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Assistive Technologies Used in Teaching Adult Learners with Learning Disabilities in the 21st Century

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Abstract

The phenomenon of assessment and evaluation concerns all practitioners of education. Their predominant concern is accommodation of people with special needs, cultural issues and creating alternative practice with equivalent standard. This paper examined the various ways by which evaluation of adult learners with disabilities is enhanced using ultra-modern scientific devises with a view to creating assessment balance between the disabled and normal learners in a typical learning environment. The paper also gave a definition of learning disabilities and clear description of who the learning disabled are. The definition extended to technology of teaching and assessment and some of the devises on the basis of how they can be used to enhance the education and assessment of the disabled learners. The challenges inhibiting the use of these devises were highlighted upon which recommendations and conclusions were made.

Keywords: Adult Learners, Assessment, Learning Disabilities, Teaching, Technology.

Introduction

Education is a fundamental human right. Over the last decade, there has been increased focus on inclusive education, which aims to provide equitable access to education for all students, including those with disabilities (Dey & Bika, 2023). Assistive technology (AT) has been proven effective in enabling students with disabilities to access educational opportunities. AT consists of devices or software that help individuals work around challenges and enable them to learn, communicate, and function more successfully, (Jamie, 2021).

These special tools are designed to enhance the academic results, performance, and life-long learning of all individuals—not just learners with exceptional needs, but those in the general school system (Akpan & Beard, 2013). With the use of AT, people with disabilities and individuals who have specific educational or therapeutic requirements can function more effectively, (Lancioni et al., 2013), overcome challenges, and be provided the opportunity to learn and communicate (Adebisi, 2015). In the educational setting, AT offers numerous solutions to persistent problems, providing support to meet students' needs (McKnight and Davies, 2012).

The reading, writing, visual, auditory, and communication aids that students are supposed to master within the educational system can be classified as assistive technologies (ATs) (Day et al., 2011). There are high-tech and low-tech ATs, including desktop and laptop computers (Hersh, 2020). The World Health Organization (2006) indicated that ATs that improve mobility, hearing, vision, or communication abilities include wheelchairs, prostheses, hearing aids, visual aids, and specific computer software and hardware. The use of ATs such as braille, audio texts, magnifiers, and screen reading software can help students with visual impairment improve their reading abilities (Muradyan, 2023). The functional performance and academic progress of students with disabilities are improved or maintained through the use of AT (Alnahdi, 2014). In the context of

this study, ATs are any tools or devices that can serve as learning support for people with disabilities. AT allows students to access and participate cheerfully and autonomously in the educational process and is, therefore, a necessity for technical colleges. Technical colleges, in particular, may need to prepare for a rise in the use of AT as it offers students with disabilities practical, hands-on experiences that can enhance their career prospects. Technical colleges are concerned primarily with imparting vocational and technical skills for employment or self-employment (Vincent, 2022). Their educational programs include computers, business, agriculture, home economics, and technical fields. These programs also cover a variety of occupational trade fields, including auto mechanics, electrical and electronics jobs, carpentry and woodworking, bricklaying, agriculture, ornamental horticulture, forestry, catering, garment manufacture, cosmetology, and other areas of employ (Ariyo et al., 2020). Technical colleges contribute to increasing the effectiveness and efficiency of the educational system and provide young people with the skills and knowledge needed for employment in industry (Cong & Wang, 2012). In the face of unemployment and underemployment across Nigeria, technical education has become central, which implies the need to strengthen programs through the use of ATs and thereby enhance the functioning capacities of students with disabilities.

Concepts of Learning Disabilities (LD)

As per the Rights of Persons With Disabilities Act RPWD, (2016) "specific learning disabilities" means a heterogeneous group of conditions wherein there is a deficit in processing language, spoken or written, that may manifest itself as a difficulty to comprehend, speak, read, write, spell, or to do mathematical calculations and includes such conditions as perceptual disabilities, dyslexia, dysgraphia, dyscalculia, dyspraxia and developmental aphasia." However, learning disabilities do not include learning problems that are primarily the result of visual, hearing, or motor disabilities, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage. According to Nwokolo (2007), the term "Learning Disabilities" (LD), was first used

by Samuel Kirk in 1963 to describe children who have serious learning problems in schools, but no other obvious "handicap". In contemporary world, learning disability is widely recognized as special condition that has connection with human ability to learn through psychological process coordinated by the brain. Lere (2007), posited that learning disabilities are internal problems and that learners with these disabilities with difficulties in understanding or using language (spoken or written), imperfect ability to listen, think, speak, read, write, spell or do mathematical calculations. The term also includes such conditions as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia and dysphasia. From the foregoing therefore, LD is a generic term that refers to a manifestly group of disorders symptomized by significant difficulties in acquisition and application of skills in speech, reading, writing, arithmetic, reasoning and logic. In isolated cases, LD may be expressed as memory and concentration problem, impulsiveness, attention deficit, hyperactivity and poor social and interpersonal relations. Therefore, the term LD is used to refer to any retardation disorder or delayed maturation of the learner in one or more of the processes of speech, language, reading, writing, computational competencies or other school subjects caused by cerebral dysfunction, emotional or behavioural maladjustments.

Adult Learners

Adult learning refers to the education specifically targeting individuals who are regarded as adults by the society to which they belong to improve their technical or professional qualifications, further develop their technical abilities, enrich their knowledge with the purpose to complete a level of formal education or to acquire knowledge, skills, and competencies in a new field or to refresh or update their knowledge in a particular field (UNESCO-UNEVOC, 2013). From the above definition of adult learning, it is clear that adult learners are group of people or individuals, typically 25 or older, who engage in learning activities to enhance their knowledge, skills and personal or professional development. They are characterized by their diverse backgrounds, experiences and motivations for learning, often seeking education to advance their careers, change professions or pursue personal enrichment.

Dimensions of Learning Disabilities

The description of learning disabled person given above could be symptomatic of any of the following conditions listed below:

- Dyslexia: A language and spelling disorder

- Dyscalculia: A mathematics or computational disability
- Dysgraphia: A writing disorder resulting in poor handwriting and illegibility
- Dysphasia: A motor coordination disorder
- Non-Verbal Learning Disorder: Having difficulty in understanding non-verbal cues e.g, body language
- Visual Perception Disability: Inability to distinguish difference in shape (graphemes). One might rotate or reserve letters or numbers e.g. 6, 9, d, p, q, b.

Technology and Assessment of Adults with Learning Disabilities

There are a range of frameworks for understanding the use and adoption of technology. Adoption of technology models highlight the perceived benefits-cost analysis that potential users complete before adopting the use of a technological device. The most 8 CHY 8259 RCN 20020052 widely regarded model, the Technology Acceptance Model (TAM), was introduced by Fred Davis in 1986: it is an information systems theory that describes how an individual's willingness to accept technology is determined. TAM suggests that when an individual is introduced to a new technology that the perceived usefulness and perceived ease of use should be used as determinants of an individual's willingness to accept assistive technology (Silva, 2015). Additionally, Chen and Chan (2014) developed and tested a senior technology acceptance model (STAM), based on the acceptance of assistive technology by older adults in Hong Kong. The STAM further augmented previous technology acceptance models by factoring in the influence that age-related health abilities and characteristics of older adults may have on their willingness to accept and adopt new technologies. Chen and Chan (2014) found that the STAM could explain up to 68% of the variance observed in the older adults' use of technology. Moreover, they identified that age, gender, level of education, anxiety, health status, and ability (i.e., the functional physical, emotional, and mental capacity of an individual) were characteristics that influenced the acceptance of technology.

Additionally, it was noted that these factors were more reliable predictors of technology usage than the commonly utilized attitudinal factors that previous acceptance models tend to use, such as usefulness and ease of use. This indicates that it may be beneficial to consider both demographic and attitudinal factors when evaluating older adults' willingness to implement assistive technology and when developing promotions and guidelines for the provision of these devices. Tsertsidis and colleagues (2019) also identified six factors that influence an older person's likelihood of successfully integrating assistive technology into their life:(i) older adults' concerns and problems regarding technology, (ii) their previous positive experience 9 CHY 8259 RCN 20020052 with characteristics of technology, (iii) their experience of the benefits of technology, (iv) their willingness to use technology, (v) social influences (friends, family, and organizations), and (vi) the characteristics of the older adults (i.e., past experiences/attitudes, physical environment, etc.). Additionally, social influence, hedonic motivation (potential pleasure that can be derived from the technology), cost, habit, and trust have been identified as important factors to consider when promoting technology to older adults Charness & Boot, (2022), Shin and colleagues (2023) further identified a gap in the need for assistive technology and older adults' adoption of these assistive devices. They found low adoption of technology can be influenced by health status and age. Their study investigated the willingness of frail, prefrail and robust groups of South Korean older adults to utilize assistive technology. They found that similar factors (social influence, habit/familiarity, cost etc.) to previous research influenced older adults' willingness to implement assistive technologies in their lives. However, they identified that frailty impacted the acceptance of assistive technology, indicating that this should be considered when developing interventions and guidelines for the provision of assistive technology to ensure that all older adults (indiscriminate of their level of frailty) have access to the required assistive technology and education on the use

of this technology. Other research has indicated that the inclusion and involvement of older adults in the development of assistive technology devices and services can decrease the challenge of integrating this support into the lives of older adults. Ageism and negative stereotypes often limit older adults' inclusion in the design of assistive devices that are developed to support them and improve their quality of life. This can create a gap with the needs of older adults not being fully met, which can be a barrier to the use of assistive technology to enable independent living (Mannheim et al., 2019).

Defining Assistive Technology

The term assistive technology is used to describe a system or service that facilitates and creates opportunities for individuals to live independently despite chronic illness, disability, and/or declining health (Borg et al., 2011; WHO, 2018). Edyburn, (2004) further defines assistive technologies as having two distinct aspects: assistive technology devices and assistive technology services. Assistive technology devices refer to any equipment or product that enables the improvement and maintenance of an individual's functional capability. On the other hand, assistive technology services are any that directly enable an individual to acquire an assistive device. The WHO (2022) stated that the concept of assistive technology is often used as an umbrella term for assistive products and the systems and services that relate to them. Additionally, they describe assistive technology as including both physical and digital devices and that the definition of assistive technology changes depending on the context of the research or situation.

The varied definitions and the interchangeable use of different terminology to describe the same technologies and devices can be confusing and act as a barrier to older peoples' understanding of these devices. There are a considerable number of devices that fall under the purview of assistive technology. Types of assistive technology for older adults include intelligent robots, wearable (i.e.,

any kind of electronic device designed to be worn on the user's body), health monitors, phones, tablets, hearing aids and speech-to-text applications, (Song & Van Der Cammen, 2019). Electronic assistive technology (EAT) is considered a subgroup of assistive technology, and is the term used to describe an item, product, or system that is electronically powered. EAT includes telecare, telehealth, and ambient assisted living devices (i.e., includes smart devices, wireless networks, software application, computer, and medical sensors). Some EATs have been developed as product-service systems, such as the personal emergency response system (PERS), where a service can be triggered by an older adult in case of emergency, such as a fall, (Song & van der Cammen, 2019).

Moreover, the use of mobile health (mHealth) as a form of assistive technology has increased rapidly in recent years, with several applications (apps), such as digital management apps and electric calendars being particularly useful in aiding older adults with cognitive impairments such as dementia (Yousaf et al., 2020). A number of apps have also been identified to enable older adults to age positively at home including amplification apps such as Pocket Talker - a listening device for individuals who are hard of hearing - and Dragon Diction - a speech-to-text voice recognition app that can assist older adults who may have mobility and dexterity issues (Lesner & Klingler, 2011). Smartphones and tablets are particularly useful assistive devices that provide access to the aforementioned apps and aids to support older adults in various aspects of their lives. These devices enable easier communication with a variety of options (i.e., phone calls, texting, Skype, face time, etc.) and allow older adults to stay in contact with their family and friends. Additionally, smartphones provide an alternative means for patient contact with healthcare services and ensure older people with functional difficulties have access to health and wellbeing services WHO, (2022). In recent years there has also been a notable increase in the utilization of

wearable technologies as health monitors. These wearable have several different functions including a global positioning system (GPS), human activity recognition (i.e., track an individual's daily activities by monitoring raw data gathered by wearable sensors), and vital sign monitoring (i.e., a tool that helps provide information about the physiologic condition of the user). The information that these devices provide can be used to monitor older adults' social and environmental interactions and to enhance their quality of life, (Pramod, 2023). Smart watches provide insight into the wearers' daily activities, which can be interpreted depending on their health, habits, and characteristics. While these watches are not an adequate replacement for home-based care, the measurements that they provide can improve the care and safety of the older adults (Boletsis et al., 2015). Pendant alarms are another form of health monitoring that have been designed to enable older people to live safely and independently in their own homes. They were developed to be utilized in specific situations but remain inactive for most of the time, and act as a communication device between a wearer and third parties, should assistance be required. There are also pendant alarms that function as constant monitors for older people with specific chronic health conditions. These monitor health outputs of the wearer and alert if there is an incident (Lynch et al., 2022). It is clear that wearable technology has massive potential in enabling independent ageing for older people; however, there is a low adoption rate of these devices and further education and integration schemes for older people would be beneficial (Ma et al., 2022). Of note, assistive technology encompasses a broad spectrum of technology and there is some overlap with digital technologies. Many of the devices that are considered to the electronic assistive technologies also fall under the purview of digital technologies (Dixon & Michaud, 2018; Yousaf et al., 2020). However, digital technology is more concerned with the provision of healthcare rather than the technologies themselves (Varri, 2020).

Teaching and Assessment of Adult Learners with Learning Disabilities using Assistive Technology

ICT is a concept that has globally become appreciated. It is generally regarded as the fourth industrial revolution in the world. It has become the gateway to the modern information and communication super-highways, skills and orientation which distinguishes the world order. Assistive Technology in education can be understood as the application of digital apparatus to all aspects of teaching and assessment.

It is the combination of technologies for collecting, storing, processing, communicating and delivery of information related to teaching and learning process. Obanya (2002), posits that the spread and efficiency of ICT is critical to the achievement of educational goals.

Some of these assistive technologies used for assessment of learning disabled adults include but not limited to the following:

- The Keyboard
- Text Reading Systems (Text to Voice)
- Speech Recognition System
- Tape Records
- Reading Pen
- Talking Calculators
- Electronic Math Worksheet
- Colour Highlighters
- Word Prediction
- Spell Checkers

The Keyboard

This may be the best assistive tool for a learned disabled person who had difficulty with the needed coordination for good and legible handwork (dysgraphia), with pen or pencil. Taiwo (2008), was of the opinion that learners who find handwriting difficult or impossible, the use of keyboard might enable them to easily record their work.

Text Reading System (Text to Voice)

This technology allows text on screen to be read aloud through a computer's sound card. Hard copy text is scanned and converted to text file that can be read by software with optical Character Recognition (OCR). The computer then read the words aloud using a speech synthesizer.

Speech Recognition System

This is a device that enables the user to dictate the computer through a microphone converting oral language to written text. The speech recognition system are helpful to adults whose oral language proficiency is better than their written ability.

Tape Recorders

A learning disabled adult with difficulty in reading can listen to recorded texts like books, journals, newspapers etc. rather than reading them. This technology can be used to capture and record spoken words such as teacher's instructions or classroom lectures. Tape recorders enable the listener to play audio-taped texts faster or slower than it was originally recorded without losing its quality.

Reading Pen

The technology of a pocket-sized "reading pen" use an optical scanning system to allow adult learners scan single word on a hardcopy page and have the word read aloud with the aid of an in-built speech synthesizer. The pen is useful for spelling, word definition and reading texts.

Talking Calculators

Calculators are electronic devices used to solve mathematical, arithmetic or computational problems. By the use of keys, mathematical operations are effortlessly carried out with accuracy. Talking calculators use built-in synthesizer to call aloud numbers, symbols and operation keys as they are pressed. They also read answers from calculators.

Electronic Math Worksheet

This technology can assist adult learners to organize, align and solve basic mathematical problems on a computer screen. Mathematic operations like addition, subtraction, multiplication and division are entered via the keyboard or mouse and made to align to the correct vertical format. Nwabueze (2008), opines that the programme can assist persons who have difficulty in organizing and aligning mathematical problems with pen and paper.

Colour Highlighter

This technology assists adults with reading difficulties to distinguish words that are homonyms, homophones or homographs. These are words that share spelling and pronunciation but may have different meanings. E.g. death, dearth, depth. This device enables the learning disabled adults to highlight difficult words or sentences in different colours and make the reader to visually differentiate these words.

Word Prediction

This programme works together with word processors. Dubblels (2004), stated that the programme predicts the word a person intends to enter into the computer with the aid of a keyboard. The person types the first letter of a word and the programme offers a variety of words that begin with that letter. If the intended word appears on the list, it is then chosen, clicked and incorporated into the sentence. If otherwise, the person continues to type the next letter until the intended word appears.

Spell Checkers

A list of correctly spelt words will appear on the computer screen when the user clicks the right word. Spell and grammar checker is a future in the built-in word processor. Others offer a complete dictionary, yet some devices pronounce the words with a speech synthesizer, so the words can be heard as well as seen on the computer screen.

The Challenges of using Assistive Technology in Assessment of Adults Learners with Learning Disabilities

Despite awareness of the existence of assistive technology devices in assessment of learners with disabilities, its usage is faced with some challenges which include but not limited to the following:

- They are expensive and costly to acquire and maintain.
- Most of the teachers are not proficient in the use of these devices, others have poor knowledge of the technology that is suitable and adaptable for the disabled learners.
- Poor power supply to operate such devices. Most schools that are located in rural areas may not have a ready source of power. In other places, which are connected to the national grid, electricity supply is erratic.
- Assistive technology for assessment of learners with learning disabilities has not been fully integrated and appreciated in the education curriculum of most countries of the world.

Conclusion

For an effective teaching and assessment of persons with learning disabilities in the 21st century, effective and maximal mobilization and utilization of assistive technology cannot be overemphasized. The use of these assistive technologies will revolutionize the process of assessment of adult learners with learning disabilities if employed in the cause of teaching and learning involving this category of learners.

Recommendations

Based on the foregoing, the following recommendations are made:

1. The federal, state and local governments, Non-Governmental Organizations and public-spirited individuals should assist by purchasing these assistive technology devices and distribute same to schools for the benefit of learning disabled adults.
2. Capacity-building workshops, seminars and conferences should be organized for facilitators and adult learners with learning disabilities to expand their horizons and skills.
3. Generating sets, solar-powered electricity and inverter devices should be provided to ensure that these devices are constantly powered.

REFERENCES

Adebisi, R. O., Liman, N. A., & Longpoe, P. K. (2015). Using assistive technology in teaching children with learning disabilities in the 21st Century. *Journal of Education and Practice*, 6(24), 14–20. http://files.eric.ed.gov/fulltext/EJ1078825.pdf. 17/02/2023

Akpan, J. P., & Beard, L. A. (2013). Overview of Assistive technology possibilities for teachers to enhance academic outcomes of all students. *Universal Journal of Educational Research*, 1(2), 113–118. https://doi.org/10.13189/ujer.2013.010211

Alnahdi, G. (2014). Assistive technology in special education and the universal design for learning. *The Turkish Online Journal of Educational Technology*, 13(2), 18–23. http://www.tojet.net/articles/v13i2/1322.pdf

Aniefiok, U. (2008). The place of computer technology in facilitating the education of gifted children. *The Exceptional Child* (1) 187-193

Boletsis, C., McCallum, S., & Landmark, B. F. (2015). *The use of smart watches for health monitoring in home-based dementia care in human aspects of it for the aged population. design for everyday life*. First International Conference, ITAP 2015, Held as Part of HCI International 2015, Los Angeles, CA, USA, and August 2-7, 2015. Proceedings, Part II 1 (pp. 15-26). Springer International Publishing.

Borg, J., Larsson, S., & Östergren, P. O. (2011). The right to assistive technology: For whom, for what, and by whom? *Disability & Society, 26*(2), 151-167

Charness, N., & Boot, W. R. (2022). A grand challenge for psychology: Reducing the age-related digital divide. *Current Directions in Psychological Science, 31*(2), 187-193.

Chen, K., & Chan, A. H. S. (2014). Gerontechnology acceptance by elderly Hong Kong Chinese: A Senior Technology Acceptance Model (STAM). *Ergonomics, 57*(5), 635- 652.

Edyburn, D. L. (2004). Rethinking assistive technology. *Special Education Technology Practice, 5*(4), 16-23.

Harris, J., Mishra, P., & Koehler, M. (2009). Teachers' technological pedagogical content knowledge and learning activity types: Curriculum-based technology integration reframed. *Journal of Research on Technology in Education*, *41*(4), 393-416

Hersh, M. (2020). Technology for Inclusion [Background paper]. UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000373655 21/7/23

Lancioni, G. E., Sigafoos, J., O'Reilly, M. F., & Singh, N. B. (2013). Defining assistive technology and the target populations. In G. E. Lancioni, J. Sigafoos, M. F. O'Reilly, & N. B. Singh (Eds.). *Assistive Technology: Interventions for Individuals with Severe/Profound and Multiple Disabilities*, (pp. 1– 7). Springer. https://doi.org/10.1007/978-1-4614-4229-5_1

Lesner, S. A., & Klingler, M. (2011). Apps with amps: Mobile devices, hearing assistive technology, and older adults. *The ASHA Leader, 16*(12), 14-17.

Lynch, J., Hughes, G., Papoutsi, C., Wherton, J., & A'Court, C. (2022). It's no good but at least I've always got it round my neck: A post phenomenological analysis of assurance in assistive technology use by older people. *Social Science & Medicine, 292*, 114553.

Lere, M.M. (2007). Towards motivating the learning disabled child for maximal performance in the Nigerian school system. In Edozoji and J. M. Okuoyibo (Eds). *The practice and future of special education in Nigeria*. University of Jos: Department of Special Education and Rehabilitation Sciences. 478-487

Ma, Z., Gao, Q., & Yang, M. (2022). Adoption of wearable devices by older people: changes in use. *International Journal of Human-Computer Interaction*, DOI: 10.1080/10447318.2022.2083573. https://doi.org/10.1080/10447318.2022.2083573

Mannheim, I., Schwartz, E., Xi, W., Buttigieg, S. C., McDonnell-Naughton, M., Wouters, E. J., & Van Zaalen, Y. (2019). Inclusion of older adults in the research and design of digital technology. *International Journal of Environmental Research and Public Health, 16*(19), 37.

McKnight, L., & Davies, C. (2013). Current perspectives on assistive learning technologies: 2012 Review of research and challenges within the field. *The Kellogg College Centre for Research into Assistive Learning Technologies.* http://www.kellogg.ox.ac.uk/researchcentres/alt

Muradyan, S. (2023). Assistive technology for students with visual impairments. *Armenian Journal of Special Education*, 7(1), 77–88. https://doi.org/10.24234/se.v6i1.309

Nwabueze, J.N. (2008). Information and communication technology. A vehicle for enhancing the education of the disabled. *Journal of Learning Disabilities in Nigeria*. (JOLDIN) *vol.2*, No. 1. 9-15.

Obanya, P.A.I (2002). Financing the universal basic education (UBE) programme. In Maduewusi E.J. (ed.). *Financing of Education in Nigeria*- Ibadan NAE.

Okeke, B.A (2001*). Essentials of special education*. Enugu Afro-Orbis Publishers

Onuigbo, L.N. (2008). School barriers to integration of information technology in teaching of visually-impaired in Enugu State. *The Exceptional Child* 9(1) 122-129

Silva, P. (2015). Davis' technology acceptance model (TAM) (1989). Information seeking behavior and technology adoption: *Theories and Trends,* 205-219.

Shin, H. R., Um, S. R., Yoon, H. J., Choi, E. Y., Shin, W. C., Lee, H. Y., & Kim, Y. S. (2023). Comprehensive senior technology acceptance model of daily living assistive technology for older adults with frailty: Cross-sectional study. *Journal of Medical Internet Research*, 25, e41935.

Taiwo, S.A. (2008). Using ICT to support students with special needs: Issues involved. *The Exceptional Child.* 10(1) 61-69.

Tsertsidis, A., Kolkowska, E., & Hedström, K. (2019). Factors influencing seniors' acceptance of technology for ageing in place in the post-implementation stage: A literature review. *International journal of medical informatics*, 129, 324-333.

Värri, A. (2020). What is digital health? Review of definitions. In A. Varri *et al.* (Eds.) *Integrated citizen centered digital health and social care: Citizens as Data Producers and Service*. 275, 67.

Vincent, D. A. (2022). Effect of training platform on interest and academic performance in technical education among technical college students in Ondo-State, Nigeria. *Journal of Digital Learning and Education*, 2(3). 159–170. https://doi.org/10.52562/jdle.v2i3.429

World Health Organization. (2018). The global network for age-friendly cities and communities: Looking back over the last decade, Looking forward to the next (No. WHO/FWC/ALC/18.4). *World Health Organization.*

World Health Organization. (2022). Global report on assistive technology. https://www.who.int/publications/i/item/9789240049451

Yousaf, K., Mehmood, Z., Awan, I. A., Saba, T., Alharbey, R., Qadah, T., & Alrige, M. A. (2020). A comprehensive study of mobile-health based assistive technology for the healthcare of dementia and alzheimer's disease (AD). *Health Care Management Science, 23*, 287-309.