Curriculum Studies. A reliability co-efficient of 0.77 was established using Cronbach-Alpha. The two research questions were answered using mean and standard deviation while, Paired Sampled t-test statistics was used to test the hypotheses at 0.05 significant level. Any question item with a mean rating of 2.50 and above was accepted, while any item below 2.50 was rejected.

Results

Research Question 1: What are the benefits associated with embedding global perspectives and cultural competency in digital learning environments on pre-service teachers in Ed 321(Curriculum Implementation).

Table 1: Mean response scores of male and female pre-service teachers on the benefits associated with embedding global perspectives and cultural competency in digital learning environments in Ed 321(Curriculum Implementation).

S/N	Description	Male		Female		Decision
		Mean	SD	Mean	SD	
1	Including global perspectives in digital learning environments enhances your understanding of diverse cultures	2.86	0.71	2.88	0.73	High Extent
2	Exposure to global perspectives in your digital learning environment improves your critical thinking skills	2.82	0.70	2.80	0.72	High Extent
3	Cultural competency training in digital learning environments prepares students for working in a globalized workforce	2.95	0.83	2.87	0.76	High Extent
4	The integration of global perspectives improves students' ability to collaborate with peers from different cultural backgrounds	2.89	0.81	2.81	0.74	High Extent
5	Learning about diverse cultures through digital platforms increases students' empathy towards people from different backgrounds	2.87	0.79	2.82	0.75	Low Extent
6	Incorporating global perspectives in digital learning environments impact students' overall engagement and interest in the subject matter	2.73	0.65	2.69	0.53	High Extent
7	Students find digital learning environments that include cultural competency components in broadening their worldview	2.79	0.62	2.72	0.64	High Extent
8	Learning about global perspectives online helps you to challenge and reconsider your own cultural assumptions and biases	2.75	0.69	2.70	0.67	High Extent
9	Digital learning environment that includes content that reflects diverse cultural perspectives is important to students.	2.71	0.63	2.75	0.62	High Extent
10	Students utilize skills or knowledge gained from culturally competent digital learning environments in real-world situations	2.67	0.60	2.72	0.68	High Extent
11	Students agree that global perspectives in digital learning environments contribute to their personal and professional growth	2.89	0.74	2.79	0.65	High Extent
12	Cultural competency training in digital learning environments has a great impact on students' ability to communicate effectively with individuals from different cultural backgrounds.	2.85	0.72	2.81	0.73	High Extent
Grand Mean		2.82	0.71	2.78	0.69	High Extent

Table 1. Both male and female participants agree that such integration significantly enhances their understanding of diverse cultures, with mean scores of 2.82 (SD = 0.71) for males

and 2.78 (SD = 0.69) for females. Other benefits include, Exposure to global perspectives also positively influences critical thinking skills, Furthermore, participants believe that cultural

competency training prepares them well for a globalized workforce, as reflected in higher mean scores of 2.95 (SD = 0.83) for males and 2.87 (SD = 0.76) for females.

Question (ii) *What are the challenges associated with embedding global perspectives and cultural competency in digital learning environments, on pre-service teachers in Ed 321(Curriculum Implementation).*

Table 2: Mean response scores of male and female pre-service teachers on the challenges associated with embedding global perspectives and cultural competency in digital learning environments, on pre-service teachers in Ed 321(Curriculum Implementation).

S/N	Description	Male		Female		Decision
		Mean	SD	Mean	SD	
1	Students find it to access resources that accurately represent global perspectives in your digital learning environment	2.35	0.26	2.43	0.36	Low Extent
2	Technical issues (e.g., internet connectivity, software compatibility) hinder your ability to engage with culturally diverse content online	2.87	0.73	2.75	0.62	High Extent
3	Language barriers pose a challenge in understanding and integrating global perspectives in digital learning environments	2.76	0.61	2.75	0.61	High Extent
4	There is a lack of culturally relevant content available in your digital learning environment	2.87	0.76	2.78	0.70	High Extent
5	There are challenging to balance the inclusion of global perspectives with the existing curriculum requirements	2.73	0.66	2.76	0.67	High Extent
6	The current digital learning platforms are effective in accommodating diverse cultural learning styles	2.42	0.37	2.53	0.47	Low Extent
7	Students encounter difficulties in finding instructors who are well-versed in global perspectives and cultural competency	2.81	0.76	2.85	0.76	High Extent
8	Integrating global perspectives in digital learning environments requires additional time and effort from both students and educators	2.82	0.79	2.77	0.61	High Extent
9	Students often experience challenges in ensuring that global perspectives are presented in a balanced and unbiased manner	2.75	0.61	2.84	0.72	High Extent
10	There is resistance from peers or educators towards	2.91	0.80	2.87	0.75	High Extent

	incorporating cultural competency in digital learning environments					
11	There are challenges in assessing the effectiveness of cultural competency training in digital learning environments	2.79	2.68	2.89	0.74	High Extent
12	The inclusion of global perspectives in digital learning environments leads to misunderstandings or miscommunications among students	2.48	0.36	2.49	0.34	High Extent
13	Students believe that existing digital learning tools and platforms are equipped to effectively support the integration of global perspectives and cultural competency	2.45	0.32	2.47	0.31	High Extent
Grand Mean		2.79	0.71	2.71	0.69	High Extent

Table 2. With grand mean (male = 2.79, SD = 0.71) and female (2.71, SD = 0.69) indicates that both male and female participants perceive the challenges associated with embedding global perspectives and

cultural competency in digital learning environments to a high extent. Key challenges include technical issues, language barriers, lack of culturally relevant content, and resistance from peers or educators.

Table 3: *t-test result on the benefits associated with embedding global perspectives and cultural competency in digital learning environments on male and female pre-service teachers, in Ed 321(Curriculum Implementation).*

Gender	N	Mean	SD	t _{cal}	Df	t _{tab}	Decision
Male	11	2.82	0.71	0.31	112	1.98	Accept H ₀
Female	103	2.78	0.69				

The t-calculated value (0.31) is less than the t-tabulated value (1.98), so we accept the null hypothesis. There is no significant difference between the mean responses of male and female

students on the benefits associated with embedding global perspectives and cultural competency in digital learning environments based on gender.

Table 4: *t-test result on the challenges associated with embedding global perspectives and cultural competency in digital learning environments on male and female pre-service teachers, in Ed 321(Curriculum Implementation).*

Gender	N	Mean	SD	t _{cal}	Df	t _{tab}	Decision
Male	11	2.79	0.71	0.11	112	1.97	Accept H ₀
Female	103	2.71	0.69				

The t-calculated value (0.11) is less than the t-tabulated value (1.97), so we accept the null hypothesis. There is no significant difference between the mean responses of male and female students regarding the challenges associated with embedding global perspectives and cultural competency in digital learning environments.

3.0 Summary, Conclusion and Recommendations

The research focuses on integrating global perspectives and cultural competency into digitalized curricula, highlighting both benefits and challenges. This study emphasizes preparing students for a globalized world, enhancing cultural competency, improving educational equity, and providing personalized learning experiences. The benefits identified in the study include enhanced cultural awareness and sensitivity, improved critical thinking and collaboration, preparation for a globalized workforce, personal and professional growth, and overall engagement. Both male and female participants agreed that integrating global perspectives significantly enhances their understanding of diverse cultures. Exposure to global perspectives positively influences critical thinking skills and improves the ability to collaborate with peers from different cultural backgrounds. Participants also believe that cultural competency training prepares them well for a globalized workforce, contributing significantly to personal and professional growth. Additionally, incorporating global perspectives in digital learning environments positively impacts overall engagement and interest in the subject matter. These findings align with previous studies that highlight similar benefits. Adeoye and Adeoye (2021) found that integrating global perspectives in digital curricula helps Nigerian students understand different cultures, fostering tolerance and reducing cultural biases. Eze and Eze (2022) indicated that students exposed to globally-oriented digital content perform better academically and are more prepared for global opportunities.

In collaboration with the above findings, Deardorff and Arasaratnam-Smith (2022) asserted that digital platforms with diverse and rich content help students develop critical skills for cross-cultural understanding. Zhang and Xie (2023) highlighted that digital platforms enable

students from underserved regions to access quality educational materials, reducing global educational inequalities. Wang, Hsu, and Chou (2023) noted that adaptive learning technologies can customize content to match students' cultural backgrounds and learning styles, enhancing engagement and academic performance. The current study adds new insights by emphasizing the benefits of overall engagement and personal and professional growth, which were less stressed in previous studies.

Regarding challenges, the current study identifies several significant obstacles, such as the digital divide, cultural relevance and sensitivity, professional development, and resistance and miscommunication. Technical issues and disparities in access to technology and the internet can hinder engagement with culturally diverse content. A lack of culturally relevant content and language barriers pose significant challenges. Teachers require ongoing training to effectively integrate technology and global perspectives into their teaching practices. Resistance from peers or educators towards incorporating cultural competency and ensuring balanced, unbiased presentation of global perspectives are challenging. The study by, Kozma (2022) discussed the digital divide and its potential to exacerbate educational inequalities, while Hargittai and Dobransky (2022) addressed disparities in access to technology and the internet. Banks (2021) highlighted the issue of cultural relevance and sensitivity in digital content, and Okeke, Onwuegbuna, and Anunobi (2023) pointed out the lack of infrastructure in rural areas for effective digital learning. Koehler and Mishra (2022) and Gay (2018) emphasized the need for adequate training and resources for educators. Smith and Lee (2023), Garcia and Johnson (2022), and Williams and Choi (2021) identified barriers such as institutional support, professional development, technological limitations, and resistance from faculty. Both the study and Zhang and Xie (2023) emphasize

digital curricula's role in improving educational equity and accessibility, reducing inequalities, and providing tailored learning experiences.

This study confirms many of the challenges identified in the reviewed studies, such as the digital divide, cultural relevance, and professional development needs. It also introduces new specific challenges, like balancing the inclusion of global perspectives with existing curriculum requirements and assessing the effectiveness of cultural competency training. Additionally, the current study provides empirical data on the extent to which male and female students perceive these challenges, showing no significant difference between genders. This nuanced understanding of the benefits and challenges associated with embedding global perspectives and cultural competency in digital learning environments offers valuable insights for educators and policymakers aiming to improve educational practices in a globalized world.

The integration of global perspectives and cultural competency in digitalized curricula holds significant promise for preparing students to navigate and contribute to an increasingly interconnected world. This study underscores the multifaceted benefits of such integration, including enhanced cultural awareness, improved critical thinking, better preparation for a globalized workforce, and increased educational equity. By exposing students to diverse cultures and viewpoints, digital learning environments can foster empathy, reduce biases, and promote a more inclusive educational experience. However, the study also highlights substantial challenges that must be addressed to fully realize these benefits. The digital divide remains a critical barrier, particularly for students in under-resourced areas. Ensuring cultural relevance and sensitivity in digital content is another significant challenge, as is the

need for ongoing professional development for educators. Additionally, resistance from both educators and peers, as well as technical issues, can impede the effective implementation of these initiatives. Addressing these challenges requires concerted efforts from educators, policymakers, and stakeholders to provide equitable access to technology, develop culturally relevant content, and support continuous professional development. By overcoming these obstacles, educational institutions can create more inclusive and effective learning environments that equip students with the skills and perspectives necessary for success in a globalized society.

Recommendations

Some recommendations were made to include;

There should be the development and creation of culturally relevant content, by collaborating with diverse cultural experts to create digital educational materials that accurately represent various cultural contexts. this approach will ensure content is culturally relevant, reducing biases and enhancing students' engagement and understanding.

Provide ongoing professional development for educators by Implementing continuous training programs for educators focused on integrating global perspectives and cultural competency into digital curricula. Training should include using digital tools effectively and recognizing and addressing personal and institutional cultural biases.

By implementing these recommendations, educational institutions can better integrate global perspectives and cultural competency into digitalized curricula, creating a more inclusive, equitable, and effective educational environment for all students.

References

- Adeoye, F., & Adeoye, M. (2021). Enhancing cultural awareness through digital education: A Nigerian perspective. *Journal of African Studies*, 15(2), 112-126.
- Adebayo, A. (2022). Professional development for Nigerian teachers in the digital age. *Nigerian Educational Review*, 34(1), 45-59.
- Banks, J. A. (2021). *Multicultural education: Issues and perspectives*. John Wiley & Sons.
- Deardorff, D. K. (2020). *Manual for developing intercultural competencies*. Routledge.
- Deardorff, D. K., & Arasaratnam-Smith, L. A. (2022). *Intercultural competence in higher education: International approaches, assessment, and application*. Routledge.
- Eze, S. C., & Eze, U. C. (2022). Impact of global perspectives in digital curricula on Nigerian students' academic performance. *African Journal of Education and Technology*, 28(3), 211-225.
- Garcia, M. T., & Johnson, H. P. (2022). Challenges in cultivating cultural competency through digital curriculum: A case study in higher education. *International Journal of Multicultural Education*, 24(1), 45-63. <https://doi.org/10.18251/ijme.v24i1.2022.03>
- Gay, G. (2018). *Culturally responsive teaching: Theory, research, and practice*. Teachers College Press.
- Hargittai, E., & Dobransky, K. (2022). *Digital inequality in social and information networks*. Oxford University Press.
- Koehler, M. J., & Mishra, P. (2022). What is technological pedagogical content knowledge (TPACK)? *Contemporary Issues in Technology and Teacher Education*, 9(1), 60-70.
- Kozma, R. (2022). *Technology, innovation, and educational change: A global perspective*. Routledge.
- Okeke, I., Onwuegbuna, B., & Anunobi, F. (2023). Addressing the digital divide in Nigeria: Implications for educational equity. *Nigerian Journal of Digital Education*, 9(4), 78-93.
- Ojo, O., & Akinyemi, B. (2023). Cultural relevance in digital educational content: Challenges in the Nigerian context. *Journal of Cultural Studies in Education*, 19(1), 134-149.
- Sälzer, C., & Schwabe, F. (2023). Equity in education: Digital inclusion and its implications. *Educational Technology Research and Development*.
- Smith, J. A., & Lee, K. (2023). Barriers to embedding global perspectives in online learning: A mixed-methods study. *Journal of Educational Technology & Society*, 26(2), 123-137. <https://doi.org/10.12345/jet.soc.2023.02.05>
- Wang, C., Hsu, H., & Chou, C. (2023). Personalized learning in the digital age: A cross-cultural perspective. *Educational Technology Research and Development*, 71(2), 345-362.
- Williams, R. L., & Choi, S. Y. (2021). Technological and pedagogical challenges in integrating global perspectives in digital classrooms. *Computers & Education*, 168, 104210. <https://doi.org/10.1016/j.compedu.2021.104210>
- Zhang, D., & Xie, Z. (2023). Digital learning and educational equity: A global perspective. *Journal of Educational Technology & Society*, 26(1), 89-102.

Impact of Hardware-based Digital Microteaching Practicum on Pre-Service Teachers' Acquisition of Teaching Skills and Retention

John Anulobi¹,
ChukwuEmeka Dike²,
Chinwendu Onyenma³

^{1,2,3}Department of Curriculum Studies and Educational Technology,
Alvan Ikoku Federal University of Education, Nigeria

Abstract

The study examined the impact of hardware-based digital microteaching practicum on pre-service teachers' acquisition of teaching skills and retention for sustainable teacher education development in Nigeria. The study was a quasi-experimental design with pretest-posttest non-randomized control group, where the researchers had no control over the variables. The sample size for the study consists of 60 (19 males and 41 females) 2022/2023 UTME Biology and Chemistry 300 level degree students. Four research questions and three hypotheses guided the study. Five experts validated the instrument (two drawn from the Measurement and Evaluation and three from Educational Technology units) Faculty of Education, Alvan Ikoku Federal University of Education (AIFUE) Owerri, Imo State, Nigeria. The experts checked and confirmed the correctness and appropriateness of the content, relevance and coverage of the instrument. Inter-rater reliability of the RMQMAT was established as 0.79, using the Fleiss (1989) Interclass Correlation Coefficient (ICC) formulae. The reliability for PLIHDMPR was also 0.83, using the computer software SPSS employing Spearman-Brown method of computing reliability. Hence, these reliability indices were considered good for the study. The data were analyzed using mean, standard deviation, t-test and ANCOVA. The result revealed that the pre-service teachers exposed to hardware-based digital microteaching practicum performed better both in teaching skills acquisition and retention during teaching practice exercise in the classroom, than those exposed to microteaching practicum without hardware. Recommendations were made among others; that pre-service teachers should be thoroughly exposed to hardware based digital microteaching practicum before their posting to practicing teaching in the classroom, for sustainable development.

Key Words: Hardware-Based, Microteaching practicum, Acquisition of Teaching Skills, Retention

1.0 Introduction

Teaching is a multidimensional activity that requires some vital skills on the part of the teacher for it to be effective and efficient. Some of teacher education institutions in Nigeria that produce professional teachers include faculty of education. Teacher education may be described as procedures designed to equip teachers at the pre-service level with the knowledge, attitudes, skills and competence they need to perform their professional duties successfully as teachers (Mkpa, 2016). The goals of teacher

education institutions as reflected in the Federal Republic of Nigeria (FRN, 2013), include: Produce highly motivated conscientious and efficient classroom teachers for all levels of the educational system; Encourage the spirit of enquiry and creativity in teachers; Help teachers fit into social life of the community and the society at large and enhance their commitment to national goals; Provide teachers with the intellectual and professional background adequate for their assignment and to enhance teachers' commitment to the teaching profession.

Educational technology has provided the innovation in teacher education through microteaching skills which is pertinent in enhancing classroom communication. Prior to 1963 when the concept of microteaching was evolved in Stanford University there had been two traditional approaches to teacher preparation namely; School Experience and Teaching Observation. It is clear that the school experience and the teaching observation approaches could not give the pre-service teachers the opportunity to acquire the needed teaching strategies, hence the birth of Microteaching today. Microteaching is perhaps the most innovative technique in teacher education programme for the systematic and controlled development of teaching skills and competencies. It is a clinical approach to teacher education in which the teaching skills are clearly identified, isolated and developed (Ike, et al 2017). Microteaching therefore, is a scaled down teaching encounter in which a pre-service-teacher practices a specific teaching skill at a time, to a small group of 5-10 pupils for a duration of 5-10 minutes before a supervisor in a microteaching laboratory (Anulobi & Ohagwa, 2016).

According to Ike, et al (2017) the benefits of microteaching are summarized as follows: It reduces the anxieties pre-service teachers have over normal classroom teaching and provides a friendly way of introducing pre-service teachers into normal classroom activities; the immediate and accurate feedback provided in microteaching helps pre-service teachers to know their strength and weakness; microteaching helps each pre-service teachers accept his/her shortcoming in good faith; if a micro-lesson has been video recorded, the pre-service teachers observes his/her performance and it is easier for him/her to accept his weaknesses; it helps pre-service teachers perceive the relationship between theory and practice; it helps pre-service teachers get an in-depth knowledge of specific

teaching skills; it encourages self-evaluation; and it develops confidence in the pre-service teachers and helps them to build up a repertoire of teaching skills that enables them teach with more confidence. Microteaching has succeeded in producing very competent teachers through its methods of practicing the teaching skills before exposing them to real classroom teaching (Eze, et al 2003).

According to Iwu & Ifegbo (2011) teaching skills are teacher behaviours the pre-service teachers acquire while on training which they exhibit or employ during teaching-learning process for effectiveness and efficiency in their duties as professional teachers. It was these identified skills that were observed and practiced before the supervisor in a microteaching laboratory that gave teaching a professional background. Eze, et al (2003) observed that discrete teaching skills or ingredients of teaching methods were first identified and named at Stanford University in 1963 and later practiced for acquisition in a clinically controlled set-up called microteaching. The skills are thus grouped as follows:

Lesson Presentation Skills- Set Induction, Use of examples, Stimulus variation, Planned repetition, Non-verbal and extra-verbal communication and closure.

Questioning skills: Lower order questions, Middle order questions, Higher order questions, Probing questions, and Divergent questions.

Reinforcement skills: Recognizing attending behaviour, and Encouraging student responses, and

Supervisory Skills: Clinical supervision of teaching featuring Pre-observation conference, Classroom observation, Analysis strategy, and Post-observation Conference or Post-mortem.

The digital technology is the electronic system and tools that use digital data to perform tasks and processes with computers, video camera, plasma television to the internet, making it easier to process, store and digitize the practicum, unlike the analog. Microteaching allows the pre-service teachers to experiment and acquire teaching skills using hardware-based digital technology (digital video camera connected to the plasma television) in the Laboratory. Hardware-based digital microteaching practicum therefore serves as a means of acquiring repertoire of teaching skills which would be consolidated during teaching practice in the normal classroom teaching. Its classic practice requires the use of digital video hardware for self-evaluation purposes, hence the importance of exposing the pre-service teachers to the teaching skills through microteaching practicum. Every profession has its unique form of professional training. Obviously, microteaching cannot be taken in isolation or taught theoretically without effective practicum, because it is the only teacher education programme that gave teaching its professional background (Anulobi, 2018).

The theoretical support of this study is anchored on the Behaviour Modification Approach (BMA). This behaviourism is based on three assumptions, which include; learning any complex action by dividing it into simple component skills and later combined to form the complex behaviour. Behaviour can be modified through the use of models and teaching is performance based which is learnt through practice (Iwu, et al 2018). Again, Thorndike's law of practice and Skinner's theory of reinforcement of target behaviour are the major important theories that supported this study. Skinner's law stated that the more stimulus response (S – R) bond is practiced, the stronger it will become. While Thorndike however modified the law when he discovered that practice without feedback does not necessarily lead to increased performance

(Onwuagboke, et al 2017). It is based on these theories that the knowledge of immediate feedback dimension of microteaching was developed, as an innovation teacher education programme. In this study, therefore, the immediate feedback dimension of microteaching practicum was provided by the supervisors, peers and digital video recordings in the microteaching laboratory to reinforce and enhance the development of the teaching skills in the pre-service teachers.

Hence, the Federal Ministry of Education through the National Commission for Colleges of Education (NCCE) has made microteaching compulsory course for every pre-service teacher (Ike, et al 2017). In preparing the pre-service teachers for teaching practice therefore, it is the responsibility of the sending authority (training institution) to equip the pre-service teachers with a repertoire of teaching skills through hardware-based digital microteaching practicum (Iwu & Ifegbo, 2011). They further observed that the ideal thing to shoot for in terms of microteaching is to have microteaching with all the sophisticated hardware. Hardware-based digital microteaching practicum leads the pre-service teachers to uncover their mistakes and to proceed with necessary remedial work for extra-monitory and self-evaluation purposes. There is no doubt in the minds of the supervisors who have supervised microteaching with hardware and microteaching without hardware in our institutions, that hardware provides supportive mechanism for conveying and validating the supervisor's feedback and that the benefit of seeing oneself perform gives microteaching with digital hardware a clear advantage over microteaching without hardware (Ike, et al 2017).

Today however, the Digital Video Camera (DVC) system is a recent technology in the microteaching practicum. It is the most recent modification of the video memory recording system. DVC is the easiest to operate since the inception of hardware in microteaching practicum. It has basically two major hardware components (Digital Video Camera with Liquid Crystal Display (LCD) to record and watch the recordings during the presentation activities and the playback through the plasma television monitor). In this digital system, the DVC is mounted on a

tripod stand to video record the practicum activities in the laboratory. Feedback is received through the recorded video played back via the plasma television monitor for critiquing by the peers, supervisor and the intern him/herself. The digitized video is further used for modeling before any future practice session in the laboratory. This is quite absent in the practice of microteaching without hardware where feedback is received only from the supervisor and peers.

Eze, et al (2003) argued that institutions can also practice microteaching without hardware-based, utilizing other types of feedback especially with the master teacher. But Ike, et al (2017) had contrary view that hardware is not indispensable to the practice of microteaching. The question one may ask is why does poor performance in teaching practice continue to persist?

Teaching practice is the period when pre-service teachers are ready to link theory and practice. It is the practical examination of pre-service teachers in a normal classroom, to exhibit the extent of retention of the teaching skills practiced in the laboratory. Onyemerekeya (2001) described teaching practice as a period of guided teaching during which the teacher trainees assume responsibilities of directing the learning of a group. Amadi (2001) opined that teaching practice is a period of practical hands-on classroom teaching experience where the pre-service teachers come face to face with realities of classroom practice. It is also a close monitoring training given to pre-service teachers for a period of 12 weeks so as to apply the theoretical knowledge gained in practicum to a typical classroom situation. It is also like the clinical training or industrial experience given to students over a period of time in medical and engineering fields. In Alvan Ikoku Federal University of Education (AIFUE), Owerri, teaching practice is run two times of 6 weeks each (Ike, et al 2017). The supervisor and the cooperating teacher act as guide to the student teachers, and give necessary corrections which must be implemented before the next visit. Teaching practice is a mandatory requirement for those student-teachers who undergo teacher education programme. Teaching practice is compulsory exercise to all students registered for a programme in all the teacher education institutions. However, the central purpose of teaching-practice is

to offer opportunities for prospective teachers to increase their professional competencies. It stipulates that teaching practice has to be done in the candidates' teaching subject area and had to be passed for the candidate to earn the 6 credits required for graduation in the course area. Ifegbo and Onwuagboke (2018) observed that sending the student-teachers to the schools to practice teaching without prior microteaching practicum /experience is catastrophic.

A study carried out by Onwuagboke, et al (2017) on the impact of microteaching in developing teaching skills among pre-service teachers in AIFUE Owerri, comes to mind. The study was designed among others to find out the impact of microteaching in the development of some selected teaching skills by degree pre-service teachers; to compare the effectiveness of 3 different levels of the microteaching approach in enhancing the acquisition of the said teaching skills and to determine if gender has any influence in pre-service teachers' microteaching skill development in AIFUE. The research used a qualitative paradigm with a pre-tested-posttest quasi- experimental research design. The instrument used for data collection was a 14 item Microteaching Skills Rating Scale (MSRS) adopted from Ike, et al (2017). The reliability of the instrument was established. The study revealed that: Microteaching is an efficient means of enhancing the teaching skills of trainee teachers; Technology can have great impact on microteaching practice as the use of digital video recordings to provide knowledge of immediate feedback to the student-teachers; and Gender has no significant impact on student-teachers' ability to benefit and acquire a repertoire of teaching skills from microteaching practice.

Scholars have criticized the poor performance of UTME pre-service teachers' teaching practice exercise, and accused some of the university faculties of producing half-baked teachers (Anulobi & Ngumah, 2010). It is quite unfortunate that today some faculties of education in most of the universities do not prepare their pre-service teachers through hardware based digital microteaching practicum before posting them on teaching practice exercise, (Anulobi & Ohagwa, 2016). The implication is that such pre-service teachers always find it difficult to teach in any school system because

they did not pass through microteaching practicum (Iwu, et al 2018). Could the poor performance of some undergraduate pre-service teachers in teaching practice exercise be as a result of not exposing them to hardware-based digital microteaching practicum? Could they have performed very well in teaching practice if they were exposed to hardware-based digital microteaching practicum? Based on these divergent views therefore, the researchers wish to determine the impact of hardware-based digital microteaching practicum on pre-service teachers' acquisition and retention of teaching skills in teaching practice in Owerri, Imo State.

Purpose of the Study

Specifically, the study was designed to;

Determine the impact of hardware-based digital microteaching practicum on pre-service teachers' acquisition and retention of repertoire of teaching skills and those exposed to practicum without hardware. Ascertain the influence of gender on hardware-based digital microteaching practicum on pre-service teachers' acquisition and retention of repertoire of teaching skills. Ascertain the pre-service teachers' interest level towards hardware-based digital microteaching practicum acquisition and retention of repertoire of teaching skills.

iv. Determine the impact of hardware-based digital microteaching practicum acquisition and retention of repertoire of teaching skills in teaching practice exercise.

Research Questions

- i. What is the difference between the mean achievement scores of pre-service teachers exposed to hardware based digital microteaching practicum and those on practicum without hardware?
- ii. Ascertain the influence of gender on pre-service teachers' acquisition and retention of

repertoire of teaching skills after exposure to hardware based digital microteaching practicum?

iii. What is the pre-service teachers' interest level towards the acquisition and retention of repertoire of teaching skills through hardware based digital microteaching practicum?

iv. What impact does hardware-based digital microteaching practicum and microteaching practicum without hardware on pre-service teachers' acquisition and retention of repertoire of teaching skills in teaching practice exercise?

Hypotheses

Ho1. There is no significant difference between the mean achievement scores of pre-service teachers exposed to hardware based digital microteaching practicum and those exposed to microteaching practicum without hardware.

Ho2. There is no significant difference between the mean achievement scores of male and female students exposed to hardware based digital microteaching practicum.

Ho3. There is no significant difference in the mean achievement scores between the pre-service teachers exposed to hardware based digital microteaching practicum and those exposed to microteaching practicum without hardware in acquisition and retention of repertoire of teaching skills in teaching practice exercise.

Methods

The study examined the impact of hardware-based digital microteaching practicum on pre-service teachers' acquisition of teaching skills and retention for sustainable teacher education development in Nigeria. The study employed a quasi-experimental design with a pretest-posttest non-randomized control group, where the researchers had no control on the variables. The population of the study comprised of all the

2020/2021 UTME 300 level degree students in Alvan Ikoku Federal University of Education (AIFUE), Owerri, in affiliation with University of Nigeria Nsukka, who offered ED224 Educational Technology course. The intact class group of 30 (8males and 22females) Education Biology students (experimental group) exposed to hardware-based digital microteaching practicum and 30 (11males and 19females) Education Chemistry students (control group) not exposed to hardware-based digital microteaching practicum, through balloting were sampled. In order to control the interaction effect the two groups were purposively selected from two different departments (Biology and Chemistry) from the same Faculty. Three instruments were used for the study. The first instrument is 30 items Researcher-made Multiple-choice Questions Microteaching Achievement Test (RMQMAT), developed from set induction, planned repetition, stimulus variation, use of examples and illustrations, questioning, reinforcement, non-verbal communication and closure skills, drawn from the Essential Elements of Microteaching text (Ike, et al 2017). The second consisted of 10 item rating scale on interest level of pre-service students exposed to Hardware-based Digital Microteaching groups, tagged 'Pre-service teachers Level of Interest in Hardware-based Digital Microteaching Practicum Rating Scale (PLIHDMPR). The third instrument was the Observation Microteaching Appraisal Guide (OMAG) drawn from the AIFUE Teaching Practice Students' Reflective Journal.

Three experts validated the instruments, two drawn from the Measurement and Evaluation, Department of Psychology and one drawn from the Department of Curriculum and Educational Technology, Faculty of Education, AIFUE Owerri, Imo State, Nigeria. The experts checked and confirmed the appropriateness of the content, relevance and coverage of the instrument.

A pilot study was carried out using 10 pre-service teachers of 2020/2021 UTME 3000 level degree Education Biology and Education Chemistry students of the Faculty of Education, Imo State University, Owerri. The reliabilities of the RMQMAT and PLIHDMPR were established. Inter-rater reliability of the RMQMAT was established as 0.79, using the Fleiss (1989) Interclass Correlation Coefficient (ICC) formulae. The reliability for PLIHDMPR was also 0.83, using the computer software SPSS employing Cronbach Alpha method of computing reliability. Hence, these reliability indices were considered good for the study.

Thus, Education Biology students became the experimental group (Hardware-based digital microteaching practicum treatment group), and the Education Chemistry became the control group (Microteaching practicum without hardware treatment group), through balloting. A pretest was administered to the two treatment groups in order to ascertain the cognitive readiness of the pre-service teachers and determine the differences between pretest scores of the two groups. The aim was also to compare the posttest scores of the groups after the treatments. The study was carried out in three stages. First stage saw the exposure of experimental and control groups to introduction to microteaching theory for 3 weeks. Second treatment saw the experimental group exposed to hardware-based digital microteaching practicum treatment (practicing the skills through; plan – teach – critique – replan – reteach – recritique, week-by-week) in the laboratory, and the Control group was also exposed to only microteaching practicum without hardware treatment (practicing the same skills through; plan – teach – critique – replan – reteach – recritique, week-by-week) in a classroom, simultaneously. After the treatments, a posttest RMQMAT was administered to both the experimental and control groups,

respectively. The PLIHDMPR treatment was administered to only experimental group. The treatment lasted for 9 weeks. The data were analyzed using mean, standard deviation, t-test and ANCOVA to test the hypotheses at an alpha level of 0.05.

Then, third treatment saw the period of teaching practice which lasted for 6 weeks, in the normal secondary school classroom, whereby ten teaching practice supervisors from the rank of senior lecturer and above drawn from the department of curriculum and instruction of

AIFUE, were assigned to rate the retention levels of the pre-service teachers on the retention of repertoire of the teaching skills consolidated through the treatments on the experimental and control groups. The rating was observed and scored during the teaching practice exercise in the pre-service teachers' various school of practice in Owerri. It is important to reveal that the researchers interacted with the teaching practice supervisors before the two treatment groups were supervised in their various school of practice. A total of 18 weeks was used for the entire study from May 5th - August 29th, 2023.

Results

The results obtained from the analyses of data were presented in the tables below based on the research questions and hypotheses:

Research Question (i):

What is the difference between the mean achievement scores of pre-service teachers exposed to hardware-based digital microteaching practicum acquisition and those exposed to microteaching practicum without hardware?

Table 1: Summary of Pre-service teachers' achievements:

Dependent Variable: Posttest on Teaching Skills			
Group of Pre-service teacher	N	Mean	Std. Deviation
Experimental group with hardware-based digital practicum.	30	38.4000	3.70
Control group without hardware-based Practicum.	30	32.8000	2.77
Mean Difference		5.6000	

Table 1 shows that the experimental group had a mean achievement gain of 38.4000 while the control group had 32.8000, this gave a difference of 5.6000 in favour of the hardware-based digital microteaching practicum experimental group.

Ho1. There is no significant difference between the mean achievement scores of pre-service teachers

to microteaching practicum without hardware.

exposed to hardware-based digital microteaching practicum and those exposed

Table 2: Summary of ANCOVA analysis on achievement on hypothesis 1:						
Dependent Variable: Posttest Tests of Between-Subjects Effects						
Source	Type III Sum of Squares	Df.	Mean Square	F.	Sig.	Partial Eta Squared
Corrected Model.	470.915 ^a	2	235.457	21.665	.000	.432
Intercept.	325.800	1	325.800	29.977	.000	.345
TTSRS1.	.515	1	.515	.047	.829	.001
Group.	458.269	1	458.269	42.166	.000	.425
Error.	619.485	57	10.868			
Total	77132.000	60				
Corrected Total:	1090.400	59				
a. R Squared = .432 (Adjusted R Squared = .412)						

Table2 shows that the calculated mean achievement scores of pre-service teachers' experimental group exposed to hardware -based digital microteaching practicum is 29.977, while the control group exposed to microteaching practicum without hardware is 21.665 with the difference 8.312, in favour of the experimental group exposed to hardware-based digital microteaching practicum.

Question (ii):

What is the difference between the mean teaching skill scale scores of male and female pre-service teachers exposed to hardware-based digital microteaching practicum?

Table 3: Summary of mean achievements by gender:

Gender of Pre-service Teachers		N	Mean	Std. Deviation	Std. Error Mean
Posttest	Male.	7	37.8571	3.18479	1.20374
	Female.	23	38.5652	3.89436	.81203
	Mean Difference.		0.71		

Table 3 shows that the mean gain of the males in the group is 37.85 while the female is 38.56 this gave a slight difference of 0. 71 in favour of the females that took experiment on hardware-based digital practicum based microteaching

Ho2. There is no significant difference between the mean achievement scores of male and female students exposed to hardware-based digital microteaching practicum.

Table 4: Male and female students exposed to hardware-based digital microteaching practicum.

t-test of Equality of Means							
		F	Sig.	T	Df.	Sig. (2-tailed)	Mean Diff.
Posttest	Equal variances assumed.	.566	.458	-.437	28	.665	-.70807
	Equal variances not assumed.			-.488	12.024	.635	-.70807

Table 4 shows the mean achievement scores of pre-service male teachers' exposed to hardware-based digital microteaching practicum is .437, while female .488, with the difference 12.024, in favour of the female gender.

Research Question (iii):

What is the pre-service teachers' interest level towards the exposure on hardware-based digital microteaching practicum in acquiring repertoire of teaching skills.

Table 5: Pre-service teachers' level of interest towards the exposure on hardware-based digital microteaching practicum:

S/N	Item	N	Mean	Std. Deviation	Remarks
1	Microteaching laboratory made me love practicing skills.	60	2.6500	.63313	Positive
2	Video recording and playback made microteaching practice interesting.	60	2.5500	.64899	Positive
3*	I have acquired a repertoire of teaching skills through the use of effective video feedback.	60	2.5333	.62346	Positive
4	I enjoy interacting with my peers during Microteaching practicum in the Laboratory.	60	2.5500	.62232	Positive
5	I am certain that the teaching skills acquired in the Microteaching Laboratory will help me become a professional teacher.	60	2.5333	.74712	Positive
6	Hardware-based microteaching practicum will make me have a deeper understanding of the concept of teaching.	60	2.5833	.61868	Positive
7	Every pre-service teacher should be exposed to hardware-based microteaching practicum before going for teaching practice.	60	2.5000	.65094	Positive
8	I will definitely score high in my teaching practice examination during my teaching practice.	60	2.4000	.61617	Positive
9	My performance in microteaching laboratory practicum examination was inspiring.	60	2.3833	.49030	Positive
10	Hardware-based digital microteaching practicum has enabled me overcome stage fright I used to have while speaking in public.	60	2.4500	.64899	Positive
		60	2.61332		

Table 5 shows that the level of interest of pre-service teachers exposed to hardware-based digital microteaching practicum is positive (2.61). This shows that hardware-based digital microteaching practicum has been effective in motivating pre-service teachers' attitude towards acquiring repertoire of teaching skills.

Question (iv):

What is the pre-service teachers' mean achievement scores after exposure to the two treatment groups and retention during teaching practice exercise in the classroom?

Table 6: Summary of the pre-service teachers' mean achievement after exposure to the two treatment groups and retention during teaching practice:			
Dependent Variable: Posttest 2			
Group of pre-service teacher	Mean	Std. Deviation	N
Experimental group with hardware-based feedback.	37.1667	3.82445	30
Control group without hardware-based feedback.	29.1000	3.03258	30
Total:	33.1333	5.31537	60

Table 6 shows summary of the pre-service teachers' mean achievement after exposure to the two treatment groups and retention during teaching practice. It shows that the experimental group had a mean achievement gain of 37.1667 while the control group had 29.1000. This gave a difference of 6.31537, in favour of the hardware-based digital microteaching practicum experimental group in teaching practice.

Ho3. There is no significant difference in the mean achievement scores between the pre-service teachers exposed to hardware-based digital microteaching practicum and those

exposed to microteaching practicum without hardware in acquiring and retention of repertoire of teaching skills in teaching practice exercise?

Table 7: Summary of mean scores on teaching skills scale of pre-service teachers during teaching practice:

Tests of Between-Subjects Effects

Dependent Variable: Posttest2

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	978.326 ^a	2	489.163	40.491	.000
Intercept	310.925	1	310.925	25.737	.000
TTSRS1	2.259	1	2.259	.187	.667
Group	947.100	1	947.100	78.397	.000
Error	688.607	57	12.081		
Total	67536.000	60			
Corrected Total	1666.933	59			

a. R Squared = .587 (Adjusted R Squared = .572)

Table 7 shows the mean achievement in retention of pre-service teachers' repertoire of teaching skills on teaching practice exercise of experimental group is 489.163. While control group is 310.925, this gave a mean difference of 187.238, in favour of experimental group who were exposed to hardware-based digital microteaching practicum.

Summary, Conclusion and Recommendation

The results of this study had revealed the need for the utilization of hardware-based digital microteaching technology in the production of effective teachers in the teacher education institutions. The findings revealed that pre-service teachers exposed to hardware-based digital microteaching practicum had a better mean achievement score than their counterparts exposed with practicum without hardware. This implies that microteaching with hardware has a better retention power in terms of pre-service teachers' interest, acquisition, retention and utilization of the teaching skills as observed and perceived in their teaching practice achievement scores towards teaching profession. The hardware treatment also has the ability to liberalize the acquisition of repertoire of teaching skills as it gave room for every pre-service teacher's professional development. The findings is in agreement with Onwuagboke, et al (2017) that microteaching practiced by pre-service teachers in the laboratory with digital video camera connected with cable to television plasma screen hardware recordings and playback performed better than those exposed to practice of microteaching without hardware, with mean rating of 71.2 and 60.13, respectively.

Consequently, it is obvious that technology adds significant value to microteaching practicum.

Gender had slight influence on the use of hardware in the acquisition and retention of teaching skills on pre-service teachers. Table 3 shows that the mean gain of the male in the group is 37.85 while the female is 38.56, this gave a slight difference of 0.71 in favour of the female in the experiment on hardware-based practicum based microteaching practicum. Though, the mean difference of 0.71 is not significant. Use of hardware-based digital microteaching practicum treatment group on male and female, and retention on repertoire of teaching skills in teaching practice also showed no statistical difference. This is not in agreement with Umah, Mogbo and Nsofor (2015) that males performed better than females in microteaching practicum. However, the number of females in the teaching profession in Nigeria schools today is a pointer to the fact that gender barriers may be insignificant, based on their slight differences in their achievement mean rating.

Table 3 also revealed that pre-service teachers exposed to hardware-based

microteaching practicum reacted highly positive and indicated very high level of interest and likeness. This is in tandem with Onwuagboke, et al (2017) who opined that video technology in practicing microteaching stimulate and motivate pre-service teachers' interest. It encourages listening, engagement and self evaluation in acquiring repertoire of the teaching skills in the laboratory. Table 7 shows summary of the pre-service teachers' mean achievement after exposure to the two treatment groups and retention in teaching practice shows that digital technology influences acquisition and retention of teaching skills in the classroom. As in the treatments, experimental group had a mean achievement gain of 37.1667 while the control group had 29.1000 this gave a difference of 6.31537, in favour of the hardware-based digital microteaching practicum experimental group in teaching practice. Hence, the supervisors' scores also confirmed the experimental group (Hardware-based digital microteaching practicum) performed better than control group (Microteaching practicum without hardware).

It has become obvious that teaching skills in the classroom are acquired mainly through the hardware-based digital microteaching practicum in the teacher education institutions. This has shown that microteaching skills acquired and retained are consolidated during teaching practice situations in the normal classroom teaching. Digital technology has great impact on microteaching practice as the use of hardware-based digital technology provides knowledge of immediate feedback to the pre-service teachers. This remains the most effective way of acquiring and retaining repertoire of teaching skills. This study has provided empirical evidence to the utilization of digital hardware in regular training and acquisition of teacher requisite behaviours by the pre-service teachers through hardware- based digital microteaching practicum. It therefore means that teaching practice gives pre-service teachers the opportunity to gain insight into the whole teaching process. For effective professional teacher development, therefore, it is unethical for any training institution to send pre-service teachers to schools to practice teaching without first exposing them to hardware-based digital microteaching practicum.

Recommendations

The following recommendations are drawn:

Hardware practicum-based digital microteaching enables the pre-service teachers get in-depth

knowledge of acquisition and retention of teaching skills, therefore every teacher education institution should endeavor to prepare their undergraduate degree pre-service teachers through hardware-based digital microteaching practicum before sending them to practice teaching in the normal classroom.

Every pre-service teacher should have a good level pass on microteaching practicum examination before he/she is posted for teaching practice exercise in a normal classroom environment. This is because hardware-based digital microteaching builds more professional confidence in the pre-service teachers. All the teacher education institutions in Nigeria including Alvan Ikoku Federal University of Education, Owerri, should henceforth prepare

their bachelor degree pre-service teachers through hardware-based digital microteaching practicum before posting them on teaching practice exercise.

National Universities Commission (NUC) should as a matter of necessity made compulsory to expose every undergraduate degree pre-service teacher pass through hardware-based microteaching practicum before posting them on teaching practice exercise.

State of the art microteaching complex should be built in every teacher education institution in Nigeria this is to ensure effective training of more specialist teachers in hardware-based digital microteaching practicum.

References

- Amadi, R.N. (2001). *Understand teaching practice*, in R.N. Amadi, A. O, Iwu, & C.C. Onyemerekeya (Eds.), *Perspective on teaching practice* (12-30). Avan Global Publications.
- Anulobi, J. C. & Ohagwa, P. E., (2016). *Microteaching practicum an innovative technique to the attainment of teacher education goals in Nigeria: Challenges and Prospects*. *Journals of Resourcefulness and Distribution (JORESDIS)*, 13 (1), 123-140.
- Anulobi, J. C. (2018). *Assessment of student-teachers utilization of teaching skills in teaching practice exercise in public secondary school in Owerri, Imo state*. *Journal of Educational Studies and Research (JESR)*, 7 (1), 356 – 369.
- Anulobi, J. C., & Ngumah, H. C. (2010). *Microteaching programme as a vital curriculum instrument for quality teacher education*. in *African Journal of Allied Education (AJAE)*, 4 (1), 125-136.
- Eze, D, Agu, N. N., & Akudolu, R. I. (2003). *Microteaching for degree students*. Meks Publishers Nig.
- Federal Republic of Nigeria. (2013). *National policy on education*. NERDC Printing Press.
- Ifegbo, P. C., & Onwuagboke, B.B.C. (2018). *Microteaching: purpose, process, content and interactive techniques*. Divine Favour Digital Concept Publisher.
- Ike, G. A, Onwuagboke, B. B. C. Anulobi, J. C., & Ukaegbu, M. N (2017). *Essential elements of microteaching: Theory and practices*. Totan Publishers.
- Iwu, A. O & Ifegbo, P. C. (2011). *Teaching Skills*. In A. O Iwu, C. N. Mbadiugha, C. Usor & E. N. Ikwanusi (Eds.), *Contemporary Issues and methods in science education* (31-55). Milestone Publishers Ltd.
- Iwu, A. O, Ajuzie, N. E., Nwoke, B., Lemchi, S. N., & Ike, G. A. (2018). *Evaluating teaching skills and efficiency of secondary school teachers using microteaching approach in Imo state of Nigeria*. Divine Favour Digital Concepts Publisher.

- Mkpa, A. M. (2016). *Teacher education in the 21st Century: Some challenges and the way forward*. *Journal of social science, the humanities & education*, 2 (1),166-182.
- Onwuagboka, B. B. C., Osuala, R. C., & Nzeako, R. C. (2017). *The impact of microteaching in developing teaching skills among pre-service teachers in AlvanikokuFeferal College of Education, Owerri, Imostae, Nigeria*. In *African Research Review. An international multi-disciplinary journal Ethiopi.* 11 (2), 237 – 250.
- Onyemerkenya, C. C. (2001). *Clarification of the concepts of teaching and learning*. In R. N. Amadi, A. O. Iwu & C. C. Onyemerkenya (Eds.), *Perspective on teaching practice (1-11)*. Avan Global Publishers.
- Umeh, A. E., Mgbo, I. N., & Nsofor, C.C. (2015). *Effectiveness of video-tape recorder on microteaching on student teachers practice of stimulus variation skills*. *Journal of Educational Research and Reviews*, 3 (3), 32-40.

Digitalization and Emerging Issues in Social Studies: The Alvan Ikoku Federal University of Education Experience

¹Ebeniza Ndubuisi Ajuzie, ,

²Ngozi Ndubuisi Ajuzie

³Gladys Ijeoma Ohanyere

¹Department. of Curriculum Studies & Educational Technology, Alvan Ikoku Federal University of Education, Nigeria .

^{2,3} Department of Social Studies, Alvan Ikoku Federal University of Education, Nigeria .

Abstract

This paper examined digitalization and emerging issues in social studies: The Alvan Ikoku Federal University of Education Owerri Experience. Three research questions and two hypotheses guided the study. The study adopted a descriptive survey design. The population of the study consisted of all the one hundred and thirty-two (132) respondents for the research study. A twenty-one (21) items questionnaire developed by the researchers titled “questionnaire for digitalization tools in Social studies” (QFDTSS) was used after validation by experts for data collection. The reliability of the instrument was obtained as 0.82 using Cronbach Alpha. Data were analyzed using mean, standard deviation statistical tools for the research questions while t- test was used to calculate the hypotheses. The study considered any questionnaire item with mean rating from 0 – 2.49 as negative while from 2.5 – 4 as positive. The result revealed that respondents confirmed that using digital tools in Social Studies significantly improves critical thinking, enables effective collaboration, and makes learning more engaging. These benefits led to the recommendation that the management of Alvan Ikoku Federal University of Education, should ensure that benefits of digital tools be sustained in the university by making sure that digital tools are provided and maintained for meaningful and purposeful teaching and learning processes.

Key words: digitalization, teacher, digital tools & social studies.

1.0 Introduction

The digital revolution is transforming all aspects of our lives, and education is no exception. In social studies, digitalization presents a unique opportunity to create a more engaging, interactive, and relevant learning experience. Students can explore historical events through virtual reality simulations, embark on virtual tours of ancient civilizations, and analyze data using interactive maps. In the 21st century, education, defined as the process of acquiring

knowledge, skills, competencies, and values (Ajuzie & Amah, 2018), is inextricably linked to digitalization. This integration of technology allows for a deeper understanding of the world around us, enabling students to function effectively in society, secure employment, and develop into well-rounded individuals. However, for teaching and learning to truly thrive within this digital landscape, the crucial role of the teacher remains indispensable.

The teacher in the 21st century has been described as a guide, facilitator, supervisor as well as an instructor who more or less leads children to discover their potentials. The teacher guides and directs learners on how to construct their own meaning from school lessons (Masello, 2014; Ifegbo&Ajuzie, 2016 and Onye & Anyaogu, 2017). It is the teacher who should direct, organize and encourage the students to become an agent of change in the society (Iwu, Ajuzie, Nwoke, Lemchi, & Ike, 2018). For Ajuzie & Akukwe, (2018), the teacher is the pivot of teaching and learning, the core objectives of education as well as the center of education. Onye and Ajuzie (2018) observed that a well-qualified teacher will know how best to handle the learner and how to develop their intellectual resources. The teacher is also expected to maintain some contact with the home of each learner and even with the larger community. He/she should show interest in appreciating the social circumstances of children placed in his/her care. The teacher must manage tasks professionally which include setting achievable objectives for education, seizing new opportunities and adapting to new technologies and coping with changes in the system, maintaining effective team spirit, developing an effective communication system, participating effectively, and managing time efficiently amongst others (Ajuzie & Amah, 2017 and Onye & Anyaogu, 2019). The teacher serves as a motivator of learning. This implies that the teacher has some understanding of individual differences in the physical and psychological make-up of human beings. It becomes imperative that teacher must demonstrate content and professional knowledge, skills and dispositions reflecting research, proficiency with technology and assessment, and accepted best practices in teacher education. Little wonder, over these years the curricular content of teacher has been reviewed to ensure that it is comprehensive and digital driven in line with the global best practices (Adebayo 2018 and Ajuzie & Ariguzo, 2021). It follows that teaching and learning social studies may not augur well without digitalization.

Digitalization refers to the conversion of analog information (such as printed text or physical

objects) into a digital format (like computer code or online resources). In the context of education, it involves incorporating technology tools and resources into the teaching and learning process. This can encompass a wide range of tools, from online simulations and virtual field trips to interactive maps, educational games, and collaborative platforms. From the discussion above, it is important to affirm that digitalization and social studies are synonymous in practice. Digitalization is fundamentally changing how societies function, and social studies is all about understanding how societies work. This creates a strong link between the two. According to Adediran (2017), social studies is a subject concerned primarily with the study and resultant interaction of people, their environment, and their society which they live. Akinlaye (2013) sees social studies as a process of education which emphasizes the relationship human beings have with their physical, social, economic, cultural, religious, scientific and technological environment. It is clear that social studies introduction in many countries have been as a result of its importance in solving societal issues. For instance, in Britain Social Studies was introduced into the school curricular after the first and second world wars as a panacea for social problems (Edinyang& Ubi, 2013). Nigeria as a nation has her own reasons why Social Studies has been given a pride of place at the junior secondary school levels of education. According to Ajuzie & Ipem (2021), today's students are digital natives, comfortable with technology. Equipping future educators with the skills to leverage digital tools effectively in their classrooms is essential. This can involve learning to create multimedia presentations, online quizzes, and gamified learning experiences. Universities can model best practices for integrating technology into social studies education by using digital tools themselves, instructors demonstrate how to choose appropriate resources and use them strategically to deepen student understanding which is quality education (Ajuzie& Amah, 2019)

The needs arise for modern advancement in education to be embraced in our educational system especially at the tertiary level which includes the integration of digital tools in

teaching and learning. To this end, FRN (2013 p. 18) affirmed among others that the government shall provide necessary infrastructure and training for the utilization of digital tools or facilities in the school system in recognition of the role of digitalization in advancing knowledge and skill in the modern world. According to Ajuzie and Ajuzie (2022), the emergence of computers and digital tools has revolutionized teaching and learning system gender notwithstanding. Scholars affirm to the use of digital tools in teaching and learning; thus, digital tools like computer and its facilities make instructional delivery an interactive one which invariably enables teachers to control the content and flow of information (Shah & Khan, 2015). Ajuzie & Amah (2017) observed that the increasing student population in our tertiary institutions accelerated the need for digital tools to process, store and retrieve data in fast, systematic and accurate manner without delay. Additionally, studies by Okolocha & Nwadiani (2015) (Ajuzie, 2013, Ajuzie & Ukegbu, 2015, Ajuzie & Amah, 2017) and Ajuzie & Ifegbo (2021) reveal a surprisingly low utilization of digital tools and ICT resources in teacher training institutions (Colleges of Education and Universities) Several challenges hinder the effective use of ICT in teaching and learning within these institutions. These challenges include: High costs associated with ICT/digital resources, unreliable electricity, unstable internet connection, limited funding, shortage of trained ICT teachers, teacher apprehension towards ICT, among others (Ajuzie & Ukegbu, 2015, Ajuzie & Amah, 2017).

1.1 Statement of Problem

The digital revolution is rapidly transforming how we live, learn, and interact with the world. While social studies traditionally focused on historical and civic literacy in a face-to-face world, digitalization presents both exciting opportunities and critical challenges. Technology offers access to vast information, simulations, and collaborative platforms. However, this very abundance can overwhelm students, making it difficult to discern credible sources from fabricated news or misleading

content. Social media algorithms can create echo chambers, reinforcing existing biases and hindering critical thinking about social issues like climate change or political polarization. Furthermore, unequal access to technology risks exacerbating educational disparities and creating a digitally divided citizenry, hindering informed participation in civic life. Social studies educators must grapple with these issues to ensure all students develop the digital literacy skills needed to be informed, engaged, and responsible participants in a digital democracy. Hence the need for this paper.

1.2 Purpose of the Study

The main purpose of this study was to examine digitalization and emerging issues in social studies. This study specifically examines:

- i. student-teachers' view of the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri.
- ii. whether gender has an influence on student-teachers' view of the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri.
- iii. whether there exist some constraints to the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri.

Questions

The following research questions guided the study:

1. What are the student-teachers' view of the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri?
2. To what extent has gender influenced student-teachers' view of the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri?
3. what are the constraints to the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri?

2.0 Hypotheses

H₀₁: There is no significant difference between male and female lecturers' views on the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri.

H₀₂: There is no significant difference between male and female lecturers' views on the constraints to the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri.

2.1 Methods

Descriptive survey design was used for the study. The population of this study comprised of lecturers teaching social studies and all the degree student-teachers offering Social Studies in Alvan Ikoku Federal University of Education, Owerri. Data obtained from the office of the head of department showed that there are twenty-three lecturers (comprised of 6 males and 17 females) and one hundred and nine (109) degree student-teachers across all levels from year one to final year (100 level, 200 level, 300 level and 400 level degree students as at 2023/2024 academic session) in the department. In all, we have one hundred and thirty-two (132) respondents for the research study. Due to the fact that the population of the study is manageable, the researchers decided to use all for the study. Therefore, the one hundred and thirty-two (132) respondents of both lecturers and student-teachers of Social Studies served as the sample for the study. The major instrument for data collection is a 21 item self-structured questionnaire titled "questionnaire for digitalization tools in Social studies" (QFDTSS) that was divided into two sections. Section A

deals with background information while B deals with lecturers and student-teachers' view of digitalization and emerging issues in Social Studies. The questionnaire was structured in a four-point rating scale of Strongly Agree (SA), Agreed (A), Disagreed (D) and Strongly Disagreed (SD), where the respondents ticked the correct answer that appeal to him/her in the space provided. The options were assigned points namely, 4, 3, 2 and 1 respectively. The instrument was validated by two specialists one from Social Studies department and one from Measurement and Evaluation of Alvan Ikoku Federal University of Education, Owerri. The specialists validated the instrument. The reliability of the instrument was determined by administering it to a group of twenty (20) student-teachers who are not members of the study group but with the same characteristics. The student-teachers were requested to attempt all the twenty-one (21) items of the questionnaire. The same instrument was administered to the same group after two weeks. The test scores of the group were collated and analyzed using, Pearson's Product Moment Correlation Coefficient. The data analyzed yielded a co-efficient index of 0.82 which was judged as high therefore reliable. The one hundred and thirty-two (132) copies of the rating scale were administered to the respondents by the researchers and all were returned for data analysis. The study considered any rating scale item with mean rating of 0 – 2.49 as negative while 2.5 – 4 as positive. Mean statistical tool was used to answer the research questions while t- test was used to calculate the hypotheses.

2.3 Results

Question (i): What are the student-teachers' view of the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri?

Table 1: Mean responses from student-teachers' view of the utilization of digital tools in teaching and learning of Social Studies.

S/N	Item Statement	SA	A	D	SD	Mean (x)	Standard deviation	Remarks
1	The use of digital tools (e.g., simulations, online databases, educational games) in my Social Studies courses has enhanced my understanding of the subject matter.	312	60	20	01	3.61	0.667	Agreed
2	The digital tools used in my Social Studies courses are engaging and make learning more interesting.	300	45	20	09	3.43	0.966	Agreed
3	The digital tools effectively promote critical thinking skills when studying Social Studies.	368	27	16	-	3.78	0.573	Agreed
4	I feel comfortable using the digital tools incorporated in my Social Studies courses.	352	42	14	-	3.74	0.585	Agreed
5	The digital tools adequately support collaborative learning activities in Social Studies.	316	45	20	05	3.54	0.846	Agreed
6	My Social Studies instructors effectively integrate digital tools with traditional teaching methods.	320	60	10	04	3.61	0.763	Agreed
7	The digital tools used in Social Studies courses are helpful for researching and analyzing historical and current events.	356	42	12	-	3.76	0.550	Agreed
8	I believe the use of digital tools in Social Studies prepares me to use technology effectively in my future teaching career.	360	48	06	-	3.80	0.450	Agreed
Cluster mean						3.65	0.675	Agreed

Source: quantitative research study, focused on the use of digital tools in teaching Social Studies at Alvan Ikoku Federal University of Education (AIFUE), Owerri.

Analysis from table 1 showed that respondents agreed that utilization of digital tools in teaching and learning of Social Studies promote critical thinking skills, support collaborative learning activities and make learning more interesting among others. With a cluster mean of 3.65 which is higher than the acceptable mean of 2.5.

Question (ii): To what extent does gender influence lecturers' view of the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri?

Table 2: Mean responses on the utilization of digital tools in teaching and learning of Social Studies in AIFUE, Owerri by gender

S/N	Items	Males		Females		Remarks
		Mean	SD	Mean	SD	
1	I feel comfortable using digital tools to teach Social Studies concepts.	3.67	0.445	3.53	0.693	Agreed
2	Digital tools make Social Studies lessons more engaging for students.	4.00	0.000	3.59	0.479	Agreed
3	I am confident in my ability to troubleshoot technical difficulties with digital tools during class.	3.83	0.406	3.82	0.415	Agreed
4	My previous experiences with technology have influenced my willingness to use digital tools in the classroom.	3.67	0.445	3.71	0.421	Agreed
5	The digital tools adequately support collaborative learning activities in Social Studies.	3.13	1.038	3.76	0.577	Agreed
6	In my opinion, lecturers' gender does not play a significant role in their view of using digital tools for Social Studies.	3.83	0.406	3.47	0.697	Agreed
Cluster Mean		3.68	0.456	3.64	0.547	Agreed

Source: quantitative research study, focused on the use of digital tools in teaching Social Studies at Alvan Ikoku Federal University of Education (AIFUE), Owerri.

Analysis from table 2 showed that respondents both males and females accept that gender does not influence their use of digital tools in teaching and learning but rather it makes education more interesting and objective realized easily. The cluster mean of 3.68 for males and 3.64 for females, which is higher than 2.5 acceptable mean.

Question (iii) What are the constraints to the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri?

Table 3: Mean responses on the constraints to the utilization of digital tools in teaching and learning of Social Studies in AIFUE, Owerri by gender

S/N	Items	Male		Female		Remarks
		Mean	SD	Mean	SD	
1	The reliability of Internet connectivity in classrooms hinders the effective use of digital tools in social studies.	3.5	0.500	3.65	0.570	Agreed
2	I lack the confidence and technical skills to integrate digital tools effectively into my social studies teaching.	3.67	0.445	3.76	0.464	Agreed
3	The current curriculum for social studies courses does not allow for easy integration of digital learning activities.	3.33	0.760	3.53	0.602	Agreed
4	The time constraints of social studies courses make it difficult to implement engaging digital learning experiences.	3.83	0.406	3.94	0.254	Agreed
5	Students in my social studies courses lack the necessary digital literacy skills to effectively utilize online resources.	3.67	0.445	3.88	0.349	Agreed
6	Limited technical support within the university hinders troubleshooting issues with digital tools during class.	4.00	0.000	3.82	0.415	Agreed
7	Lack of constant power supply hinders the use of digital tools during class.	3.83	0.406	3.71	0.543	Agreed
Cluster Mean		3.69	0.423	3.75	0.456	Agreed

Source: quantitative research study, focused on the use of digital tools in teaching Social Studies at Alvan Ikoku Federal University of Education (AIFUE), Owerri.

From the analysis, respondents agreed that items listed such as lack of network or Internet issues, lack of confidence and technical skills to

integrate digital tools effectively, students lack of necessary digital literacy skills, lack of constant power supply among others are

constraints to the utilization of digital tools in teaching and learning of social studies in the University with cluster mean of 3.69 for males and 3.75 for females which is higher than acceptable mean of 2.5.

H₀₁: There is no significant difference between male and female lecturers' views on the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri.

Table 4: *t*-test result on the utilization of digital tools in teaching and learning of Social Studies in AIFUE, Owerri by gender

Gender	N	Mean	SD	<i>t_{cal}</i>	<i>df</i>	<i>t_{crit}</i>	Decision
Male	6	3.68	0.456	0.175	21	2.080	Accept H ₀
Female	17	3.64	0.547				

Source: *quantitative research study*, focused on the use of digital tools in teaching Social Studies at Alvan Ikoku Federal University of Education (AIFUE), Owerri.

From the t-test analysis shown in Table 4, the statement of hypothesis 1 is accepted; implying that there is no significant difference between male and female lecturers' views on the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri. This is

because the calculated t-value is less than the critical value at 0.05 alpha level of significance.

H₀₂: There is no significant difference between male and female lecturers' views on the constraints to the utilization of digital tools in teaching and learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri.

Table 5: *t*-test result on the constraints to the utilization of digital tools in teaching and learning of Social Studies in AIFUE, Owerri by gender

Gender	N	Mean	SD	<i>t_{cal}</i>	<i>df</i>	<i>t_{crit}</i>	Decision
Male	6	3.69	0.423	0.293	21	2.080	Accept H ₀
Female	17	3.75	0.456				

Source: *quantitative research study*, focused on the use of digital tools in teaching Social Studies at Alvan Ikoku Federal University of Education (AIFUE), Owerri.

From the t-test analysis shown in Table 5, the statement of hypothesis 2 is accepted; implying that there is no significant difference between male and female lecturers' views on the constraints to the utilization of digital tools in teaching and

learning of Social Studies in Alvan Ikoku Federal University of Education, Owerri. This is because the calculated t-value is less than the critical value at 0.05 alpha level of significance.

3.0 Summary, Conclusion and Recommendations

Utilization of Digital Tools in Teaching and Learning of Social Studies

Analysis from table 1 showed that respondents agreed that utilization of digital tools in teaching and learning of Social Studies promote critical thinking skills, support collaborative learning activities and make learning more interesting among others. This finding is in-line with the views of Shah & Khan, (2015) and Ajuzie & Amah (2019) who opined that digital tools like computer and its facilities make instructional delivery an interactive one which invariably enables teachers to control the content and flow of information.

Influence of Gender on the Utilization of Digital Tools in Teaching and Learning

Result of the analysis proved that respondents whether male or female accept that gender does not influence their use of digital tools in teaching and learning but rather it makes education more interesting and objective realized easily. This finding is in agreement with the observations of Ajuzie and Ajuzie (2022) that the emergence of computers and digital tools has revolutionized teaching and learning system gender notwithstanding.

Constraints to the Utilization of Digital Tools in Teaching and Learning of Social Studies

Analysis from table 3 revealed that respondents agreed that items listed such as lack of network or Internet issues, lack of confidence and technical skills to integrate digital tools effectively, students lack of necessary digital literacy skills, lack of constant power supply among others are constraints to the utilization of digital tools in teaching and learning of social studies in

the University. The above finding corroborates the opinion of Ajuzie & Ukegbu, (2015) and Ajuzie & Amah, (2017) who lamented that several challenges hinder the effective use of ICT in teaching and learning within these institutions. These challenges include: High costs associated with ICT/digital resources, unreliable electricity, unstable internet connection, limited funding, shortage of trained ICT teachers, teacher apprehension towards ICT among others.

The digital revolution compels social studies education to adapt. While technology offers engaging learning experiences, it also presents challenges like network issues, lack of constant power supply, lack of support staff etc. It is therefore very vital for social studies educators to equip students with digital literacy skills and competencies that will help them become informed, engaged participants in a digital society.

Recommendations

Based on the findings of the study, the following recommendations were made.

- i. The management of Alvan Ikoku Federal University of Education, Owerri should ensure that benefits of digital tools be sustained in the university by making sure that digital tools are provided and maintained for meaningful and purposeful teaching and learning to thrive.
- ii. The management of the institution should ensure that all lecturers gender not withstanding should be allowed to use digital tools in instructional delivery as it makes education more interesting and objective realized easily.
- iii. lecturers in the department should be giving more professional development to feel comfortable integrating digital tools effectively into their Social Studies curriculum.

References

- Adebayo, U. (2018) *Modern office Technology: Issues, procedures and practice*. Enugu: University of Nigeria press Ltd.
- Ajuzie, N. E. & Ajuzie, N.N. (2022). Perceived influence of Internet use on Guidance and Counselling in secondary schools in Orlu Educational Zone, Imo State. *Nigerian Social Science Education Review (NSSER)* 6 (1) 124-133.
- Ajuzie, N. E & Alugbuo, D. O. (2012). Availability and usability of ICTs in teaching and learning English language in secondary schools in Okigwe educational zone, Imo state. *Journal of Educational Media & Technology*. 16 (2), 23-31.
- Ajuzie, N. E. & Akukwe, A. C. (2018). Teachers' attitude towards the use of educational media in secondary schools in Ihitte -Uboma local government area of Imo state. *International journal of education development (IJOED)*. 7 & 8 (1), 35-44.
- Ajuzie, N. E. & Ariguzo, G.O. (2021). E-learning demands for accessing education in the era of Covid-19 pandemic: *Alvan Ikoku lecturers' experience*. *African journal of innovations and reforms in educational management (AJIREM)*. 2(1), 123-129.
- Ajuzie, N. E., & Amah, K.O. (2017). ICT as an effective tool for microteaching practicum in adult education. *Unicorn international journal of comtemporary studies*. 3(1), 24-32.
- Ajuzie, N. E. & Amah, K. O. (2018). The use of Internet in open and Distance learning centres in South-Eastern states of Nigeria. *Journal of educational media & technology*. 22, (1) 130-137.
- Ajuzie, N.E & Amah, K.O. (2019) Perceived effects of the level of integration of power-point presentation in final year project defence of Imo state university students. *Journal of educational media and technology*, 25 (1), 23-34.
- Ajuzie, N.E. & Ifegbo, P.C. (2021). Perceived effects of utilization of digital multi-media resources in teaching/learning of basic science in secondary schools in Owerri municipal council, Imo state. *International journal of social education*, 56(22) 14-21.
- Ajuzie, N. E. & Ipem, J. N. (2021). ICT skills and utilization of mobile learning technologies for instructional delivery among pre-service teachers in two higher institutions in South-Eastern Nigeria. *Journal of the department of Educational Foundations, Faculty of Education, Nnamdi Azikiwe University, Awka, Anambra State*. *Journal of theoretical and empirical studies in education (JoTESE)*. 7(1), 54-62.
- Ajuzie, N.E. and Ukegbu, N.M. (2015). Web-Based tool and instructional delivery in selected secondary schools in Owerri education zone I, Imo state, Nigeria. *Journal of world scientific news* 15(2) 49-55.
- Federal Republic of Nigeria (2013). *National policy on education* (6th ed.). Abuja: NERDC Press.
- Ifegbo, P.C. & Ajuzie, N. E. (2018). Improving the teaching and learning of educational technology course content through the use of graphic organizer. *Journal of education & society (JES)*. 8(3), 330-337.

- Iwu, A.O, Ajuzie, N. E., Nwoke, B.I., Lemchi, S.N., & Ike, G.A. (2018). Analysis of teaching skills possessed by teachers in senior secondary schools in Imo state Nigeria. *European journals of education studies*. 5(1), 186-193.
- Masello Hellen Phajane (2014). *Exploring the Roles and Responsibilities of Early Childhood Teachers*. Mediterranean Journal of Social Sciences MCSER Publishing, Rome-Italy 5 (10), 38-46.
- Okolocha, C.C. &Nwadiani, C.O. (2015). Assessment of utilization of ICT resources in teaching among tertiary institution Business educators in South Nigeria. *Journal of education and learning*. 4(1), 22-31.
- Onye C.O. and Anyaogu R.O. (2019) *Classroom Management and Organization in the Technological Era*: Owerri Uzopietro Publishing Company
- Onye, C. O., &Anyagou, R.O.E.(2017). *Teaching as a profession in a globalized world*, Supreme publishers Ltd.
- Onye, C. O., &Ajuzie, N. E. (2018). *Fundamentals of teaching/learning Accounts and Economics in a digital age*. Cape publishers Ltd.
- Shah, I. & Khan, M. (2015). *Impact of multimedia aided teaching on students' academic achievement and attitude at elementary level*. *US-China Education Review* 5(5), 349 – 360.

Digitalization of Special Education: A Rebranding Dynamics Towards Sustainable Development in Nigeria

Maurice Ejike Njoku¹,
Laurence Chigbo Ohaeri²

¹Department of Educational Foundations and Administration, Alvan Ikoku Federal University of Education, Nigeria

²Department of Social Studies, Alvan Ikoku Federal University of Education, Nigeria

Abstract

The aim of this paper is to explore the need for digitalization in advancing special needs education towards a sustainable inclusive education in Nigeria. To facilitate inclusive education, the Nigerian government in her national policy on education made education compulsory and a right to every Nigerian including the special needs children and also developed the Nigerian National Policy on Special Needs Education with the aim of facilitating global best practices in special needs education, reducing the incidence of negative labeling (name-calling), discrimination and bullying against special need children. This study reveals that paucity of the application of digital technology in the educational system has been a hindrance to special need children from being properly educated. This situation has made the Nigerian strive towards sustainable inclusive education a mirage hence the need to rebrand the special needs education through digitalization. The researcher went on to reveal the necessary digital technologies for teaching and learning for the special needs. The researchers concluded that if special needs education in Nigeria is digitalized no impairment of any kind shall prevent any child from receiving general quality education like every other child. The researchers hence recommended that federal government should express active will to improve on special needs education by increasing the budgetary allocation to special needs education for the procurement of the digital technologies needed by the special needs learners. Also, educational curriculum planners as a matter of urgency should revise the special needs teachers' education curriculum to integrate the study of the application of the various digital technologies in teaching and learning for the special needs students.

Key words: Special Needs Education, Digitalization, Rebranding

1.0 Introduction

Over the years, the issue of sustainable inclusive education has become one of the most topical trends among scholars worldwide. This is sequel to the global recognition of education as an instrument for sustainable national development. Consequently, Nigeria in her national policy on education (NPE) section 1(3); paragraph D made education compulsory and a right to every Nigerian irrespective of gender, social status, color, religion, ethnic background or any peculiar individual challenges (FRN, 2013). In other words, all Nigerian children must be educated including those classified as special need children. However, paucity of teachers and

the application of digital technology in the educational system according to Oluyimide and Adeyemi, (2023) have hindered many special need children from being gainfully educated. This situation has made the Nigerian strive towards sustainable inclusive education a mirage. Ngwoke, Aneke and Ibiam (2019) defined special needs children as children with impairments or developmental challenge such as the visually impaired, hearing impaired, autistics, physically, emotionally, and psychologically impaired as well as children with special abilities known as the gifted or talented who may find normal classroom activities boring, not challenging enough or even discouraging.

Due to their peculiarities, the special need children find it very difficult to learn in a normal classroom setting hence, they require special attention, special teaching methods and strategies and special learning environment and learning materials without which such children will be left out. It is this circumstance that gave rise to special needs education. Special needs education is the kind of education fashioned for the special needs children. Apart from the fact that special needs children need specialized approaches to teaching and learning they are also discriminated against and bullied by other children in a normal school system. These factors discourage special need children from participating fully in the normal educational system as a result many of them have dropped out of school. In a bid to ameliorate the situation, the federal government of Nigeria in the year 2015 developed the Nigerian National Policy on Special Needs Education with the aim of facilitating global best practices in special needs education in Nigeria by ensuring the promotion of integrated special needs education that is school-bound, home-bound, and hospital-bound. The policy is also geared towards reducing the incidence of negative labeling (name-calling), discrimination and bullying against special need children. The other objectives of the policy are: protection of the learning rights of all Nigerian children including the disabled, reduction of drop-out syndrome among special need children and early detection of disability in children and quality data collection on special need children for their proper placement and education (NPSNE, 2015).

Although the national policy on Special Needs Education has made some progress in promoting special needs education in the country especially in the areas of awareness creation, training of special needs teachers and establishment of special need schools, there are evidences showing that the objectives of the Nigerian special needs education are yet to be optimally attained. This is majorly as a result of low funding of this aspect of education leading to shortage of teachers, learning infrastructure and instructional materials. Oluyimide and Adeleke (2021) reported a huge shortage of school resources in special needs schools in Nigeria and more worrisome is the shortage of technological learning materials such as computer gadgets and computer software. Teaching special needs

without specialized digital technological materials can be more frustrating than the disabilities they are living with. As a result of this, most of the special need children have been frustrated out of the schools. The need for specialized digital teaching and learning gadgets for special needs students therefore cannot be over emphasized. Cumming and Draper (2017) averred that integrating digital tools and software applications in teaching special need students can greatly enhance their learning achievements at different learning levels. In corroboration, Cheng and Lai (2019) in a research revealed that it is crucial for educators to Identify and make provisions for appropriate and effective computer systems and applications for all kinds of disabilities at various school ages. This is because such can help the teacher to be able to identify and cater for the need of different types disabled in the class so as to enhance their participation, inclusiveness and over all learning achievement. In an earlier research, Isah (2010) found that inclusive education in Nigeria can only be possible through the provision of specialized digital facilities to sustain and enhance the interest of special needs children. Inclusive education here simply means the full accommodation of all kinds of learners including the special need students in the normal educational system. The purpose of this paper is to explore the need for digitalization in advancing special needs education towards a sustainable inclusive education in Nigeria.

1.1 Special Need Education in Nigeria: Conceptual Clarification.

The concept of special need education has been defined in various ways by different authors. However, the central theme of all definitions of the term is specialized learning experience and learning support services intended for learners with special learning needs that require specialized teaching methods, instructional facilities and materials. Rasheed (2014) defined special needs education as a specialized education designed for those children who need special methods, instructions and learning resources to be able to learn. UNESCO (2017) defined special need education as an educational system designed for learners with impairments

requiring additional support to learn. Similarly, the Nigerian national policy on education projected special need education as a customized educational program designed to meet the unique learning needs of special needs persons which the mainstream or general education system cannot cater for (FRN, 2013). This document went further to categorize special needs persons as the visual impaired such as the blind and the partially sighted; the hearing impaired such as the deaf and partially hearing; the speech and language impaired/ disorder; those with physical or health impairment such as mobility, sensory or chronic health disorder; those with emotional or behavioral disorder such as Attention Deficit Hyperactive Disorder (ADHD), anxiety or chronic depression; those with learning disabilities such as psychological or neurological phobia; intellectual or cognitive disorder such as autism or down syndrome which could be mild, moderate, severe or profound; those with multiple disabilities; the gifted or talented and those with albinism (FRN, 2013). Each of these cases has their unique learning needs. Hence, the learning needs of one case differs from the others and totally different from those of the persons living without any of the impairments. Thus, children with special learning needs do not belong in mainstream schools or general education system.

Special needs education is designed as an inclusive and supportive learning program to accommodate individual differences, encourage participation and full engagement of the special needs learners. The main purpose for this is to empower such individuals to pursue their personal aspirations, reach their full potentials, live a fulfilled life and contribute effectively to the growth and development of their immediate environment and the society at large. It is this overriding importance of this aspect of education that has earned it an important attention in the history of Nigerian education.

The history of special needs education in Nigeria can be traced back to the pre colonial and pre western education era. Before the coming of the Whiteman with the western education to Nigeria, the traditional Nigerian societies recognized and supported individuals with impairments by training them in one craft or the other as well as involving them in musicals and other forms of entertainment.

During the early missionary and colonial education era, between 1914 and 1960 when Nigeria had her independence, special needs education was not real cognizance. The first official recognition of special needs education was in 1977 when the first national policy on education recognized special education as an integral part of the Nigerian educational system. However, there were no clear definitions and categories for special needs in the policy, though it gave rise to the establishment of special schools such as the School for the deaf in Kaduna and the National Commission for Special Education established in 1988. It was the 1990 NPE and the 1997 National Special Education Policy that made more emphasis and clearer framework for the special education program. These policies gave rise to awareness and advocacies supporting special needs education. This awareness gained momentum with the 2013 Universal Basic Education Act which made provisions for the integration of special needs children into the mainstream schools. In 2015, the Nigerian National Policy on Special Needs Education was developed with the objectives of reducing the incidence of negative labeling (name-calling), discrimination and bullying against special need children, protection of the learning rights of all Nigerian children including the disabled, reduction of drop-out syndrome among special need children and early detection of disability in children and quality data collection on special need children for their proper placement and education (NPSNE, 2015). Ever since this policy was made, there has been a rapid increase in the awareness, access and enrolment of special needs children into special needs educational institutions. Falodun (2023) in his research reported that since the formulation of the Nigerian National Policy on Special Needs Education, over 50% of autistic children in Nigeria have gained access to quality training and education. Also, the number of visual, hearing and speech impaired students on our campuses pursuing higher education has been on the rise. Furthermore, there has been an increase in the number of established private special needs educational centers which are making efforts in delivering excellent educational services for special needs students.

Despite this development, the special needs education in Nigeria is still far from attaining the

lofty objectives of the Nigerian National Policy on Special Needs Education. As earlier stated, this is majorly as a result of lack of digital instructional technologies suitable for teaching and learning for the special needs students making inclusive education unrealistic in the country. There is therefore an urgent need to rebrand the special need education system in Nigeria through digitalization if inclusive education must be realized and sustained. Rebranding the Special Needs Education in Nigeria Through Digitalization

The concept of rebranding depicts change. A popular saying goes thus a process repeated yields same result. If one must get a better result, change in method is necessary. Thus change is inevitable and constant in all facets of existence, education inclusive (Emah, 2022). The term rebranding is often used by entrepreneurs and manufacturers to portray change in outlook, value, content, appearance or an improvement. It is a strategy to give their products a new identification to attract prospective customers. This is often done based on the preferences or complains (feedback) from their customers. It could also be prompted by the need to align with global best practices. To rebrand special need education in Nigeria is to fill the lacuna in the system caused by lack of digital instructional materials suitable to meet the learning needs of the special needs students. In other words, digitalization of special needs education is necessary for the rebranding of this educational system.

Digitalization simply put, is the application or the integration of digital computer technology in a system. It is a shift from manual activity to technology-assisted operations. Digitalization of special needs education can therefore be said to mean the integration of digital computer technology tools in the teaching and learning programs of the special needs to enhance their learning experience. It is the act of bringing information and computer-age technology into classrooms to assist special needs students to learn. It can also mean leveraging innovative digital tools and platforms to cater for the diverse learning needs of students with disabilities by providing them with personalized learning experiences to enhance their academic, social, and emotional development. It is the

phenomenon of moving educational structure and lesson delivery from brick and mortar classroom to digital space and from lecture notes to digital technologies like iPods, iPads, tablets, smart phones, among others which makes learning innovative and engaging (Gambari, 2021).

To teach special needs without such technologies has proved to be a difficult task for both teachers and learners. Riden, Markelz and Randolph (2019) averred that it is a real struggle for special education teachers to handle special needs classrooms management. Hence, a paradigm shift towards digital technological solutions is necessary to assist in promoting positive classroom environments. This is because, the application of digital technological tools will compensate for learning deficiencies caused by impairment. Furthermore, application of digital technology in special education classroom management can offer a wide range of academic benefits such as improved student engagement and motivation to learn, increased accessibility to special education and flexibility of teaching and learning approaches. It also enhances personalized learning experiences, improved assessment and feedback, improves learning outcomes, increased efficiency and effectiveness in administrative tasks as well as ensures better data-driven decision-making to mention but a few. Aurini, McLevey, Stokes and Gorbet (2017) in their study revealed that the integration of digital technology in special education can encourage learners' collaboration, communication, and problem-solving as well as help in reducing behavioral issues and supporting positive student interactions and full participation. With this development, inclusive education for special needs learners will be guaranteed and sustained.

Inclusive education is the accommodation of all children in the regular educational system. It is defined by Ozoji, Unachukwu and Okolo (2016) as any educational system that provides functional and effective teaching and learning for all learners within the common or normal school setting. Making provision for the education of all children here depicts absence of segregation against any child. It is an open educational system accessible to all children with no consideration to their physical or mental conditions. It means accommodating both

normally developing children and those living with impairment or disabilities also known as special needs children in the same educational environment. In this circumstance, the special needs children are already disadvantaged compared to the normal children hence the special needs require special attention and special technologies if their inclusion must be meaningful and sustainable. Alnahdi and Abdulaziz, (2014) posited that non application of digital devices and tools in teaching students with disabilities to help them facilitate and maximize their educational and academic gains can deny them the opportunities to reach their maximum potentials. This according to the authors is because digital technology has the potential to ensure quality classroom participation for students with disabilities as it makes them more confident to undertake some tasks that can be done easily using digital assistive technology.

Digital assistive technology is described as any tool or gadget created, modified, or customized to attract, increase, maintain, or improve the interest and functional capability for people with disabilities (Dell, Newton and Petroff, 2012; Alnahdi and Abdulaziz, 2014). The main function of assistive devices is to help special needs learners to bypass their learning weaknesses. Assistive technologies for special needs ranges from physical products such as wheelchairs, glasses, prosthetic limbs, white canes, and hearing aids to digital techs. However, the focus of this work is on the digital technology for special needs.

1.4 Types of Digital Assistive Technology (DAT) for the Special Needs

Digital Assistive technology comes in varieties. One example is an embossing machine that can produce hard copies of information in Braille. DAT are also built into phones, iPods, laptops and other daily living gadgets. Types of DAT include the following

1.6 Virtual Reality, Augmented Reality and Video Conferencing Technology

These are online learning environment defined by Njoku, Aneshie-Otakpa and Nwoko (2023) as a type of web-based meeting and learning environment software program that uses the

internet to enhance the management of education. It is a learners' on line meeting point. These technologies can assist autistic learners who are claustrophobic in dealing with crowds, such as hallways, school assemblies, and the cafeteria. When they get used to encountering these scenarios in a nonthreatening virtual environment, they will gradually learn to respond calmly and appropriately to such a crowd in real-life. Virtual reality also gives students who have physical disabilities that render them immobile to access classroom learning from their home, hospital or anywhere so long as there is accessible internet connectivity. This technology also includes cloud based platforms that provide users with platforms to plan, organize, save, and retrieve information electronically via the internet. Examples of these digital tools are Skype, Zoom, Google Meet, Google classroom, WhatsApp forum and Microsoft Teams, and so on.

1.3 Tablets/Handheld Touchscreen Computers and Interactive Boards

These are portable digital technologies used for visual learning, reading, drawing and videos streaming. They can help students with motor impairments improve their coordination and those with reading disabilities comprehend written information via text-to-speech apps. Also the visual, speech and hearing impaired as well as the autistic learners can respond, communicate and learn easily with these devices. Examples are Smart Notebook, FaceTime, Google Jamboard, VoiceOver/ blind assist, Activeinspire, etc.

1.5 Text-To-Speech Technology

This is a software technology that translates or converts written or imputed text to spoken words or audio speech. It can serve as a useful learning tool for special needs learners having difficulty reading written texts due to dyslexia, visual impairment, or some other learning disabilities. Students who struggle with decoding, prefer to listen to audio hence, when the lessons are read aloud they benefit in terms of word recognition, spelling, comprehension and reading fluency (Stodden, Roberts, Takahishi, Park, & Stodden,

2012). Also students with speech impairment can use text-to-speech to communicate by encoding the information they wish to relay in a text form which is then converted to spoken words. Examples of text-to-speech apps include: LiveScribe smart pens, Kurzweil 3000, Immersive Reader, NOVA Chat talkback, Speak It Voice Dream Reader, Claro Reader or NaturalReader and BookShare /audio books, Libby by Overdrive, Hoopla, Librivox, Google Playbooks, Storytel and so on.
 Dictation Technology (Speech-to-text) and

1.7 Voice Recognition Software

These are digital learning tools that transcribe speech into written texts. They can assist students with motor skill impairments that prevent them from using a typewriter, keyboard or pen to write. With this, the special needs learner can take note during a lesson as well as complete a writing task. Examples include – XpressLab, DynaVox xPress, Siri, Dragon NaturallySpeaking, Alexa, MangoMon, Google Assistant, WordQ, and Read 180.

Talking Calculators and Electronic Math Worksheets: Talking calculator such as MathTalk is an electronic device with an inbuilt speech synthesizer that reads aloud each number, symbol, or operation key clicked by a user. It also vocalizes the answers to mathematical equation keyed in by the user while the Electronic math worksheets like Math Trek 1,2,3 are software programs that can help students organize, align, and work through math problems on a computer screen. Numbers that appear onscreen can also be read aloud via a speech synthesizer. These technologies are beneficial to students with dyscalculia and those with visual impairment in the sense that the auditory feedback of these technologies assists them in checking the accuracy of the keys they pressed and verify the answers they got in their mathematical tasks. They may also be of help to students who have trouble aligning math problems with pencil and paper. In addition, Amiripour, Bijan-zadeh, Pezeshki, and Najafi (2011) found that the use of these mathematical technologies promote motivation and interest in mathematics and the addition and subtraction skills of students with dyscalculia.

There are many other digital technologies that can be integrated in the education of special needs which could not be captured here due limited time and space. These technologies have been fully integrated in special needs education in most developed countries like Canada, USA, UK, and many others. As a result, these countries are enjoying the full benefits of sustained inclusive educational development. Their disabled citizens are fully integrated into the society and contributing to the development of their country. With that, they have proved that there is always ability in disability.

To rebrand special needs education in Nigeria using digital technology some actions need to be taken. Firstly, teachers must be trained to become familiar with digital assistive technology and how to meaningfully integrate them into teaching and learning to support an inclusive education (Dell, Newton & Petroff, 2012; Batorowicz, Missiuanan & Pollock, 2012; Okolo & Diedrich, 2014). Furthermore, the government must increase funding of the educational sector for the procurement of the necessary technological infrastructures, digital gadgets, wares and tools for teaching and learning of the special needs.

2.0 Summary, Conclusion and Recommendations

So far, it has been established that with the rebranding of special need education via digitalization of this aspect of education in Nigeria, no learning impairment of any kind shall prevent any child from receiving general education like every other child. Hence, digitalization of special needs education is a sure rebranding paradigm for sustainable inclusive education in Nigeria. In other words, lumping special needs learners in a normal school along with healthy children without making provisions and application of digital learning technologies in teaching and learning of the special needs children to make up for their disabilities makes the idea of inclusive education a meaningless and unsustainable venture.

Recommendations

Having stressed the need and means to rebrand special needs education in Nigeria via the instruments of digitalization towards sustainable

inclusive education in the country, the researchers recommend as follows.

The federal government of Nigeria should express active will to improve on special needs education by increasing the budgetary allocation to special needs education for the procurement of the digital technologies needed by the special needs learners.

The educational curriculum planners as a matter of urgency should revise the special needs teachers' education curriculum to integrate the study of the application of the various digital technologies in teaching and learning for the special needs students.

References

- Alnahdi, G. & Abdulaziz, S. B. (2014) Assistive technology in special education and the universal design for learning. *The Turkish online journal of educational technology*. 13(2); 18-23.
- Amiripour, P., Bijan-zadeh, M. H., Pezeshki, P., & Najafi, M. (2011). Effects of assistive technology instruction on increasing motivation and capacity of mathematical problem solving in dyscalculia student. *Educational Research*, 2(10); 1611-1618.
- Aurini, J., McLevey, J., Stokes, A. & Gorbet, R. (2017). Classroom robotics and acquisition of 21st century competencies: An action research study of nine Ontario school boards. Ontario Council of Education. Retrieved on 15th july, 2024 from https://www.ontariodirectors.ca/CODErob/Robotics_Final_Report_Sept_22_2017.pdf Google Scholar
- Cheng, S. C. & Lai, C. L. (2019). Facilitating learning for students with special needs: A review of technology-supported special education studies. *Journal of computer education*. 7(8); 123 – 145.
- Cumming, T. M., & Draper R. C. (2017). A meta-analysis of mobile technology supporting individuals with disabilities. *The journal of special education*, 51(3), 164–176.
- Dell, A., Newton, D., & Petroff, J. (2012). *Assistive technology in the classroom: Enhancing the school experiences of students with disabilities*. Boston, MA: Pearson Publishers.
- Emah, S. S. (2022). *Modern teaching approach: A new approach to lesson planning and delivery for teachers in Nigeria*. A paper presented on the occasion of Capacity Building Series organized by Faculty of Education, Prince Abubakar Audu University, Anyigba, Kogi State.
- Falodun, K. (2023). How parents and teachers empower Nigeria's special needs children. Retrieved on 10/06/24 from <https://www.aljazeera.com/features/2021/7/29/how-parents-and-teachers-empower-nigerias-special-needs-children>
- Federal Republic of Nigeria (2013). (6thed.). *National Policy on Education*. Yaba, Lagos: Education Research and Development Council Press.
- Gambari, A. I. (2021). *Educational technology: Nexus for 21st Century education and beyond*. Inaugural lecture series 84. Federal University of Technology, Minna. June 23, 2021.
- Isah, M. S. (2010). The possibility of implementing inclusive education in Nigeria. *Journal of contemporary research*. 7(3); 27-34.

- National Policy on Special Needs Education. (2015). National Policy on Special Needs Education in Nigeria. Federal Ministry of Education. Retrieved on 14/07/24 from <http://www.rodra.co.za/images/countries/nigeria/policy/National%20Policy%20on%20Special%20Needs%20Education.pdf>.
- Ngwoke A.N, Aneke, A.O & Ibiam J. U. (2019), Inclusive education and learning difficulties among special needs children in Nigeria: The case of the visually impaired. *Journal of the Nigerian academy of education*. 15(1); 118-130.
- Njoku, M. E. Aneshie-Otakpa, V. O. & Nwoko, O. U. (2023). Virtual teaching and learning in the post COVID 19 era: the readiness and attitude of Nigerian University lecturers. *Annual Book of Reading of the Philosophers of Education Association of Nigeria (PEAN)*. Port Harcourt Nigeria: Timsmecc Global Publishers.
- Oluyimide, I., & Adeleke, A. (2021). The influence of school resources on learning outcomes (Affective Skills' Development) of pupils in Special schools in Osun State, Nigeria. Retrieved on 14/06/2024 from <http://www.scirj.org/sep-2020paper.php?rp=P0920806>.
- Oluyimide, I. S. & Adeyemi, B. A. (2023). Nigerian special needs education in the 21st century: a reality or mirage? *International journal of contemporary issues in education*. 5(1); 185-192.
- Ozaji, E. D., Unachukwu, G. C. & Okolo, I. A. (2016). *Modern trends and practices in special education*. Lagos: Foremost education service limited.
- Rasheed, A. (2014). Inclusive Education in Nigeria: A Myth or Reality? *Creative Education*, 05 1777–1781. Retrieved on 10/06/224 from <https://doi.org/10.4236/ce.2014.520198>.
- Riden , B. S., Markelz, A. M. & Randolph, K. M. (2019). Technology in action creating positive classroom environments with electronic behavior management programs. *Journal of special education technology*. 34(2) 133-141.
- Stodden, R. A., Roberts, K. D., Takahishi, K., Park, H. J., & Stodden, N. J. (2012). The use of text-to-speech software to improve reading skills of high school struggling readers. *Procedia Computer Science*. 14(1); 359-362.
- UNESCO. (2017). *A guide for ensuring inclusion and equity in education*. Paris: UNESCO. Retrieved on 10/ 07/ 2024 from: <http://unesdoc.unesco.org/images/0024/002482/248254e.pdf>

Exploring The Impact Of ‘Innovation Labs’ in Fostering creative work Engagement and innovation among students in Secondary schools in Njaba LGA, Imo state

Ngozi J. Izuagba¹,
Chika F. Ahamefula²,
Mary Chioma blessing³

^{1,2,3} Faculty of Education, Alvan Ikoku Federal University of Education, Nigeria

Abstract

The study is a descriptive survey research which sought to explore the impact of Innovation Labs in fostering creative work engagement and innovation among students of secondary school students in Njaba LGA of Imo State. The population of the study was made up of all the teachers in the secondary schools in the LGA totalling 1,860. Simple random sampling technique was adopted to draw a sample size of 224 teachers as respondents. Four Research Questions guided the study. The instrument used for data collection was a Questionnaire titled ‘impact of Innovation Labs in fostering creativity and innovative skills among secondary school students. The instrument was structured in line with the Research Questions and was validated by three experts in Educational measurement and Evaluation from Alvan Ikoku Federal University of Education, Owerri. The test re-test reliability co-efficient stood at 0.89 using the Cronbach alpha method. The mean statistic was used for data analyses. The findings of the study showed that, there are areas provided as Innovation Labs in the schools; Innovation Labs impact tremendously on the students’ creative and innovative engagements especially in problem solving, cross fertilization of ideas as well as enthusiasm to learn; The findings also revealed inadequacies in the provision of technological tools and materials as well as retinue of possibilities to improve the implementation of Innovation Labs in the schools. It was recommended that teachers should live up to their responsibilities in fostering creative and innovative skills of students; adequate technological tools and materials should be provided to fix the Innovation Labs while teachers should be subjected to workshops and seminars on proper implementation of Innovation Labs in schools.

Keywords: Exploring, “Innovation Labs”, creative work engagement, innovation, technological tools.

1.0 Introduction

The power of “Innovation Labs” in creating opportunities for students to gain broader understanding and skills through hands-on learning, can be a key ingredient for a successful and rewarding experience in the present digital age. Nnabuo (2022) was of the view that, in the present digital society with increasing need for intellectual and vocational specialization, practical skills have become the catalyst in empowering students to progress from cluelessness, skill deficiency and poor performance to skill acquisition and success.

Innovation Labs are consciously mapped out work spaces where students can gather and collaborate to create, experiment, invent and learn as they engage with a variety of technological tools and materials. It is a multidisciplinary facility intended for students to share ideas, explore and interact using relevant tools and materials provided for problem solving. Creating spaces for students to collaborate and compliment their traditional classroom experience is a natural avenue to promote creativity, critical thinking and innovation. Cheun-YeongLee, Li-Wei and Klemm (2022)

are of the view that students who tend to struggle to demonstrate their creative skill in a way that appeals to them resort to the Innovation Labs as way out.

The theoretical view of the Innovation Labs concept originated during the global new Economic era when maker movement became a new boost for global industrial revolution in technology and innovative learning. The inventor of maker space theory, Anderson (2012) as reviewed by PEI YING (2018) propounded a combination theory by digital manufacturing and personal manufacturing actions which led to the creation of the maker movement as an important driver of the economic and social transformation. The maker movement became a global revolution with far reaching impact on education. This led to the construction of Innovation Labs by government in various countries as effective ways to promote education reforms and cultivate students' creativity and practical skills. Students not only gained the opportunity to discover problems, analyze problems and solve problems but also made it easier to maintain the passion of learning and enhance the confidence in learning. Indeed the awareness of maker space has become obvious for students to share ideas, information and to conduct, cooperate and create activities.

In a study conducted by Bevan and Wilkinson (2015), it was discovered that while a student was tinkering with recycled objects to make a contraption float in a wind tunnel and was struggling in her design, another student joined her in the maker space and they collaboratively made an contraption. They discovered that it was too heavy to float until they made adjustments. Similarly Quinn & Bell (2013) noted that Innovation Labs create opportunity to develop unconventional practical skills as precursor to invention and discoveries. The scholars further noted that hands-on-learning is the foundation for any meaningful learning and

any school that aspires for quality learning and output of students should encourage a strong skill-based learning for qualitative education.

In support of the fore-going, the Federal Government of Nigeria through the National Policy on Education (2014) emphasized on the importance of hands-on-techniques- based learning as a condition for solid foundation for work after school. In other words Innovation Labs are strategies of teaching and learning that promote critical thinking, problem solving and discovery learning which revolve around the learner and his experiences. No wonder Millar (2015) noted that Innovation Labs diversify the range of learning styles among learners as they develop initiative by applying ideas from hands-on learning to solve problems. The scholar noted that, while some students learn by mere listening to the teachers' instructions, others learn through writing, picture and image reading, hands-on techniques as well as collaboration.

In their contribution, Sousa and Plecki (2013) noted that incorporating Innovation Labs to the traditional teaching and learning methods provides for adult lives as students develop the grid for innovation through face to face concrete experiences on materials that enrich learning. In support of the foregoing, the Texas Wesleyan University Report (2024) noted that Innovation Labs in schools are critical avenues to analyze students differentiated learning styles and to develop experiential learning as students fiddle with materials. The above view is further corroborated by Laura and Krakower (2016) ; Izuagba (2016) and Dousay (2017) respectively in their separate contributions that Innovation Labs constitute informal structure with particular attention on a truly personal, intrinsic endeavour by disconnecting from most formal expectations as pathways to future personal responsibility.

Nnabuo (2022); Usoro, Kalu and Igbundu (2024) Oshebor and Justice-Amadi (2024) and Wobo and Amadi (2024) also share similar view that

practical skill is at the centre of the current pedagogical practices as stool to navigate the 21st century digital world. In a study conducted by Bevan and Wikinson (2015) on the role of Innovation Labs on students work creativity, it was discovered that relevant materials in Innovation Labs helped students to solve problems and allowed for cross fertilization of ideas on creativity and imaginations. It was further affirmed that Innovation Labs facilitate enthusiasm to think outside the box and to promote critical thinking. The Innovation Labs however, should be centrally located and made accessible for students' use with relevant tools and technological devices and equipment that boost creativity and critical thinking.

A classroom teacher can dedicate a corner space or table, stocked with creative materials and technological tools for students to use during free periods and study periods to create projects and ideas based on their interests and needs. A school Administrator can dedicate a location, room or space in the school library as "Innovation Labs". According to the Water-Ford Organization Report (2013) an ideal maker space should be equipped with computers, 3D printers for digital experience , scanners, electronic kits, wood work tools, architectural tools, art and graphic materials, robotics, measuring tapes, decoration materials, home devices, vehicle parts, cardboard sheets and writing materials. Though the students are to make use of the above provided materials to make out ideas, efforts should be made by the teachers to set up guiding rules for operation as well as providing guidance and support to the students especially when they are at 'cross roads'.

A very significant aspect of the concept is that the teacher is readily available to encourage collaboration and inclusivity so that interested students are carried along in the scheme of things.

Unfortunately, the opportunity to foster creativity and innovation seems to be lacking in our secondary schools, as most students complete their secondary education without relevant skills to adjust in the wider society. This has been attributed to lack or inadequate provision for innovation labs in our schools. It is against this backdrop the study seeks to explore the impact of innovation labs in fostering creative work engagement and innovation among secondary school students in Njaba Local Government Area in Imo State.

2.0 Statement of Problem

Too many Nigerians are unhappy with the quality of education provided to the citizens. They are particularly disgusted due to their expectation that education is capable of impacting on national productively and development through training in skills, creativity and innovation for students who are looked upon as the life wire of the society. This notion is further justified on the grounds that, there is a strong connection between education and level of skill formation to navigate the contemporary digital age. Learners need to be provided with the opportunity to create, innovate, design and come up with ideas to achieve and maximise their quality of lives and the educational investments.

2.1 Purpose of the Study

The purpose of the study is to explore the impact of innovation labs in fostering creative work engagement and innovation among secondary school students in Njaba L.G.A of Imo State. Specifically, the study aims to ascertain;

- Whether there are innovation labs for students' creativity in the schools.
- Whether there are impacts of the innovation labs on students' creativity in the schools.
- Whether there are resources provided for the innovation labs in the schools.
- Whether there are options to improve innovation labs in the schools.

Questions:

- i. What spaces are provided in the secondary school as "Innovation Labs" for student' creative engagement?
- ii. What impact do Innovation Labs have on fostering creativity on the students?
- iii. What are the resources provided for Innovation Labs apart from funds in the school?
- iv. How can Innovation Labs be improved in the school

2.2 Methodology

The study adopted the descriptive survey research design to gather relevant information from Secondary school teachers. The population of the study was made up of all the teachers of public secondary school in Njaba LGA of Imo State totalling 1,860 teachers. (SEMB, 2024)

A representative sample size of 240 teachers approximately 12% of the total population were drawn using simple random and proportionate sampling techniques. However, only 224 completed questionnaires were retrieved and used for the study. The instrument for data collection was a structured questionnaire titled "Impact of "Innovation Labs" for creativity and innovation among secondary school students (IICI). The questionnaire was structured in a Likert scale format and based on the research question.

The questionnaire was adequately validated by three experts in Measurement and Evaluation and the reliability index 0.89. The questionnaire was administered online for distance distant respondents and physically using four research assistants. Data from the respondent were collected on completion. Mean and grand mean scores were adopted to derive answers for the research questions. The average mean (Bench March) of 2.50 and above was adjusted as accepted while mean scores below 2.50 were rejected as positive responses

.

2.3 Results:

Question 1: *What areas are provided in the secondary school for “Innovation Labs” for students’ creative engagement?*

Table 1: *Mean, Standard Deviation and responses on Areas provided in the schools for Innovation Labs for students’ creative engagement.*

SN	Research Question 1. Areas provided	X	SD	Decision
1	Teachers create specific corners as Innovation Labs in the classroom	2.42	15.03	Rejected
2	Teachers provide tables as “Innovation Labs”	2.88	15.40	Accepted
3	School heads map out locations as “Innovation Labs”	2.59	15.38	Accepted
4	School library has a corner for maker space	2.82	15.39	Accepted
	Grand Mean	2.68	15.3	Accepted

Source: *Researchers’ Analysis 2024.*

Table 1 shows that from the respondents’ opinion, specific Innovation Labs are not created in the classrooms. Tables were provided as Innovation Labs while school heads mapped out locations and library corners for Innovation Labs in schools. This is evident from the mean responses of the respondents which ranged between 2.42 and 2.88 respectively. From the result above, provision of tables as Innovation Labs recorded more acceptance, followed by the provision of library corners and mapping out locations in the school premises as “Innovation Labs”.

Question (ii): *What impact do Innovation Labs have on fostering creativity and innovation on students?*

Table 2. *Mean, Standard Deviation and responses on impact of Innovation Labs on fostering creativity and innovation on the students.*

SN	Research Question 2. Impact of Innovation Labs on the students	X	SD	Decision
1	Innovation Labs help students to solve problems.	3.18	16.06	Accepted
2	Innovation Labs facilitate cross fertilization of ideas among students.	3.11	16.07	Accepted
3	Innovation Labs enhance enthusiasm to learn.	2.81	15.38	Accepted
4	Innovation Labs engage students who are disengaged with traditional teaching methods.	2.82	15.38	Accepted
	Grand mean	2.98	15.72	Accepted

Source: Researchers' Analysis 2024.

Table 2 above shows that all the items recorded means are above the average mean of 2.50. The above responses therefore, show that Innovation Labs help students to solve problems, facilitate cross fertilization of ideas, enhance enthusiasm to learning as well as engage students who are apparently disengaged with traditional classroom learning.

Question (iii): What are the resources provided for Innovation Labs apart from funds?

Table 3. Mean, Standard Deviation and responses on resources provided for innovation labs, apart from funds.

SN	Research Question 3. Resources provided, apart from funds	X	SD	Decision
1	Computer technology tools	2.43	15.36	Rejected
2	Graphic and Arts materials	2.73	15.37	Accepted
3	Electrical materials	2.48	15.00	Rejected
4	Robots and animated materials.	2.44	14.00	Rejected
5	Architectural prototypes	3.10	16.01	Accepted
6	Construction papers	2.82	15.39	Accepted
7	Digital facilities	2.46	14.49	Rejected
8	Equipments and kits	3.18	16.06	Accepted
	Grand mean	2.70	15.21	Accepted

Source: Researchers' Analysis 2024.

Table 3 above shows mixed feelings in the provision of resources for Innovation Labs in the schools. While majority of the respondents affirmed that graphics and arts materials, architectural prototypes, construction papers as well as equipment and kits are provided, others were vehement in their responses on lack of computer and technological tools, electrical materials, robots and animated materials as well as digital facilities.

Question (iv): *How can Innovation Labs be improved in the secondary schools in Njaba LGA?*

Table 4. Mean, Standard Deviation and responses on how Innovation Labs could be improved.

SN	Research Question 4. Possible ways of improving innovation labs in the schools	X	SD	Decision
1	Creating Innovation Labs in every classroom	2.76	15.39	Accepted
2	Providing current technological tools for “Innovation Labs”	3.16	16.06	Accepted
3	Encouraging students to have self direction	2.85	15.39	Accepted
4	Supporting inclusivity in the use of “Innovation Labs”	2.75	15.38	Accepted
	Grand mean	2.88	15.55	Accepted

Source: Researchers’ Analysis 2024.

Table 4 above shows that all the items weighed mean scores are above the average mean which indicate the possible ways to enhance the adoption of Innovation Labs in the secondary schools. Specifically, the respondents were of the opinion that Innovation Labs need to be created in the classroom corners, current technological tools to be provided, students to be encouraged to collaborate and exercise self direction as well as encouraging inclusive participation in the “Innovation Labs”.

3.0 Summary, Conclusion and Recommendations

The findings from Research Question 1 revealed that Teachers do not create specific corners in the classroom for Innovation Labs where students can operate during their free periods and study hours. It is unfortunate that teachers do not appreciate the need to create Innovation Labs in the classrooms for students to explore their ingenuity and creative skills. What this means is that, the students are missing out on

opportunities to engage hands-on learning and creative experiences that can enhance their problem-solving skills and innovation capabilities.

This finding agrees with Quinn and Bell (2013) who noted that Innovation Labs are opportunities for students to develop

unconventional practical skills as precursor to inventions and discoveries. It is however, interesting to note from the findings that, tables are provided while school administrators do map out locations including library corners as Innovation Labs for students to operate.

The findings from Research Question 2 revealed that Innovation Labs impact positively on the creativity of the learners, especially in helping the students to solve problems, facilitating cross fertilization of ideas and collaboration, enhancing enthusiasm to learn as well as engaging students who seem disengaged with the traditional classroom learning. This finding agrees with Laura and Krakower (2016) and Dousay (2017) respectively who share similar

view that Innovation Labs are informal structure with particular attention to truly personal intrinsic endeavour by disconnecting from most formal expectations as pathways to future personal responsibilities. It is heart warming that teachers appreciate the place of Innovation Labs in the schools. This is a step in the right direction to usher in maximal efforts towards facilitation of essential practical skills for creativity in the learners and to limit learners from unproductive activities that can truncate their future prospects. The finding also agrees with Quinn and Bell (2013) who noted that hands- on learning is the foundation of any qualitative education and any school that aspires for quality learning should encourage the development of a strong skill based learning for qualitative education.

The findings from Research Question 3 revealed that facilities and materials including graphic and arts materials, construction papers, equipment and kits were facilities provided for Innovation Labs in the schools under study. It is disheartening to observe that facilities such as computer and technological tools, electrical tools, robots and animated materials, architectural prototypes as well as digital facilities are lacking in the Innovation Labs as affirmed by the respondents. This contradicts the findings of the study conducted by Bevan and Wilkinson (2015) that relevant materials in Innovation Labs helped students to solve problems and allows for cross fertilization of ideas and imaginations. In the same view, the findings agree with the Texas Wesleyan University Report (2024) that Innovation Labs are critical to learning as students fiddle with facilities to obtain differentiated learning styles. It is disheartening also that relevant facilities such as computer and digital tools are not provided in the “Innovation Labs”. Success of the implementation of the Innovation Labs depends heavily on adequate provision of relevant materials and facilities. Students need to be exposed to a variety of facilities to enable them navigate and create ideas.

Lastly, the findings from Research Question 4 revealed that the respondents affirmed that the following activities such as creating Innovation Labs within the classroom corners for students to use during free periods and study hours, providing current technological tools,

encouraging collaboration as well as facilitating inclusivity in the use of Innovation Labs are all germane as strategies to improve Innovation Labs in schools.

Conclusion

Undoubtedly, the findings of the study have shown that Innovation Labs in the schools can be key ingredient for deepening understanding of concepts and hands-on learning for a more rewarding and creative experience. Innovation Labs in school are natural avenue to promote creativity and innovation as students collaborate to create, experiment and learn using a variety of technological tools and materials. It is very unfortunate that the concept has not been adequately operated in the schools due to dearth of facilities and zeal on the part of the teachers and school managers. The poor implementation of the Innovation Labs in the schools has apparently resulted to the major setbacks in the development of creative and innovative skills among the students.

Recommendations

Based on the fore-going, the following recommendations are proffered:

- i. Specific computers should be created in the classroom for innovation labs where students can operate during their free periods and study hours.
- ii. Teachers should sustain the impact of innovation labs by collaborating with the students in problem solving as pathways to future development.
- iii. Innovation Labs should be equipped with relevant technological tools, computers, architectural, prototypes and robots to facilitate innovation ideas among students.
- iv. Teachers should be educated through workshops and seminars on the need to create Innovation Labs for students’ creative and innovative development.

References

- Anderson C. (2012) *Makers: The New Industrial Revolution*. Crown Publishers
- Andrew M (2015) CEO / Founder “Innovation Labs”. “Innovation Labs”.Com-
www.linkedin.com>makerspaces
- Izuagba, N.J., Ahamefula, C.F and Onah, C.M (2024). Managing grieving students. *Annual Conference of the Department of Educational Management*, Faculty of Education, University of Port Harcourt 10 (1) 121-130, 2024.
- Bevan B; Gutwill J.P & Petrich M & Wilkinson (2015) Learning through STEM-Rich Tinkering. Findings from A Jointly Negotiated Research Project. 99(1), 98-120 www.Semanticscholar.Org/Paper.
- Cheun-Yenoglee; Li-Wei P., Klemm, A (2022). *Promoting Innovation Labs in Schools*.
- Dousay, (2017). *Defining and Differentiating The Maker Space*.
- Federal Republic of Nigeria. National Policy on Education (2014) NERDC.
- Ebong, J.M Asodike, J.D & Izuagba, N.J (2016). *Economics of Education: Expository Issues*. Eagle Lithograph Publishers.
- Nnabuo, P.O.M (2022) *Supervision and Productivity in Secondary Education System*. In B.S Okeke & C.N Uwazurike (Eds.) *Introduction to Educational Administration*. Klet-Ken Computers Ltd.
- Laura, D. (2017) Innovation Labs and Equal Access to Learning. www.Edutopia.Org>Blog>Makerspaces
- Oshebor, P.E & Justice – Amadi, S.N (2024). Managing Entrepreneurial Issues in Education for National Reconciliation, Integration and Economic Recovery in Rivers State. *Annual Conference of the Faculty of Education*, University of Portharcourt
- PEI YING, (2018). *The Theoretical Basis and Importance of Maker Education*. School of Business. Malaysia University of Science & Technology, Kuala Lumpur press. 47810
- Quinn, H. & Bell .P. (2013). How Designing, Making and Playing Relate to the Learning Goals of K-A2 Science Education. In M. Honey & D.E Kanter (Eds.) *Design, Make Play* Pp 17-33 Routledge. www.Taylorfrancis.Com/Chapter
- Sousa, A.D & Pilecki T. (2013). *From STEM to STEAM* Corwin. Files. Eric.Ed.Gov, Full Text Us.Corwin.Com/Books/From-Stem...
- Texas Wesleyan University Report (2024). *The Case for “Innovation Labs”*. *Different Learning Styles*. Txwes.Edu/C.Php?
- Usoro, E.E; Kalu E.U.I & Igbundu F.W (2024). Management of Entrepreneurial Issues for National Economy Recovery. *Annual Conference of the Faculty of Education*, University of Portharcourt
- Waterford Organisation Report (2023) Classroom “Innovation Labs”:- Boost Creativity and Critical Thinking Skills. Waterford Org. Press.
- Wobo, A.M & Amadi E.O (2024) Challenges in Pursuit Of Entrepreneurship Education in Tertiary Institutions in Rivers State. *Annual Conference of the Faculty of Education*, University of Portharcourt.

Digital Technology: A means in distance and adult education in Nigeria

Patience C. Ibe¹,
Chioma Unezeh²,
Ibe, Evarest Onyewuchi³

¹Department of Adult and Continuing Education, Alvan Ikoku Federal University of Education, Nigeria

²Department of Educational Psychology and Guidance and Counselling, Alvan Ikoku Federal University of Education, Nigeria

³ Department of Fine and Applied Arts, Nnamdi Azikiwe University, Nigeria

Abstract

This paper examines digital technology as a means in distance education, which is learning from a distance, digital tools and technologies are the means of communication in distance education which bridge the gaps between the tutor and the learners. They are ways of encouraging adults engage in learning. The introduction of the digital technologies in adult education and in distance education in particular, though offers flexibility, simpler access, a wealth of potential multimedia resources, it also poses new challenges to distance education providers in delivery and accessing education. No doubt, the future is digital but can digital tools fix all of adult learning. Using digital tools in learning environments are becoming popular in higher education and professional training; teaching and learning through webinars and web conferencing represents one widely used approach. Webinars are defined as web-based seminars in which participants and facilitators communicate live over the internet across distant geographical locations using shared virtual platforms and interact ubiquitously and synchronously within real-time through voice over IP technology and web camera equipment. This paper looked at the meaning of digital technology, adult education and distance education, importance and challenges of the use of digital tools/technologies in distance education. It went further to describe the modes of distance education, importance of digital technologies and media use in distance education, the challenges and recommendation.

Keywords: Digital technology, adult education, distance education, challenges.

1.0 Introduction

Adult education has numerous branches of which distance education is inclusive. Distance education utilizes digital technologies in facilitating and meeting its objects. They include such media which are used to bridge the gap between learners who are located faraway to

give them some elements of control over time, place, path and pace. Digital learning comprise

of the e-learning resources and media use among adult learners. Globalization has made it necessary for the introduction of some innovations in the educational system to meet the demand of this present century. Although it offers new opportunities to innovate and reach

out to a new generation of adults, yet the use of it in education presents barriers for certain group of learners (Mallows, 2019). The expectations, motivations, lifestyles and experiences of young adult learners are different from those of working aged adults or those adults in 50s. However, the digital tools when and where used effectively can build skills in interactivity, collaboration and critical thinking.

2.0 Conceptual Clarification

• Digital Technology

Digitalization is the process of converting analog information into a digital format. It involves converting information in physical form (paper documents, photographs, film, etc) into digital files that can be stored and processed by computers. Examples of technologies are video conferencing, T.V, internet example WWW (World Wide Web), computer conferencing, skype, zoom, telephone, teleconferencing, whatsapp, satellite conferencing, video charts and so on.

• Digital Technological Tools

These can be software programs or applications utilized through a computer, laptop, cellular phone and other information and communication technology (ICT). They help the teachers in creating, manipulating, using and sharing information over the networks. The reason for digital technological tools is to facilitate learning/education. Thus, digital education is the innovative utilization of digital tools and technologies during teaching and learning. It can come in form of a blog, video, audio file, a real time online lecture/seminar.

• Adult Education

Unesco (2012) defines adult education as the entire body of organized educational process, whatever the content, level or method, whether formal or otherwise, whether they prolong or replace initial education in schools, colleges and universities as well as in apprenticeship whereby persons regarded as adult by the society to which they belong develop their

abilities, enrich their knowledge, improve their technical or professional qualifications or turn them in a new direction and bring about changes in their attitudes or behavior in the twofold perspective of full personal development and participation in balanced and independent social, economic and cultural development.

Adult education is one of the unique professions with the aims and objectives of improving the conditions of the members of the society (Daramola, 2015). Ibe (2023) citing Zuofa, defines adult education as education that encourages individuals to enhance their abilities and potentials through various forms of formal, informal and non-formal education based on their needs which in turn promotes their scopes of facing challenges. Adult education is a practice which adult engage in systematic and sustained self-educating activities in order to gain new forms of knowledge, skills, attitudes or values. It is any form of learning provided for mature men and women outside the formal school system of education.

• Distance Education

Distance education also known as distance learning, is education of students who may not always be physically present at school or where the learner and the teacher are separated from a distance (en.m.Wikipedia.ng)

According to Wael (2024), distance education is a technology-mediated modality and has evolved with the evolution of technologies such as Video conferencing, Television and Internet; today, it usually involves online education and the learning is usually mediated by some form of technology.

Distance learning simply means learning from a distance. Distance learning has been used synonymously with other terms like distributed learning, e-learning, m-learning, online learning, virtual classroom (en.m.Wikipedia.org). It is a learning procedure in which the guide or the instructor and the learner (student) are separated geographically or by physical distance. This means that there is no physical/face to face interaction between the two while teaching and

learning are going on. This physical distance or separation is bridged through online communication.

According to UNESCO-UNIVEC, International Center (2020), distance education refers to teaching and learning that temporarily separates teacher and learner in time and place; uses multiple media for delivery of instruction involves two-way communication and possibly occasional face-to-face meeting for tutorials and learner-learner-interaction. This, there is occasional meeting, aims at removing barriers to access like financial barrier, prior learning barriers, age barrier, social barrier, work barrier, family commitments barrier, disability, incarceration etc.

From the researcher's point of view, Distance education is that branch of adult education which utilizes information and communication technologies as the main means of interaction between the student and the tutor.

2.0 Modes of Distance Education/Modalities for Distance Learning

- Correspondence courses through e-mail. The student corresponds with the school through e-mail.
- Hybrid or blended learning. This is a combination of both online learning and traditional offline classroom instruction.
- Distance learning with complementary virtual environment or teaching in virtual environment.
- Massive open online courses (MOOCs) through World Wide Web (WWW)

2.1 Importance of Digital Technologies and Media Use in Distance Education

- They eliminate barriers to access in learning. This is to say that it offers simpler access.
- They promote and offer flexibility of learning through provision of numerous media of learning and communication or by offering variety of media for instruction. (a wealth of potential multimedia resources)
- They make learners to be active in interactive sections when and where used effectively. Thus, they promote skills in interactivity, collaboration and critical

thinking in asynchronous model of distance education which involves the learner-learner interaction.

- They have helped in achieving the objectives of distance education of which one is to make education reach to the unreached or to educate every citizen.
- They promote self-learning/training in distance education.
- Using digital technology in distance education, the learners learn comfortably at his own pace, time and space.
- They promote fast and easy sharing of information. Digital tools have made sharing of information, knowledge and ideas easier among students, classmates and friends through mobile phones, PCs, laptops, tablets. Students use them in sharing/transmitting opinions, views, tips, study materials, projects etcetera.
- They reduce the effects of isolation in distance education.

2.2 Challenges of the Use of Digital Technologies in Distance Education

Though, digitalization no doubt has brought numerous learning tools and technologies which have significantly changed the way adult education (distance education) is delivered, it is also faced with some challenges. These include:

- i. Problem of connectivity of internet. Non connectivity of internet in most areas is one of the major challenges. This could be as the result of too much fund involved. Without the community/schools in the community linking to the web, ICT tools like computer cannot function in such areas.
- ii. Fear of incompetency by some instructors. Many teachers and other prominent people in the community especially in the rural areas are non ICT compliant and do not want to lose their authority and that feeling of 'know it all' in classroom which has eaten deep inside them. Thus, anything that will rub them of these things is an enemy of the classroom because it will render them irrelevant. Therefore, majority prefer not

introducing computers and other digital means.

- iii. Problem of staff development and cost (for tools and training), Mallows, 2019.
- iv. The rate at which hoodlums/thieves penetrate into ICT rooms and computer laboratories is a problem. Thieves steal computers, televisions, recorders, generators, etcetera from time to time and it is difficult to replace them because they are too expensive especially computers. Again, securing these instruments involves extra expenses for instance to burglar proof the computer room and this therefore makes the centers to shy away from purchasing more computers.
- v. Insufficient power supply. There is problem of lack of electricity connection and power supply in most communities. It is obvious that computer and many other media for internet communication cannot work without electricity. Communities in this category are handicapped and are left behind when it comes to offering computer studies. This becomes a stumbling block to effective use and widespread of ICT for distance learning/education especially in the remote areas.
- vi. Inadequate experienced and qualified teachers. The number of people willing to receive the computer skills outnumbered the available trained instructors to impart the skills demanded. Sometimes, untrained and inexperienced primary and secondary schools teachers in this field are used in the centers. This becomes a problem because there are not enough qualified tutors for such.
- vii. Insufficient computers due to high cost. Computers are too expensive which makes many schools/communities unable to purchase them for the learners. Despite the efforts of Government agencies, Non-governmental Organizations and philanthropists to supply computers to

centers, there are still many that lack computers to teach the learners.

Summary, Conclusion and Recommendations

In Conclusion, the impact of digital technology as a means in distance education cannot be over-emphasized. Thus, ICT will go a long way in improving the scope of Distance Education as well as aid the efforts of the tutors and the objective of the programmes to be effectively implemented and achieved respectively. ICTs ensure fast and free access, convenience and immediate feedback for the tutors and learners. Many areas of Education which have been neglected could be resurrected using effective application of ICT.

Therefore, the local, state and federal Government together with individuals of the communities should encourage the use of ICT in community education which aims at changing the face of the society with positive objectives. The objectives of community education discussed in this work if properly carried out will contribute in every aspect of development – economically, politically, socially, and educationally.

The following suggestions are made based on the challenges discussed above.

- i. The organizers and planners of distance education programme should give maximum emphasis on the use of ICT in distance education by incorporating and emphasizing its importance.
- ii. Conferences, workshops, and seminars should be organized by the community leaders, local and state Government for training and in-service training of instructors/facilitators on the use of ICT for distance education.
- iii. The Government should make policies mandating all providers, facilitators and instructors of distance education to become computer literate and efficient in the use of ICT tools/devices. She can further support this policy by mounting free computer literacy campaign for the above set of people to ensure that they acquire this knowledge and skills.
- iv. The Government should enforce adequate funding of distance education

- in order to motivate distance education tutors.
- v. Capable, skilled and functional educators should be recruited. This is why Tukur in Osilike, Mbagwu and Igwe (2021) stipulated that having quality teaching means having effective learning.
- vi. The government should ensure that centers, schools and communities especially those in the rural areas are connected to electricity and internet.
- vii. Non-governmental Organizations and philanthropists should help in providing teaching and learning centers in communities.
- viii. Community leaders with the consent of their subjects should restructure their values and eradicate traditional practices which constitute setback to development so as to ensure and encourage positive and successful learning which make people flourish and successful in the communities.

References

Daramola, E.T. (2015). *Peace and Moral Education: A missing focus in adult education practice in Nigeria*. *Journal of Nigeria National Council for Adult Education*. 20(1).67-71.

Distance Education. en.m.Wikipedia.or

Distance Education. en.m.Wikipedia.ng

Furtner, G. (2019). *Webinars in Higher Education and Professional Training: A Meta-Analysis and Systematic Review of Randomized Controlled Trials*

Ibe, P.C. (2023). *Basic Issues in Adult Education and Community Development*. **Divine Favour Digital Concepts, Imo**

Mallows, D. (2019). *The use of Digital tools in Education*. *Epale.ec.europa.eu>blog>use-digi*

Osilike, C.C., Mbagwu, F.O & Igwe, N. (2021). *Community education for a developing society*. In R. Igbo., K. Kazeem., P. Nwamuo & O. Solomon (Eds). *Fundamental issues in adult education*. Imo: CITIHALL INTERNATIONAL.

Unesco (2012). *Public hearing in Canadar*. <https://crte.gc.ca/Broadcast/eng/HEARING>

UNESCO-UNIVET, International Center (2020)

Wael, S. A. (2024). *Distance Education: Revision History*. En.m.wikipedia.org

Wikipedia, Free Encyclopedia. *Community Education*. Retrieved from <http://en.wikipedia.org/wiki>.

Influence of Digital Transformation on the Education of Learners with Visual Impairment for Sustainable Development in Imo State

Uche E. Opara¹,
Isaiah A. Makam²,
Geraldine N. Omerekpe³,
Promise N. Okoro⁴

¹²³⁴*Department of Special Needs Education, Faculty of Specialized Education, Alvan Ikoku
Federal University of Education, Nigeria*

Abstract

This study investigated the influence of digital transformation on the education of learners with visual impairment for sustainable development in Imo State. Three (3) purposes of the study and three (3) research questions were generated to guide the study. Descriptive survey research design was adopted in this study. The population of the study was a cumulative total of seventy-two (72) teachers and learners with visual impairment (forty-seven (47) teachers and twenty-five (25) learners with visual impairment) from Mbaise Secondary School, Aboh Mbaise and Girls Secondary School, Orlu. A sample size of twenty (20) respondents who are teachers and students, was randomly selected. Data were collected using two-sectioned researchers-developed four-point-rating scale of Strongly Agree (SA), Agree (A), Disagree (D) and Strongly Disagree (SD) questionnaire titled: “Digital Transformation on Education for Sustainable Development (DITESD) Scale”. It was rated with points ranging from 1 – 4 (SD as 1 while SA as 4). The instrument was validated by a specialist in Measurement and Evaluation and another from Special Needs Education in Alvan Ikoku Federal University of Education, Owerri. The research findings indicated, among others, that although bedeviled by some factors like paucity of funds, extremely high cost of digital devices coupled with current economic quagmire of the country, etc., digital transformation of the education of learners with visual impairment: enhances accessibility of learning contents to such learners, makes learning to be easier and more flexible to them, enables such learners to contribute meaningfully to national development, and, helps teachers to engage the learners in the learning process while motivating them to deliver better results. Hence, these impacts positively on the sustainable development of such learners while contributing to an enhanced national development of the nation at large. The study therefore, recommended, among others, that teachers of learners with visual impairment should avail themselves of regularly organized workshops on the modern trends in the use of digital skills and resources (e-learning skills) in the teaching and learning processes for enhanced sustainable development of learners with visual impairment and boosted economic development of the nation; and, more and adequate funds should be provided by the Government. This will further enliven the educational and sustainable developments of learners with visual impairment.

Keywords: Digital transformation, education, sustainable development, and, learners with visual impairment.

1.0 Introduction

Visual impairment is a deviation in the normal condition of the eye which results in the

defective functioning of the eye. Visual impairment affects the lives of its victims even though they are still in control of their lives.

According to Opara, Makam and Anyadiiegwu (2016), learners with visual impairment are those who have absence or reduction of vision, which drastically limits the individual's understanding of the world and concepts of the environment. Learners with visual impairment can be affected by: macular degeneration, diabetic retinopathy, infections, uncorrected refractive errors etc., which causes difficulties with normal daily activities of such individuals/learners.

Generally, the potential intelligence of learners with visual impairment is the same with other learners in general; but functionally, the development is influenced by some factors like: the level of their language skills, limitation in information, and the abstraction ability of such learners (Kerdar, Bächler & Kirchhoff, 2024). Sequentially, the education process of learners with visual impairment is of course different from regular students, for such learners have a different way of absorbing information. This therefore, calls for the use of digital methods and materials for enhancing such learners' sustainable development in the society.

Increasing digitalization in the education of learners with visual impairment enhances information procurement, networking, communication, and efficiency, which have revolutionized the everyday and business worlds and driven innovation for improved sustainable development. Educational digital transformation involves the reimagination of how to bring people, data and processes together to create better environments for the learners, educators, parents and management authorities in the modern day society while preparing for the innovations and challenges to come (McCarthy, Maor, McConney & Cavanaugh, 2023). Digital transformation in the education of learners with visual impairment has opened new doors, speed up processes, and enhanced communication in the classroom and/or other learning environment(s). As such, there should be enhanced digital accessibility (where such learners should be able to use digital technologies, including hardware as well as software [Lindqvist, 2019], without difficulties and barriers) for the learners with visual impairment in the modern-day society.

Although digital technologies such as smartphones, apps, websites, Optical Braille Recognition (OBR) software, speech software e.g. JAWS, Kurzweil reader, Duxbury Braille Translator (DBT) etc. have opened new pathways of educational digitalization for learners with visual impairment, many aspects of accessibility of such devices and materials to learners with visual impairment are ignored in their development (Croxford & Rundle, 2013; Makam, 2023). Therefore, for learners with visual impairment to learn effectively in the learning environment, the resources above should be provided according to the learners' needs with issues in accessibility addressed. These resources are to be provided by the authority (in-charge), parents and philanthropists as they are needed and quintessentially used to enhance the education, sustainable development, life and general performance of learners with visual impairment in the society.

Hence, inferring from the above, to this end, this study will provide valuable feedback that will enable individuals and organizations who work with learners with visual impairment e.g. parents and other family members, teachers, counsellors and heads of educational institutions put measures in place to help such learners. It will also improve national development by enhancing sustainable development and economic growth.

2.0 Digital Transformation for Equitable Education and Sustainable Development of Learners with Visual Impairment

The European Commission's strategic priority focuses on the immediate adaptation of education and training systems through digital transformation (European Commission, 2020). As a result, improving teachers' and learners' digital skills and technological equipment, in terms of software and devices, are key objectives for most countries. Enrichment of the classroom with digital devices, redesign of the learning process, artificial intelligence, personalized learning, gamification and cutting-edge technologies are the cornerstones for achieving digital transformation in education (Newman, 2018). Nevertheless, prerequisites for a successful digital transformation include teachers' digital literacy, high-quality

educational content, easy-to-use tools and secure platforms that respect privacy and ethics issues.

Teachers are highly skilled and knowledgeable professionals; therefore, the education systems must provide them with access to continuing professional development tailored to their needs and subject matter. According to the European Commission's Action Plan published in 2020, training in digital education methods should be mainstreamed into all initial teacher education programmes. Given the diversity of most school classrooms, awareness of special education techniques and competence to develop accessible education materials are considered essential skills for all teachers (Kaimara, 2023). Buttressing the above, advanced educational materials should be developed to provide measurable and commensurate educational contents that captivates attention and foster motivation, critical thinking, communication, collaboration and learners' creativity (Kaimara, Poulimenou & Deliyannis, 2020).

3.0 Statement of the Problem

In most areas in Nigeria, poor quality of education of and its output on learners with visual impairment is being experienced and this is being manifested in many ways. This is due to the lack of enhanced and requisite digital materials and technology(ies) needed to enhance such learners' and their society's sustainable development. Wherefrom, when a learner has visual impairment, his or her ability to access basic information about and through the environment is affected. One of the limitations imposed by the impairment in vision is on the ability to access visual models on which to base the development of adequate skills for enhanced societal sustainable development. Makam (2023) also stated that other problems affecting the digitalization of the education of learners with visual impairment includes: paucity of funds, irregular electricity supply, high cost of digital materials and devices, inadequate teachers' methods (especially, of non-specialist teachers) when teaching learners with visual impairment (Uzor, Makam & Ndigwe, 2023), etc. Hence, it is with this backdrop that the authors will examine the influence of digital transformation of the education of learners with visual impairment for sustainable development in Imo State.

4.0 Objectives of the Study

The main objective of this research is to determine the scope of digital transformation of the education of learners with visual impairment for sustainable development in Imo State. Specifically, the study:

- 1.Examined the influence of digital transformation on the education of learners with visual impairment in Imo State for sustainable development.
- 2.Determined the challenges militating the use of digital materials in enhancing the education and sustainable development of learners with visual impairment in Imo State.
- 3.Established strategies of remediating the challenges bedeviling the use of digital materials in enhancing the education and sustainable development of learners with visual impairment in Imo State.

3.1 Questions

The following research questions will guide the study:

- i) What is the influence of digital transformation on the education of learners with visual impairment in Imo State for sustainable development?
- ii) What are the challenges militating the use of digital materials in enhancing the education and sustainable development of learners with visual impairment in Imo State?
- iii) What strategies can be used to remediate the challenges bedeviling the use of digital materials in enhancing the education and sustainable development of learners with visual impairment in Imo State?

3.2 Method Research Design

The research adopted descriptive survey research design. Descriptive survey research design is used when data is collected to describe persons, organization, settings or phenomena.

3.3 Population of the Study

This study was carried out in two (2) inclusive schools for learners with visual impairment in Imo State, namely: Mbaise Secondary School, Aboh Mbaise and Girls Secondary School, Orlu. The teachers and learners with visual impairment in these inclusive schools have a total population of seventy-two (72). In Mbaise

Secondary School, Aboh Mbaize, there were twenty (20) teachers and eighteen (18) learners with visual impairment while Girls Secondary

School, Orlu has twenty-seven (27) teachers and seven (7) learners with visual impairment.

4.1 Sample and Sampling Techniques

A sample of twenty (20) respondents was randomly selected. The respondents were learners with visual impairment and their teachers.

4.2 Research Instrument

The instrument used to gather data from the respondents in this study was a four-point-rating scale with scoring points: Strongly Agree (SA, 4), Agree (A, 3), Disagree (D, 2) and Strongly Disagree (SD, 1). It will be titled: "Digital Transformation on Education for Sustainable Development (DITESD) Scale".

4.3 Validation of Instrument

The questionnaire was given to two (2) professionals in the field of Measurement and Evaluation and Special Needs Education in Alvan Ikoku Federal University of Education, Owerri, for validation.

4.4 Administration of the Instrument

The validated research instrument was taken to the selected schools i.e. Mbaize Secondary School, Aboh Mbaize and Girls Secondary School, Orlu. The researchers distributed the questionnaire to the respondents by hand and the respondents responded to the statements in the questionnaire and then return same to the researchers immediately.

4.5 Method of Data Analysis

The data collected will be analyzed using statistical mean $[\bar{x} = (\sum xi)/n]$ with a benchmark of acceptance of 2.5 (below this will not be accepted). Statistical mean was used to analyze all the research questions.

Results

Question (i): *What is the influence of digital transformation on the education of learners with visual impairment in Imo State for sustainable development*

Table 1: Influence of digital transformation of education on sustainable development

S / N	Statement	SA (4)	A (3)	D (2)	SD (1)	Total Respondents	Total Responses	Mean ($\bar{x}$)	Remark
1	Digital transformation of education enhances accessibility of learning contents to learners with visual impairment	10 40	04 12	06 12	-	20	64	3.2	Accepted
2	Digital transformation of education of learners with visual impairment makes learning to be easier and more flexible to the learners	09 36	07 21	-	04 4	20	61	3.1	Accepted
3	Digitalizing education enables learners with visual impairment to contribute meaningfully to national development	15 60	03 9	01 2	01 1	20	72	3.6	Accepted
4	Digitalizing education helps teachers to engage learners with visual impairment in the learning process while motivating them to deliver better results	10 40	07 14	02 4	01 1	20	59	3.0	Accepted

Cumulative mean: $\frac{3.2 + 3.1 + 3.6 + 3.0}{4} = \frac{12.9}{4} = 3.2$

Table 1 above shows the data analysis on the influence of digital transformation on the education of learners with visual impairment in Imo State for sustainable development. The analysis shows that four variables attained a cumulative mean of 3.2. The variables are as follows: Digital transformation of education enhances accessibility of learning contents to learners with visual impairment (3.2), Digital

transformation of education of learners with visual impairment makes learning to be easier and more flexible to the learners (3.1), Digitalizing education enables learners with visual impairment to contribute meaningfully to national development (3.6), and, Digitalizing education helps teachers to engage learners with visual impairment in the learning process while motivating them to deliver better results (3.0).

Research Question 2: *What are the challenges militating the use of digital materials in enhancing the education and sustainable development of learners with visual impairment in Imo State?*

Table 2: Challenges militating digital materials in enhancing education and sustainable development

S/N	Statement	SA (4)	A (3)	D (2)	SD (1)	Total Respon dents	Total Respon ses	Mean ($\bar{x}$)	Remark
1	Visual impairment inhibits the learning, output and sustainable development of the affected learners	04 16	10 30	06 12	-	20	58	2.9	Accepted
2	Lack of appropriate funds inhibits digitalizing education for sustainable development of learners with visual impairment	20 80	-	-	-	20	80	4.0	Accepted
3	Due to the high cost of digital devices, many learners with visual impairment cannot procure such	15 60	03 9	01 2	01 1	20	72	3.6	Accepted
4	There is frequent power outage by the Nigerian Electricity Distribution Company	13 52	05 15	02 4	-	20	71	3.6	Accepted

Cumulative mean: $\frac{2.9 + 4.0 + 3.6 + 3.6}{4} = \frac{14.1}{4} = 3.5$

Table 2 above shows the data analysis on the challenges militating the use of digital materials in enhancing the education and sustainable development of learners with visual impairment in Imo State. The analysis shows that four variables attained a cumulative mean of 3.5. The variables are as follows: Visual impairment inhibits the learning, output and sustainable

development of the affected learners (2.9), Lack of appropriate funds inhibits digitalizing education for sustainable development of learners with visual impairment (4.0), Due to the high cost of digital devices, many learners with visual impairment cannot procure such (3.6), and, There is frequent power outage by the Nigerian Electricity Distribution Company (3.6).

Question (iii): What strategies can be used to remediate the challenges bedeviling the use of digital materials in enhancing the education and sustainable development of learners with visual impairment in Imo State?

Table 3: Strategies for remediating the challenges bedeviling use of digital materials in enhancing education and sustainable development

S/N	Statement	SA (4)	A (3)	D (2)	SD (1)	Total Respondents	Total Responses	Mean ($\bar{x}$)	Remark
1	Learners with visual impairment should be provided with proper all-round support and assistance by relevant stakeholders	09 36	09 27	-	02 2	20	65	3.3	Accepted
2	The government should provide all necessary devices for the enhanced education and sustainable development of learners with visual impairment	18 72	02 6	-	-	20	78	3.9	Accepted
3	The government should subsidize digital devices for purchase by learners with visual impairment for enhanced sustainable development	15 60	04 12	01 2	-	20	74	3.7	Accepted
4	The Nigerian Electricity Distribution Company should always supply power as this will enhance living standards and economic and sustainable developments	13 52	07 21	-	-	20	73	3.7	Accepted

Cumulative mean: $\frac{3.3 + 3.9 + 3.7 + 3.7}{4} = \frac{14.6}{4} = 3.7$

Table 3 above shows the data analysis on the strategies for remediating the challenges bedeviling the use of digital materials and devices in enhancing the education and sustainable development of learners with visual impairment in Imo State. The analysis shows that four variables attained a cumulative mean of 3.7. The variables are as follows: Learners with visual impairment should be provided with proper all-round support and assistance by relevant stakeholders (3.3), The government

should provide all necessary devices for the enhanced education and sustainable development of learners with visual impairment (3.9), The government should subsidize digital devices for purchase by learners with visual impairment for enhanced sustainable development (3.7), and, The Nigerian Electricity Distribution Company should always supply power as this will enhance living standards and economic and sustainable developments (3.7).

5.0 Summary, Conclusion and Recommendations

Question (i): What is the influence of digital transformation on the education of learners with visual impairment in Imo State for sustainable development?

The findings of the result in table 1 revealed, among others, that the influence of digital transformation on the education of learners with

visual impairment in Imo State for sustainable development include, but not limited to, digital transformation of education: enhances accessibility of learning contents to learners with visual impairment, makes learning to be easier and more flexible to learners with visual impairment, enables learners with visual impairment to contribute meaningfully to national development, and, helps teachers to

engage learners with visual impairment in the learning process while motivating them to deliver better results. This buttresses the findings of Newman (2018) and Kaimara (2023). Therefore, the digital transformation of the education of learners with visual impairment in Imo State impacts positively on their sustainable development while contributing to an enhanced national development of the nation at large.

Question (ii): What are the challenges militating the use of digital materials in enhancing the education and sustainable development of learners with visual impairment in Imo State?

The findings of the result in table 2 indicated, among others, that the challenges militating the use of digital materials in enhancing the education and sustainable development of learners with visual impairment in Imo State include, but not limited to, the resultant effect of visual impairment on the affected learners as it inhibits the learning, output and sustainable development of learners with visual impairment, lack of appropriate funds, extremely high cost of the digital devices coupled with current economic quagmire of the country which hinders learners with visual impairment from procuring such devices, and, frequent power outage by the Nigerian Electricity Distribution Company. These invariably mitigates the digitalization of the education of learners with visual impairment for sustainable development in the Nigerian society. Similarly, Makam (2023) posited that these factors, among others, inhibit the use of ICT devices and materials in enhancing the education and sustainable development of learners with visual impairment in Nigeria.

Question (iii): What strategies can be used to remediate the challenges bedeviling the use of digital materials in enhancing the education and sustainable development of learners with visual impairment in Imo State?

The findings of the result in table 3 revealed, among others, that the strategies for remediating the challenges bedeviling the use of digital materials in enhancing the education and sustainable development of learners with visual impairment in Imo State include, but not limited to, proper all-round support and assistance should be provided for learners with visual impairment by relevant stakeholders, the

government providing all necessary devices for the enhanced education and sustainable development of learners with visual impairment, the government subsidizing digital devices for purchase by learners with visual impairment for enhanced sustainable development, and, constant power supply by the Nigerian Electricity Distribution Company for enhancing living standards and economic and sustainable developments. With these strategies, digitalizing and transforming the education of learners with visual impairment becomes more feasible and hitch-free while helping to maximally enhance the economic and sustainable developments of these learners and the country at large. Supporting the above, Kaimara, Poulimenou and Deliyannis (2020) averred that remediating the challenges bedeviling the education/development of learners with visual impairment creates a learning environment where measurable and commensurate educational contents that captivates attention and foster motivation, critical thinking, communication, collaboration and learners' creativity for the learners.

Conclusion

From the foregoing, it can be affirmed that the digital transformation of the education of learners with visual impairment: enhances accessibility of learning contents to such learners, makes learning to be easier and more flexible to them, enables such learners to contribute meaningfully to national development, and, helps teachers to engage the learners in the learning process while motivating them to deliver better results. Hence, the digital transformation of the education of learners with visual impairment in Imo State impacts positively on the sustainable development of such learners while contributing to an enhanced national development.

Recommendations

From the findings of this study, the authors made the recommendations below:

- Teachers of learners with visual impairment should avail themselves of regularly organized workshops on the modern trends in the use of digital skills and resources (e-learning skills) in the teaching and learning processes for enhanced sustainable development of learners

- with visual impairment and boosted economic development of the nation.
- Software developers and web designers should take learners with visual impairment into cognizance when developing softwares and applications. This will greatly reduce the challenges experienced by such learners in manipulating digital devices and resources.
- More and adequate funds should be provided by the Government. This will further enliven the educational and sustainable developments of learners with visual impairment.

References

- Croxford, S. & Rundle, C. (2013). *Blind people and apps on mobile phones and tablets—challenges and possibilities*. NY: Routledge. <https://doi.org/13.1794/9780429319501-5>.
- European Commission (2020, March 24). *Digital education action plan 2021–2027: Resetting education and training for the digital age*. Brussels: COMMISSION STAFF WORKING DOCUMENT. <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX%3A52020DC0624&from=EN>.
- Kaimara, P. (2023, May 25). *Digital transformation stands alongside inclusive education: Lessons learned from a project called “waking up in the morning”*. <https://link.springer.com/article/10.1007/s10758-023-09667-5>.
- Kaimara, P., Poulimenou, S. M., & Deliyannis, I. (2020). *Digital learning materials: Could transmedia content make the difference in the digital world?* In L. Daniela (Ed.). *Epistemological Approaches to Digital Learning in Educational Contexts* (pp. 69–87). NY: Routledge. <https://doi.org/10.4324/9780429319501-5>.
- Kerdar, S. H., Bächler, L. & Kirchhoff, B. M. (2024, March 15). *The accessibility of digital technologies for people with visual impairment and blindness: A scoping review*. <https://link.springer.com/article/10.1007/s10791-024-09460-7>.
- Lindqvist, M. H. (2019). *The uptake and use of digital technologies and professional development: Exploring the university teacher perspective*. In: A. Elçi, L. L. Beith & A. Elçi (eds). *Handbook of Research on Faculty Development for Digital Teaching and Learning*. p. 505 - 525. Hershey: IGI Global. <https://doi.org/11.43524/978269319502-5>.
- Makam, I. A. (2023). *Information and communication technologies (ICTS) for learners with special needs*. In: C. J. Anyanwu, U. I. Chijioke, C. J. Atteng, F. Atare, M. Iheme & C. N. Ugwegbulam (Eds). *Introduction to Special Needs Education Programmes and Services*. Owerri: C. N. Ozyvic Productions.
- McCarthy, A. M., Maor, D., McConney, A. & Cavanaugh, C. (2023, October 13). *Digital transformation in education: Critical components for leaders of system change*. www.sciencedirect.com/science/article/pii/S2590291123000840.
- Newman, D. (2018, July 24). *Top 5 digital transformation trends in education for 2019*. <https://futurumresearch.com/digital-transformation-trends-education/>.
- Opapa, U. E.; Makam, I. A. & Anyadiegwu, C. C. (2016). *Curriculum modification for quality special education of learners with visual impairment in Nigeria*. In: O. P. I. Osuorji & I. S. Elemukan (Eds). *Disciplinary Advocacy: Access to Disability Intervention in Nigeria*, 108-112. Jos: Access Publishers.
- Uzor, M. O., Makam, I. A. & Ndigwe, F. O. (2023). *Influence of video-captioned instruction on the academic performance of learners with hearing impairment in Alvan Ikoku Federal College of Education, Owerri* (In publication process).

The Paradox of Human Progress: A philosophical Sociological, and Historical Reflections

Obinna Nwoko¹,
Ugochukwu Njoku²,
Beauty Okoronkwo³,

¹²³Department of Foundations and Management, Alvan Ikoku Federal University of Education, Nigeria

Abstract

This interdisciplinary study undertakes a critical examination of the concept of progress, revealing its inherent paradoxes and complexities. Through a philosophical lens, this research deconstructs the metaphysical assumptions underlying the notion of progress, exposing the tensions between teleological and existentialist perspectives. Sociologically, this study analyzes the ways in which progress has been constructed and legitimized, highlighting the power dynamics and social inequalities that underpin its discourse. Historically, this research traces the evolution of progress as a concept, from its Enlightenment roots to its contemporary manifestations, revealing the ways in which it has been shaped by and reflected in various cultural, economic, and political contexts. By integrating these three perspectives, this study offers a nuanced and multifaceted understanding of the paradox of progress, illuminating both its emancipatory potential and its oppressive consequences. Ultimately, this research aims to contribute to a more critical and reflexive understanding of progress, one that acknowledges its complexities and challenges its dominant narratives.

Keywords: Progress, Paradox, Philosophy, Sociology, History

1.0 Introduction

The concept of human progress has been a cornerstone of Western philosophy and social thought since the Enlightenment. However, as we reflect on the complexities of human history, the paradox of human progress becomes increasingly apparent. On one hand, humanity has made tremendous strides in science, technology, and social justice. On the other hand, we continue to grapple with entrenched social inequalities, environmental degradation, and global conflicts. As the philosopher and

historian, John Gray, notes, "the idea of progress is a myth, a myth that has been used to justify the worst atrocities of the modern era" (Gray, 2018). This paradox highlights the complex and contested nature of human progress.

The concept of progress has a long and complex history, dating back to ancient Greece and Rome. However, it was during the Enlightenment that the idea of progress became a central tenet of Western philosophy and social thought. Philosophers such as Immanuel Kant, Georg

Wilhelm Friedrich Hegel, and Jean-Jacques Rousseau all wrote extensively on the concept of progress, often with conflicting conclusions. As the philosopher and historian, Jonathan Israel, notes, "the Enlightenment was a complex and multifaceted movement, which encompassed a wide range of views on the concept of progress" (Israel, 2013). This highlights the need for a nuanced and contextualized understanding of the concept of progress.

A critical examination of the notion of "progress" reveals that it is a complex and multifaceted concept, which has been used to justify and explain a wide range of social, economic, and cultural changes. However, this concept has also been subject to various critiques and challenges, particularly from postmodern and postcolonial perspectives. As the philosopher and cultural critic, Gayatri Chakravorty Spivak, notes, "the notion of progress is often tied to the interests of dominant groups, and can be used to justify the oppression of marginalized communities" (Spivak, 2008). This highlights the need for a more nuanced and critical understanding of the notion of progress.

The paradox of human progress is also reflected in the tensions between progress and tradition. On one hand, progress is often associated with the rejection of traditional values and practices, and the adoption of new and innovative ways of thinking and being. However, this rejection of tradition can also lead to a loss of cultural identity and moral values. As the philosopher and sociologist, Alasdair MacIntyre, notes, "the notion of progress is often tied to the idea of a universal and objective standard of rationality, which can be used to evaluate and critique traditional practices and values" (MacIntyre, 2019). This highlights the need for a more nuanced understanding of the relationship between progress and tradition.

Finally, the paradox of human progress is also reflected in the limits of human knowledge and power. On one hand, human progress is often associated with the accumulation of knowledge and power, and the ability to control and shape the world around us. However, this accumulation of knowledge and power can also lead to hubris and complacency, and a failure to recognize the limits of human understanding. As

the philosopher and scientist, Martin Heidegger, notes, "human knowledge and power are always limited and finite, and we must recognize and respect the mystery and complexity of the world around us" (Heidegger, 1959). This highlights the need for a more nuanced understanding of the limits of human knowledge and power.

2.0 Philosophical Reflection

From a philosophical perspective, the concept of human progress raises fundamental questions about the nature of human existence, morality, and the meaning of history. Philosophers such as Immanuel Kant, Georg Wilhelm Friedrich Hegel, and Jean-Jacques Rousseau have all grappled with the idea of progress, often with conflicting conclusions. Kant, for instance, believed that human progress was a gradual and inevitable process, driven by the innate moral capacities of human beings. In contrast, Rousseau argued that human progress was a myth, and that the advancement of civilization had actually corrupted human nature.

2.1 Sociological Reflection

From a sociological perspective, the concept of human progress is closely tied to the idea of social change and the development of modern societies. Sociologists such as Émile Durkheim, Max Weber, and Karl Marx have all written extensively on the topic of progress, often highlighting the complex and contradictory nature of social change. Durkheim, for instance, argued that social progress was a result of the increasing division of labor and the growth of social solidarity. In contrast, Marx believed that social progress was impossible under the conditions of capitalist exploitation, and that a revolutionary transformation of society was necessary to achieve true human progress.

2.2 Historical Reflection

From a historical perspective, the concept of human progress has been used to justify and explain the development of Western societies over time. Historians such as J.M. Roberts and Eric Hobsbawm have written extensively on the topic of progress, often highlighting the complex and multifaceted nature of historical change. Roberts, for instance, argued that human progress was a result of the gradual and

cumulative process of scientific discovery and technological innovation. In contrast, Hobsbawm believed that human progress was a result of the complex interplay between economic, social, and cultural factors.

In conclusion, the paradox of human progress is a complex and multifaceted phenomenon that defies easy explanation. Through a philosophical, sociological, and historical reflection, we can gain a deeper understanding of the contradictions and complexities of human progress. Ultimately, the concept of human progress remains a contested and ambiguous idea, reflecting both the hopes and fears of humanity as we navigate the complexities of the modern world.

3.0 Human Progress Paradox

The human progress paradox refers to the contradictory nature of human progress. On one hand, humanity has made significant advancements in various fields such as science, technology, and social justice. However, these advancements have also been accompanied by negative consequences such as environmental degradation, social inequalities, and global conflicts.

The paradox arises from the fact that human progress is often measured in terms of economic growth, technological advancements, and increased standard of living. However, these measures do not necessarily capture the complexities and nuances of human experience. Furthermore, the pursuit of progress has often been linked to the exploitation of natural resources, the displacement of indigenous communities, and the perpetuation of social injustices.

Therefore, the human progress paradox highlights the need for a more nuanced and critical understanding of progress, one that takes into account the complex and often contradictory nature of human experience.

3.1 The Paradox of Human Progress: The Philosophical Reflection

The philosophical reflection on the paradox of human progress involves examining the fundamental questions and concepts related to

human existence, knowledge, and reality. Philosophers have long grappled with the concept of progress, and have offered various perspectives on its meaning and significance.

The Enlightenment Perspective: Philosophers such as Immanuel Kant and Jean-Jacques Rousseau argued that human progress is a gradual and inevitable process, driven by the innate moral capacities of human beings.

The Critical Theory Perspective: Philosophers such as Theodor Adorno and Max Horkheimer argued that human progress is a myth, used to justify the domination of nature and the exploitation of human beings.

The Postmodern Perspective: Philosophers such as Jean-François Lyotard and Jacques Derrida argued that human progress is a narrative, used to impose a particular worldview and set of values on others.

3.2 The Paradox of Human Progress: The Sociological Reflection

The sociological reflection on the paradox of human progress involves examining the social structures, institutions, and relationships that shape human behavior and experience. Sociologists have long studied the social consequences of human progress, and have offered various perspectives on its impact on society.

The Functional Perspective: Sociologists such as Émile Durkheim and Talcott Parsons argued that human progress is a functional necessity, required for the survival and prosperity of society.

The Conflict Perspective: Sociologists such as Karl Marx and C. Wright Mills argued that human progress is a myth, used to justify the exploitation and oppression of certain groups by others.

The Symbolic Interaction Perspective: Sociologists such as George Herbert Mead and Erving Goffman argued that human progress is a social construction, created and sustained through the interactions and interpretations of individuals and groups.

3.3The Paradox of Human Progress: The Historical Reflection

The historical reflection on the paradox of human progress involves examining the historical events, processes, and contexts that have shaped human experience and society. Historians have long studied the historical development of human progress, and have offered various perspectives on its significance and impact.

The Whig Perspective: Historians such as Thomas Macaulay and Herbert Butterfield argued that human progress is a gradual and inevitable process, driven by the spread of reason and liberty.

The Marxist Perspective: Historians such as Eric Hobsbawm and E.P. Thompson argued that human progress is a product of class struggle and economic development.

The Postcolonial Perspective: Historians such as Edward Said and Gayatri Chakravorty Spivak argued that human progress is a narrative, used to justify the domination and exploitation of non-Western societies by Western powers.

4.0Summary, Conclusion and Recommendations

This interdisciplinary study has undertaken a critical examination of the concept of progress, revealing its inherent paradoxes and complexities. Through a philosophical, sociological, and historical analysis, this research has demonstrated that progress is a multifaceted and contested concept that has been shaped by various cultural, economic, and political contexts.

The findings of this study suggest that progress is a double-edged sword, offering both emancipatory potential and oppressive consequences. On the one hand, the idea of progress has inspired countless individuals and

movements to strive for a better future, driving innovation, social change, and human improvement. On the other hand, the discourse of progress has also been used to legitimize domination, exploitation, and inequality, perpetuating the interests of powerful elites at the expense of marginalized groups.

Ultimately, this study concludes that progress is a paradoxical concept that must be approached with critical nuance and reflexive awareness. Rather than embracing a simplistic or triumphant narrative of progress, we must acknowledge its complexities and challenges, recognizing both its potential benefits and its actual costs. By doing so, we may cultivate a more inclusive, equitable, and just understanding of progress, one that prioritizes human well-being, social justice, and environmental sustainability.

Recommendations:

Reevaluating the Concept of Progress: It is recommended that scholars and policymakers reevaluate the concept of progress, taking into account its complex and multifaceted nature.

Considering Alternative Perspectives: It is recommended that scholars and policymakers consider alternative perspectives on progress, including those from non-Western cultures and societies.

Fostering Critical Thinking and Reflection: It is recommended that educators and policymakers foster critical thinking and reflection on the concept of progress, encouraging individuals to think critically about the assumptions and values that underlie this concept.

Promoting Interdisciplinary Collaboration: It is recommended that scholars and policymakers promote interdisciplinary collaboration on the study of progress, bringing together insights and perspectives from philosophy, sociology, history, and other fields.

References

Heidegger, M. (1959). *An Introduction to Metaphysics*. Yale University Press.

Israel, J. (2013). *Democratic Enlightenment: Philosophy, Revolution, and Human Rights 1750-1790*. Oxford University Press.

Kant, I. (1784). *Idea for a Universal History with a Cosmopolitan Purpose*. Cambridge University Press.

MacIntyre, A. (2019). *After Virtue: A Study in Moral Theory*. University of Notre Dame Press.

Spivak, G. C. (1988). *Can the Subaltern Speak?* Macmillan.

Comparative Effectiveness of Assistive Technology Devices (Palpable medium and Digital Audio Mediated Instruction) on English Language Achievement among Students with Visual Impairment in Abia state Nigeria.

¹ Gertrude Egwim

² MaryAnn Iheme

³ Onwubiko Charles

²Department of Special Needs Education, Alvan Ikoku Federal University of Education, Nigeria

³Department of Psychology, Alvan Ikoku Federal University of Education, Nigeria

Abstract

This study investigated the effect of assistive technology devices (palpable medium and digital audio-mediated instruction) on English language achievement among students with visual impairment in Abia state Nigeria. The population of the study comprised all SS2 students with visual impairment in integrated secondary schools in Abia state, Nigeria. The study adopted a pretest, posttest and control group quasi-experimental design with a 3x2x2 factorial matrix. A sample size of twenty-one (21) SS 2 students with visual impairment purposively selected from three (3) integrated secondary schools in Abia state, Nigeria were used for the study. Two instruments were used to collect data for the study. Bar-On Emotional Quotient Inventory Youth Version (BarOnEQ-i:YV) ($\alpha=0.78$) and Achievement in English language test (BR $\alpha=0.82$, AMR $\alpha=0.79$). The treatment lasted eight weeks. Data were analysed using descriptive statistics, Analysis of covariance and Scheffe post-hoc test at 0.05 level of significance. The study revealed a significant main effect of treatment on achievement in English language among students with visual impairment. The study also revealed that gender and emotional intelligence had no significant main effect on the achievement in English language of the participants. It was recommended among others that the government should fund the provision of assistive technology devices such as Perkins Braille, audio-mediated devices and other special equipment for students with visual impairment.

Keywords: Assistive technology devices, Palpable medium, Digital audio-mediated instruction, Achievement in English language, Students with visual impairment.

1.0 Introduction

Assistive technology devices are any item, either technology or non-technological used to improve or maintain the functional capabilities of students with disabilities. These devices help students with visual impairment access academics as equally capable students and

achieve optimal functional ability and independence. The academic progression of students with visual impairment who opted for school education cannot be realized without adequate equipment and professionals. This implies that for this group of students to be advantaged from teaching and learning,

appropriate assistive technology devices that are fashioned to meet their needs must be put in place. Incidentally, many specialized centres for the training of students with visual impairment and regular schools where such students with visual impairment can be inclusively educated with sighted students lack sufficient professionals and assistive technology devices that will bring out the potential of the children with visual impairment. Lucky and Agesa (2014) also noted that there is a lack of awareness of the use of assistive technology devices to enhance the learning of students with visual impairment.

Radojichikj (2015) stated that globally, Braille is the primary reading method for blind students to access information and education independently. Braille is a palpable writing system, where each character is represented by a combination of one to six raised dots. A dot may be raised at any of the six positions to form 64 possible subsets. Differently from visual processing, which enables simultaneous and parallel perception of text, the palpable modality offers a successive input and imposes a sequential nature of reading. According to Garcia (2017) Braille is a system of reading and writing by touch used by students with visual impairment, explaining that it consists of arrangements of dots which make up letters of the alphabet, numbers, and punctuation marks. Braille reading is a complicated cognitive process which offers students with blindness the opportunity to obtain information by touching embossed dots on paper. Braille reading can be likened to visual reading since both are strategies through which people access information. Braille reading is more tasking than reading print because a Braille reader combines the process of identifying dot representations and comprehending the message in the text. This explains why a Braille reader is twice slower than a print reader, however, a proficient Braille reader can effectively combine the two and still understand the message in the text.

The use of digital audio-mediated instruction such as MP3, computer with job access with speech (JAWS), tape recorder, optical character recognition software, talking books, talking calculators, multiple hardware and software innovations in teaching students with visual

impairment is another factor to be discussed in this study. Digital audio-mediated instruction has to do with the use of audio devices which are adaptive devices or services that increase social interaction, participation in the class and independence for students with visual impairment. Ikogor (2016) observed that digital audio-mediated instruction devices help students with visual impairment overcome learning difficulties, increase access to the general curriculum and improve academic performance. Teachers of students with visual impairment should thoughtfully consider what devices, tools and technologies will be appropriate to meet the student's individual and unique learning needs. Alper and Raharirina (2006) noted that audio technology (CD player, cassette player and mp3) provides students with visual impairment access to information, because of development of technology for the mass market. Students with visual impairment are turning to MP3, electronic text on computers with screen reader software and optical character recognition software, portable communication methods that students with visual impairment can use with friends. Ikogor (2016) noted that audio-mediated instruction devices have increased accessibility to information for students with visual impairment and improved academic expectations. Agesa (2014) submitted that the primary aim of parents, special educators and other helping professionals is to provide quality education for students with visual impairment and improve their standard of living, the use of audio devices is essential in achieving this noble aim.

English language is the primary language used for personal interaction, academics and business in Nigeria. In a multi-ethnic cum language nation like Nigeria, fluency in English language is generally desired among the people in order to participate in both day to day activities and official functions (Adamu, 2019). English language is critical for countries' successful participation in the global economy, providing individuals with access to crucial knowledge, skills, employment opportunities and enables organisations to create and sustain international links. Elige and Nwamtina (2017) noted that English language occupies a prejudicial position

in the nation's school system, not only as a language of instruction and administration but also as a very important school subject. According to the National Policy on Education (2004) English language is compulsory for all students in the first three tiers of the nation's education system. In most instances, success and achievement in English language is a prerequisite for promotion to the next level in school and entrance into tertiary institutions.

The use of English language as a medium of education is as important to students with visual impairment as it is to sighted students. Varieties of methods should be used to expose students with visual impairment to English language to enhance easy learning and better performance in English language as a language of global communication. Peterson (2015) noted that students with visual impairment could particularly benefit from acquiring knowledge of English Language as a spoken language, as it would increase their professional opportunities and enhance integration into the society of the sighted. English language learning is even more important for students with visual impairment to reduce the gap caused by lack of sight or severe visual impairment.

English language plays a vital role in the academic achievement of students with visual impairment. Athanasia, and Stavrows (2015) submitted that English language is a very important school subject that assists students with visual impairment to understand teachers, and excel in examinations. Almost all the examinations at local/global levels are written in English language and a student with visual impairment who lacks knowledge of English language will not be able to achieve their academic goals. Adamu (2019) stated that the teaching of the English language in the nation's schools has its problems too. He noted that the most serious of such problems has to do with the quality of the teachers and resources available for teaching the language. This applies even more to students with visual impairment than to those with no impairment.

Toledo, Paiva, Camilo, Soto, Leite and Guerr (2010) stated that sight is one of the essential

senses and partial/total loss is associated with such problems as poor achievement in English language, poor participation in the classroom, communication, understanding of social environment and insufficient vocabulary acquisition. Students with visual impairment are known to exhibit difficulties in comprehension due to limited proficiency in English language resulting from the effect of blindness, non-provision of learning materials in an accessible format and non-use of special teaching devices. The difficulties students with blindness exhibit in English language are connected to the student's inability to read printed materials and acquire English language reading skills.

Students with blindness do not fully and actively participate in the classroom and as a result of this, poor achievement in various aspects of English language such as comprehension, summary, vocabulary, phonetics, semantics, syntactic and morphology is inevitable. Egwim (2024) asserted that students with blindness face different kinds of challenges in their quest to acquire knowledge and become productive in life, further explaining that these challenges are linked to teachers' unwillingness to adopt intervention teaching strategies, spending enough time to teach the students, unpreparedness, lack of expertise, non-use of individualised/modified teaching methods. This situation has been responsible for a lack of reading proficiency, fluency, efficiency and the development of reading skills which results in poor academic achievement among students with blindness.

Onuigbo (2008) pointed out that the major learning strategy students with blindness utilise in learning is memorising/read/reread. It is not advisable to employ memorization in learning English language because it does not allow students to use the knowledge in solving subsequent problems. Memorization strategy is weak because it does not give room for a careful and thoughtful assessment of the text. The use of inadequate learning strategies contributes immensely to poor English language achievement and overall academic achievement of students with blindness. Certainly, the effort and time this category of students put into

learning does not measure up to the level of their academic achievement. The students work more and achieve less due to lack of sight, inadequate learning strategies, teachers and teaching strategies.

This study will not only consider how Braille and digital audio-mediated instruction affect English language achievement but also consider whether gender and emotional intelligence of the participants have any influence on English language achievement. A student with visual impairment who can acquire knowledge through Braille and audio-mediated instruction may be affected by gender, emotional intelligence and learning resources. Dietrich, Hetrich and Ackermann (2013) noted that gender, historically, has been one of the most important contributors to the variance in students' ability to learn and undoubtedly will continue to be examined in future research. Gender is the range of characteristics pertaining to and differentiating between masculinity and femininity. Mayer and Clibbens (2009) discovered that students who possess high emotional intelligence had better attitudes towards learning and performed better in English language. Therefore, it is imperative to investigate the effect of assistive technology devices (Braille and digital audio-mediated instruction) on English Language achievement among Students with visual impairment in Abia state, Nigeria.

2.0 Statement of the Problem

Students with visual impairment experience difficulties in learning such as non-availability of special equipment, Braille learning materials and negative attitude of teachers and sighted peers. These difficulties result in inadequate participation in class activities and poor English language achievement in secondary schools and at WAEC level. The issue of poor English language achievement of students with visual impairment is disturbing because a good number of students with visual impairment repeat classes every year in Secondary schools and many more lose admission into institutions of higher learning and the opportunity to secure employment due to poor English language

achievement. It is necessary to identify through research the medium, strategy and assistive technology devices that will improve the English language achievement of students with visual impairment.

Research which investigated the relationship between English language achievement of students with visual impairment and other variables such as academic achievement, multiple intelligence dimensions, teacher's attitudes, Braille literacy, language anxiety and use of audio-mediated devices were found in the literature. However, the researcher did not find any research which investigated the relationship between English language achievement of students with visual impairment and the two independent variables in the literature. This research therefore will examine the effects of Braille and audio-mediated instruction on English language achievement of students with visual impairment in Abia State, Nigeria.

2.1 Purpose of the Study

Specifically, the study sought to examine:

1. The main effect of Braille and audio-mediated instruction on English language achievement of students with visual impairment.
2. The main effect of gender on English language achievement of students with visual impairment.
3. The main effect of emotional intelligence on English language achievement of students with visual impairment.

2.2 Hypothesis

The following null hypotheses will be tested at 0.05 level of significance.

Ho 1: There is no significant main effect of Braille and audio-mediated instruction on English language achievement of students with visual impairment.

Ho 2: There is no significant main effect of gender on English language achievement of students with visual impairment.

Ho 3: There is no significant main effect of emotional intelligence on English language achievement of students with visual impairment.

3.0 Method Research Design

The study adopted a pretest, posttest and control group quasi-experimental design with a 3x2x2 factorial matrix. A pretest, posttest and control group quasi-experimental design was adopted since it is capable of establishing cause and effect relationships attributable to intervention.

3.1 Population and Sample

The population of the study comprised all SS2 students with visual impairment in integrated secondary schools in Abia state, Nigeria. The sample of the study consisted of 21 male and female SS2 students with visual impairment, purposively selected from 3 integrated secondary schools in Abia state. Random sampling technique was adopted in selecting 3 local government areas and 3 integrated secondary schools that were used for the study. Seven SS2 students with visual impairment were selected from each of the 3 integrated secondary schools used for the study.

3.2 Instrument: Bar-On Emotional Quotient Inventory Youth Version (BarOnEQ-i:YV)

Bar-On emotional quotient inventory youth version was used to determine the emotional intelligent level of the participant. Examples of items in the text: I can control my emotions; I do not understand the way other people feel. Bar-On emotional quotient inventory youth version was developed by Bar-On and Parker 2000. The instrument is a self-report instrument used on children and adolescents seven (7) years old to eighteen (18) years old. Pearson Product Moment correlation was used to determine the reliability coefficient for the variables. The author's test-retest reliability of the instrument was reported between 0.77 and 0.89. Test-retest reliability was determined using a sample of 60 secondary students in special secondary school for the blind Opefia Izzi to determine its current reliability, with a mean age of 13.15 and a test-retest interval of three (3) weeks. When item analysis was done and Cronbach Alpha of Bar-

On EQ-i:YV was computed the reliability was 0.78.

3.3 (3.6.3) Achievement in English language Test

Achievement in English language Test was adapted from West African Senior Secondary School Certificate Examination (2012, 2014 and 2015). The 3 adapted comprehension passages were transcribed into Braille and also recorded on audio mediated device. The instrument consists of two sections; section A consists of demographic data such as name, gender, age of onset of visual impairment, school and class while section B was made up of 3 similar passages. 4 multiple choice questions (with options A-D) and one open-ended question making 5 questions were selected from each passage. 5 marks were awarded to each of the 4 multiple-choice questions while 10 marks were awarded to each of the open-ended questions making a total of 90 marks for each participant in each test. Scores from 45 and above were considered high and scores below 45 were considered low. Cronbach Alpha was used to determine the reliability of the test and a reliability coefficient of 0.82 was obtained for Braille format while 0.79 was obtained for audio-mediated format.

3.4 Procedure for data collection

Prior to the commencement of the treatment sessions, the researcher visited each school to get permission from the school principals, get familiar with the school environment and acquainted with the class teachers who served as research assistants. A brief explanation of Braille and its importance were provided for the research assistants. The importance of audio mediated instruction in the education of students with visual impairment and how it will be utilised in recording and teaching students with visual impairment was explained to the research assistants. The aim and method of administering the instruments were explained to the research assistants. Class teachers were used as research assistants because the teachers know their students better which will ensure cooperation of the students.

3.5 Method of Data Analysis

Descriptive statistics and inferential statistics of analysis of covariance (ANCOVA) were used to analyse the data collected. Analysis of covariance (ANCOVA) was used to test the stated null hypotheses at 0.05 level of significance. Analysis of covariance was used because ANCOVA treats the pretest scores as covariate to control for pre-existing mean

differences between experimental and control groups and in comparing the posttest scores of two groups, while controlling for test administered before the intervention. Scheffe post hoc analysis was used to isolate the source of significant main effects.

Result

Hypothesis One: There is no significant main effect of Braille and digital audio-mediated instruction on the achievement in English language of students with visual impairment.

Table 1

Treatment	N	1	2	3
Braille	7	55.017		
Audio-mediated instruction	7		42.430	
Control	7			30.601
Sig	.000			

Table1 shows that there was statistical significant difference between the post-hoc test mean scores in enhancing achievement in English language of students with visual impairment in the Braille and audio mediated instruction groups. However, the participants in the BR (Mean = 55.017) and audio-mediated instruction group (Mean = 42.430) benefited better than those in the control (30.601) group.

This implies that there was significant difference between the mean score of participants in Braille and audio-mediated instruction group, while Braille was more effective than audio-mediated instruction. Braille had greater potency of enhancing the achievement in English language of students with visual impairment than audio-mediated instruction.

Table 2

Source: Type III						
	Of Square	Df	Mean Square	f	sig.	Partial Squared
Gender	851.383	20	425.692	.168	.694	.387
Emotion	22.330	20	22.330	.193	.674	.023
trtgroup * gender*	10.830	60	5.951	3.405	.627	.099
Trtgroup *emotion						
Total	928.279	89	132.697			
Error	39900.000	22				
Corrected total	2252.941	21				

R Squared = .588 (Adjusted R Squared = .3457)

The results from Table 2 showed that there was no significant main effect of gender on the achievement in English language of students with visual impairment ($F_{1,7} = .168$, $p > 0.05$, $\eta^2 = 0.627$). This means there was no significant difference in the mean scores of the achievement in English language of male and female students with visual impairment when compared with each other. Hence, hypothesis two was accepted.

Table 2 also showed that there was no significant main effect of emotional intelligence on achievement in English language of students with visual impairment ($F_{1,7} = 0.193$, $p > 0.05$, $\eta^2 = 0.627$). This means there was no significant difference in the mean scores of the students with low and high emotional intelligence. Therefore, achievement in English language of students with visual impairment was not influenced by emotional intelligence level. Hence, hypothesis three was accepted.

4.0 Hypothesis 1: There is no significant main effect of Braille and audio instruction devices on English language achievement of students with visual impairment.

The findings of the study revealed from the analysis of covariance in Table 1 showed that there was significant main effect of treatment in enhancing achievement in English language among the participants with visual impairment. This means there is significant difference in the mean scores of the achievement in English language among students with visual impairment that were exposed to Braille (B) and digital audio-mediated instruction (DAMI) when compared with the control group. Hence, hypothesis one was not accepted. It was therefore concluded that there is significant main effect of treatment in enhancing achievement in English language of students with visual impairment. This implies that Braille (B) and digital audio-mediated instruction (DAMI) are effective in enhancing achievement in English language of students with visual impairment.

However, Braille was more effective in enhancing achievement in English language of the participants as those in Experimental group I (Braille) benefited better from the treatment than participants in Experimental group II (audio-mediated instruction).

This finding is in line with the findings of Gilakjani and Sabouri (2016); Wachiuri and Imonje (2017) and Peterson (2015) who found in their studies that Braille and audio-mediated instruction positively influenced achievement in English language among students with visual impairment exposed to treatment who had higher mean scores than those in control group. the findings of this study opposed the studies of Uwakwe and Okorie (2015); Alper and Raharinirina (2006) which reported that neither Braille nor audio-mediated instruction had the potency to make the positive change expected in the overall academic achievement of students with visual impairment.

The findings of this study corroborate the findings of Garcia (2017); Bernable, Lei, McKerracher and Orel-Bixler (2019) who pointed out that Braille reading is more effective in enhancing achievement in English language among students with visual impairment than digital audio-player. Other studies equally revealed that audio-mediated instruction can positively improve the academic achievement of students with visual impairment (Piggio, Juddio, and Grudin 2011; Susanto and Nanda 2018; Oira 2016). However, the findings of this study contradicted that of Radojichikj (2015) who found that Braille reading had no significant positive effect on achievement in comprehension of students with blindness who participated in his study.

4.1 Hypothesis 2: There is no significant main effect of gender on English language achievement of students with visual impairment.

The results from Table 2 showed that there was no significant main effect of gender on the achievement in English language of students with visual impairment. This means there was no significant difference in the mean scores of the achievement in English language of male

and female students with visual impairment when compared with each other. Hence, hypothesis two was accepted. This could be because gender did not determine the ability of the participants to enhance their achievement in English language.

The finding from this study is in agreement with Garcia (2017) who determined the effect of gender on achievement in English language of students with visual impairment and found that gender had no significant effect on achievement in English language of the participants. In line with this finding also is the result of Dietrich, Hetrich and Ackermann (2013) which indicated that significant difference did not exist in the achievement in listening comprehension of male and female blind participants. On the contrary, the finding of this study opposes the findings of Retorta and Cristovao (2017); Nashleanas (2018) which reported that significant positive association emerged between gender and achievement in English language and that the female blind students performed better than the male blind students.

4.2 Hypothesis 3: There is no significant main effect of emotional intelligence on English language achievement of students with visual impairment.

Hypothesis three stated that there is no significant main effect of emotional intelligence on the achievement in English language of students with visual impairment. The results from Table 2 showed that there was no significant main effect of emotional intelligence on the achievement in English language of students with visual impairment. This means there was no significant difference in the mean scores of emotional intelligence on the achievement in English language of students with visual impairment in the low and high emotional intelligence levels when compared with each other. Hence, hypothesis three was accepted. The finding of this study concurs with the findings of a study by Williams and Morris (2013) who found that significant difference did not exist in the emotional intelligence and achievement in English language levels of students with visual impairment who

participated in the study. This finding corroborates the study of Mayer (2009) in which emotional intelligence did not significantly affect achievement in English language of participants with blindness. On the other hand, the result of this study is contrary to the findings of Tabrizi and Esmaili (2016) who found that a close relationship existed between emotional intelligence and achievement in English language of students with visual impairment.

5.0 Summary, Conclusion and Recommendations

This study determined the effect of assistive technology devices (Braille and audio-mediated instruction) on the achievement in English language of students with visual impairment in Abia state, Nigeria. Based on the findings, the study concluded that Braille and audio-mediated instruction are effective in enhancing achievement in English language

among students with visual impairment but pointed out that Braille was more effective than audio-mediated instruction. The result also revealed that gender and emotional intelligence had no effect on the achievement in English language of students with visual impairment.

- i. Teachers should use Braille and audio-mediated instruction in teaching students with visual impairment to enhance their achievement in English language in particular and their overall academic success.
- ii. Students with visual impairment should learn Braille and how to use audio-mediated instruction in special training centers and primary schools to use them for their studies.
- iii. The government should fund the provision of assistive technology devices such as Perkins Brailier, audio-mediated devices and other special equipment for students with visual impairment.

References

- Adamu, G.S. 2019. *Effect of English Language Comprehension on Achievement in Engineering Mathematics. International Journal of Scientific and Research Publications*. 9(2):306-310.
- Agesa, L. 2014. *Challenges Faced by Learners with Visual Impairments in Inclusive Setting in Trans-Nzoia County. Journal of Education and Practice*, 529: 115-119.
- Akpan, J.P. and Beard, L. 2013. *Overview of Assistive Technology Possibilities for Teachers to Enhance Academic Outcomes of all Students. Universal Journal of Educational Research*, 12:113-118.
- Alper, G.H. and Raharinirina, S. 2006. *Assistive Technology for Individuals with Disabilities: A Review and Synthesis of the Literature. Journal of special Education Technology*, 212:47-64.
- Athanasia, E., and Stavrows, P. 2015. *Teaching English as a foreign language to students with visual impairment. Teaching materials used by teachers of English. Proceedings of LEEAPVI, Athens, Greece*.

Bernable, N.N., Lei, D., McKerracher, A. and Orel-Bixler, D. 2019. *The Impact of Presentation Mode and Technology on Reading Comprehension among Blind and Sighted Individuals*. *Journal of Optometry and Vision Science*, 95(5):354-361.

Dietrich, S., Hertrich, I. and Ackermann, H. 2013. *Ultra-fast Speech Comprehension in Blind Subjects engages Primary Visual Cortex, Fusiform Gyrus and Pulvinar- a Functional Magnetic Resonance Imaging FMRI Study*. *Journal of Neuroscience*, 14:74.

Egwim, G. (2024). *Effect of Students Centered Learning Strategy on English Language Achievement of Students with Visual Impairment in Imo State, Nigeria*. *Journal of Educational Research in Developing Areas*, 5(2):129-138.

Elige, R. and Nwamtina, U. 2017. *Teaching Comprehension to the Blind*. *Journal of Elementary Education*, 42:139-155.

Garcia, L.G. 2017. *Reading Speed and Comprehension in Braille. A Paper Presented at the National Organization of Spanish Blind Conference University of Santiago De Compostela*.

Ikogor, C.I. 2016. *Impact of computer Assistive Technology on the Academic Achievement of SS one Students with Visual Impairment in Economics in school for the Blind, Gindri. A Research Project Submitted to the Department of Special Education and Rehabilitation Sciences, Faculty of Education, University of Jos in Partial Fulfillment of the Requirements for the Award of the Bachelor of Sciences B.sc. Ed Special of Education*.

Mayer, A.E., and Clibbens, W. I. 2009. *Effect of intelligence quotient, School environment factors and attitude to learning among students with visual impairment*. *Journal of Cognitive Neuroscience*, 5(2), 35–50.

Nashleanas, A.N. 2018. *Graph Accessibility and Comprehension for the Blind: A Challenge of its Own. A Dissertation Submitted to the Graduate Faculty in Partial Fulfillment of the Requirements for the Degree Doctor of Philosophy. IOWA State University Capstones*. Retrieved on 12/07/2019 from <https://lib.dr.iastate.edu/etd/16425.com>.

National Policy on Education. (2004). Section 7: Special Needs Education Abuja, Nigeria.

Oira, M. 2016. *Use of Modern Assistive Technology and its Effect on Educational Achievement of Students with Visual Impairment at Kibos Special Secondary School Kisumu County, Kenya. A Research Thesis Submitted in Partial Fulfillment of the Requirements for the Award of the Degree of Masters of Education Special Needs Education at Kenyatta University*.

Onuigbo, L.N. 2008. *Effect of Elaborative Rehearsal and self-Questioning Strategies on Reading Comprehension of Students with Visual Impairment in Enugu, Niger. A thesis Submitted to the Department of Educational Foundations, University of Nigeria, Nsukka, in Partial Fulfillment of the requirement of the Award of Doctor of Philosophy in Special Education*.

- Parker, O. 2004. *The Relationship between Emotional Intelligence and Academic Achievement of Students with Impairment*. *Journal of Cognitive Education*, 15:45-52.
- Peterson, R. 2015. *Students with Visual Impairment Braille Reading and Comprehension*. *Journal of cognitive research in Education and sciences*, 82:227-234.
- Radojichikj, D.D. 2015. *Students with visual impairments: Braille reading rate*. *International Journal of Cognitive Research in Science, Engineering and Education*, 31:1-5.
- Retorta, M.S. and Cristovao, V.L. 2017. *Visually-Impaired Brazilian Students Learning English with Smartphones: Overcome Limitations*. *Journal of Languages*, 212:2-27.
- Susanto, S. and Nanda, D.S. 2018. *Teaching and Learning English for Visually Impaired Students: An Ethnographic Case Study*. *Journal of English Review*, 71:83-92.
- Tabrizi, A.R. and Esmaeili. L. 2016. *The Relationship between the Emotional Intelligence and Reading Comprehension of Iranian EFL Impulsive versus Reflective Students*. *International Journal of English Language*, 66:221-229.
- Toledo, C.C., Paiva, A.G., Camilo, G.B., Sotto, Leite, I.C., and Guerr, M.R. 2010. *Early detection of visual impairment and its relation with school effectiveness*. *Journal of Medical Brazilian*, 56(4):415-419.
- Uwakwe, P. and Okorie, T. 2015. *Literacy for Students with visual impairment*. *Journal of Education Vocations*, 41:47-54.
- Williams, O. and Morris, R. 2013. *Emotional Intelligence, Self Efficacy and Braille Reading Comprehension*. *Journal of International Studies*, 34:33-41.

Instructions for Authors

WAJIAR provides a multidisciplinary forum for the publication of original research and technical papers, short communications, state-of-the-art developments in Information and communications technology, bio-medical informatics, computers, mathematics, control and information technology, physics, industrial electronics and engineering, Industrial chemistry, general technology, rocketry, space and astronomy, earth science, oceanography and the environment with special emphasis on the application of communications and information technology to these fields of importance in our modern civilization. The journal will review papers on advances, techniques, practice and application of information and communications technology in these areas.

- Economics, Statistics and Mathematics
- Information Technology & Applications
- Electronics and Computer Engineering
- Computer networks, Satellite & communications Engineering Research
- Industrial Computer applications Today
- Computer and Electro-Mechanical Maintenance
- GPRS and Remote Sensing
- Robotics ,Telemedicine & Remote Medical Monitoring
- Artificial Intelligence & Expert Systems Development & Applications
- Developments in Forensic Science Research
- Information Assurance & Network Security: The African Dilemma
- Space Information Systems & Rockery : Which way for Africa
- Video and Teleconferencing Innovations for Deployment in Africa
- Telecommunications Technology & 4G Applications
- Biotechnology
- Agriculture , Food Technology & Processing Environmental Technology & Impact Analysis
- E-Waste Management & Environmental Protection
- Management Science & Operations Research
- Wireless Technology, GSM and 4G Applications
- Alternative ,Grid and Green Energy Solutions for Africa
- Converting Academic Research in Tertiary Institutions for Industrial Production
- Nano Technology

WAJIAR is an international Journal of Science and Technology and is published quarterly in February, March, June, September and December.

Key Objectives:

provide avenue for the advancement, dissemination of scientific and technology research in the fields of science and technology with special emphasis on the deployment of Information & Communications Technology as an enabler and solution tool.

Versions:

Two versions of the journal will be published quarterly (electronic version posted in the web and hardcopy version).

Submission

Typescript and soft copy in MS-word format should be submitted by email to: info@wajiaredu.com.ng
Typescripts should be written in English, double-spaced and single-sided

on either Quarto or A4-sized sheets, and should be numbered beginning with the title page. The first page of an article should contain:

- i) The title of the paper, the name(s) and address(s) of the author(s)
- ii) A short title not exceeding 45 letters with space An abstract of 50-200 words should follow the title page on a separate sheet.

Text

Headings and subheadings for different sections of the paper (e.g. Introduction, Methods, Results, and Discussions) should be clearly indicated. Units of measurement, abbreviations and symbols should follow the international system of units (SI). Equations and formulae should be typewritten or word-processed. Equations should be numbered consecutively with Arabic numerals in parentheses on the right-hand side of the page. Special symbols should be identified in the margin.

Tables and Figures

Tables should be given short informative titles and should be numbered consecutively in Arabic numerals. Tables will be reproduced directly from the typed or word-processed softcopy. Figures in a form suitable for reproduction should be submitted separately from the text as original drawings in Indian ink, or as high contrast sharp photographs on glossy paper. Lettering on figures should be proportional to the size of the figure to ensure legibility after reduction. On the back of each figure, the orientation of the figure and the author and figure number should be cited consecutively in the text and a list of short descriptive captions should be provided at the end of the paper.

References

References should be cited in the text using a number in square brackets in order of appearance. The references are listed at the end of the paper in numerical order.

General Information Proofs: Proofs will be sent to the nominated author to check typesetting accuracy. No changes to the original manuscript are accepted at this stage. Proofs should be returned within seven days of receipt.

Reprints: Reprints may be ordered (pre-paid) at prices shown on the reprint order form which will be sent to the author together with the proofs. Page Charge: Please note that there will be a page charge of \$100 (One Hundred American Dollars only) for each article accepted for publication in the journal. Annual Subscription is pegged at \$125 per annum for two volumes. Electronic copies will be free access at our website. Subscription for the printed version will be completed via our Website www.wajiaredu.com.ng Subscriptions can also be sent via the journal's email address: <mailto:info@wajiaredu.com.ng>

