TECH FOR ELDERLY: CLOSING THE DIGITAL GENERATIONAL GAP

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A PROJECT SUBMITTED TO THE DEPARTMENT OF COMPUTER SCIENCE, FACULTY OF COMPUTING IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF SCIENCE (B.Sc.) DEGREE IN COMPUTER SCIENCE, UNIVERSITY OF BENIN, BENIN CITY, NIGERIA.

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DECLARATION

I, **ADAGHE GIFT**, do hereby declare that this thesis is entirely my own work and composition. The work embodied in the project has not been submitted for any degree and is not currently being submitted for any other degree. All references made to the works of other persons have been duly acknowledged

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ADAGHE GIFT **Date**

CERTIFICATION

This is to certify that this thesis was carried out by **ADAGHE GIFT** with Matriculation Number: **PSC1813775** of Department of Computer Science, Faculty of Computing, University of Benin, Benin City, Edo State, Nigeria.

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DEDICATION

This project is dedicated to God Almighty

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ABSTRACT

In the 21st century, digital technology has become deeply embedded in nearly every aspect of daily life from communication and commerce to healthcare and education. While younger generations have adapted rapidly to this digital transformation, many elderly individuals remain on the margins of the digital world. This generational divide has created a significant barrier to inclusion, autonomy and access to essential services for older adults. The inability to navigate digital platforms not only limits their participation in modern society but also exacerbates feelings of isolation, dependence and vulnerability. This project investigates the multifaceted challenges that elderly populations face in adopting and using digital technologies. These challenges include physical limitations such as impaired vision and motor skills, cognitive barriers like memory decline and unfamiliarity with digital interfaces and socio-economic factors such as lack of access to devices or internet connectivity. The study also explores the psychological impacts of digital exclusion, including reduced self-esteem, social withdrawal and increased mental health risks. The research further examines how emerging technologies such as voice activated assistants, simplified user interfaces and wearable health devices can be tailored to meet the needs of older adults. It also considers the role of caregivers, family members and community organizations in supporting digital adoption among seniors. Ultimately, this project argues that closing the digital generational gap is not merely a technical challenge but a social imperative. By fostering inclusive design, empathetic education and supportive ecosystems, society can empower elderly individuals to engage meaningfully with technology. Through inclusive design and community driven support, this project envisions a future where older adults actively participate in the digital world, fostering equity and stronger bonds across generations.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The 21st century has ushered in a digital revolution that has transformed nearly every aspect of human life. From communication and commerce to healthcare and education, digital technologies have become indispensable tools for navigating modern society. Smartphones, internet platforms, wearable devices, and smart home systems are now embedded in daily routines, offering convenience, efficiency, and connectivity. However, while younger generations have adapted seamlessly to these innovations, a significant portion of the elderly population remains digitally excluded. This exclusion has given rise to what scholars and practitioners refer to as the digital generational gap. A disparity in access, literacy, and engagement with technology between older and younger age groups (Xu et al., 2024).

The digital generational gap is not merely a technological issue; it is a social and developmental challenge with far-reaching implications. Older adults often face barriers to technology adoption due to physical limitations (e.g., impaired vision, reduced motor skills), cognitive decline (e.g. memory loss, slower processing), and psychological resistance (e.g. fear of failure, low self-confidence). These challenges are compounded by socio-economic factors such as limited access to devices, lack of internet connectivity and absence of structured digital literacy programs. In many developing countries, including Nigeria, infrastructural deficits and cultural perceptions further widen the gap, leaving many elderly individuals disconnected from the digital world.

One emerging field that seeks to address these challenges is Gerontechnology a multidisciplinary domain that combines gerontology (the study of aging) with technology. Gerontechnology focuses on designing and implementing technological solutions that enhance the quality of life, independence and social participation of older adults. It encompasses innovations in healthcare (e.g. telemedicine, health monitoring), communication (e.g. video

calling, voice assistants), mobility (e.g. GPS tracking, smart walkers), and safety (e.g. emergency alert systems, fall detection). By aligning technological development with the needs and capabilities of aging populations, Gerontechnology offers a framework for inclusive digital transformation (Bouma et al., 2007).

In Nigeria, the digital divide among the elderly is particularly pronounced. While mobile penetration and internet access have grown rapidly in urban centres, many seniors especially in rural and semi-urban areas remain disconnected. Even among those with access to devices, digital literacy is often low, and usage is limited to basic functions such as voice calls or SMS. The lack of age-friendly interfaces, culturally relevant training programs, and supportive policies contributes to this exclusion. For example, many banking apps and government portals are designed with younger users in mind, featuring complex navigation and small text that are difficult for older adults to use. As a result, seniors often rely on younger family members to perform digital tasks, which can undermine their autonomy and self-esteem.

The consequences of digital exclusion are profound. Elderly individuals who are unable to engage with technology may struggle to access healthcare services, manage finances, communicate with loved ones, or participate in civic activities. This exclusion can lead to increased isolation, depression, and dependency. Conversely, studies have shown that when seniors are empowered to use digital tools, they experience improved mental health, greater social connectivity, and enhanced quality of life. For instance, in Sweden, government-funded digital literacy programs have enabled over 80% of seniors aged 65 and above to use the internet daily (Statista, 2023). 70% smartphone adoption rate among elderly citizens, up from 40% in 2015 (International Telecommunication Union [ITU], 2023). In Japan, “Silver ICT” centres provide targeted training that has significantly increased smartphone adoption amongst older adults (ITU, 2023).

In the United States, initiatives such as AARP's "Senior Planet" offer free tech classes that help seniors navigate digital platforms confidently. Pew Research (2023) reports that 68% of Americans aged 65+ now own smartphones, a significant increase from previous years. These examples demonstrate that with the right support, older adults can become active participants in the digital age. They also highlight the importance of culturally sensitive, age-appropriate interventions that address both technical and emotional barriers to adoption.

The digital transformation of society has brought about unprecedented changes in how individuals interact, work, and access essential services. From mobile banking and e-commerce to telemedicine and virtual learning, digital platforms have become integral to daily life. However, this transformation has not been evenly distributed across age groups. While younger generations often referred to as digital natives have embraced technology with ease, older adults frequently find themselves excluded from this digital evolution. This exclusion is not simply a matter of age; it reflects a complex interplay of physical, cognitive, economic, and cultural factors that contribute to the digital generational gap (Francis et al., 2019).

In developing countries like Nigeria, the digital divide is particularly pronounced. Although mobile phone penetration has increased significantly, internet access remains uneven, especially in rural and underserved communities. According to the Nigerian Communications Commission (NCC), smartphone usage among adults aged 60 and above is still below 30%, compared to over 80% among younger adults. This disparity is exacerbated by low digital literacy, limited access to training programs, and the absence of age-friendly digital infrastructure. Many elderly individuals are unfamiliar with basic digital concepts such as app navigation, online security, and virtual communication tools, which hinders their ability to participate fully in the digital economy (Arieli et al., 2023).

Cultural perceptions also play a role in shaping the digital experiences of older adults. In some communities, technology is viewed as a domain reserved for the young, leading to internalized

beliefs among seniors that they are “too old” to learn or adapt. This mindset can discourage engagement and reinforce feelings of inadequacy. Moreover, the rapid pace of technological change frequent updates, new devices, and evolving platforms can overwhelm older users, especially those with limited exposure to digital tools during their formative years (Francis et al., 2019).

Gerontechnology, a field that merges gerontology and technology, offers a promising framework for addressing these challenges. It emphasizes the development of technologies that are tailored to the needs of aging populations, focusing on usability, accessibility, and relevance. This technology encompasses a wide range of innovations, including:

- Health technologies such as wearable monitors, telemedicine platforms, and medication reminders.
- Communication tools like voice-activated assistants, simplified messaging apps, and video calling interfaces.
- Safety systems including fall detection sensors, emergency alert devices, and smart home automation.
- Mobility aids such as GPS-enabled walking sticks and electric wheelchairs with navigation support (Arieli et al., 2023).

In Nigeria, however, such initiatives are still in their infancy. While some NGOs and community groups have launched digital inclusion programs for seniors, these efforts are often limited in scope and reach. There is a pressing need for coordinated national strategies that prioritize digital equity for older adults. This includes investing in infrastructure, developing age-friendly technologies, and creating culturally sensitive training programs that respect the learning pace and preferences of elderly users.

The social implications of digital exclusion are profound. Seniors who lack access to technology may experience increased isolation, reduced autonomy, and limited access to

healthcare and financial services. During the COVID-19 pandemic, for example, many elderly individuals were unable to access telehealth consultations or digital banking services, highlighting the urgency of digital inclusion. Conversely, when seniors are empowered to use technology, they report improved mental health, stronger social connections, and greater independence (Francis et al., 2019; Arieli et al., 2023).

Economic participation is another critical dimension. As governments and businesses shift toward digital service delivery, seniors who are digitally excluded may struggle to access pensions, pay bills, or engage in e-commerce. This not only affects their financial well-being but also limits their ability to contribute to the economy. By promoting digital literacy and inclusion, societies can unlock the potential of older adults as active participants in the digital economy.

Intergenerational learning has emerged as a powerful tool for bridging the digital generational gap. Programs that pair younger individuals with seniors for tech training foster mutual respect, empathy, and knowledge exchange. These initiatives not only enhance digital skills but also strengthen social bonds across generations. A recent scoping review by Ahmad et al. (2025) found that intergenerational strategies significantly improve digital literacy and confidence among older adults.

This study seeks to explore the digital generational gap in Nigeria, with a focus on elderly populations in urban and semi-urban settings. It aims to identify the key barriers to technology adoption, analyse the psychological and social impacts of digital exclusion, and evaluate global best practices that can be adapted to the Nigerian context. By integrating insights from Gerontechnology, community-based learning, and intergenerational support, the study will propose sustainable strategies for promoting digital inclusion among older adults.

Ultimately, bridging the digital generational gap is not just a matter of teaching seniors how to use smartphones or apps it is about fostering dignity, independence, and social equity. As

population's age and technology continues to evolve, it is imperative that societies invest in inclusive digital ecosystems that empower all citizens, regardless of age. This project contributes to that vision by offering a comprehensive analysis of the challenges and opportunities involved in closing the digital generational gap.

In conclusion, the digital generational gap is a multifaceted issue that demands a holistic response. It is not enough to provide devices or internet access; there must be intentional efforts to design inclusive technologies, deliver targeted education, and build supportive ecosystems. This study aims to explore these dimensions in depth, with a focus on the Nigerian context. By drawing on global best practices and the principles of Gerontechnology, the research will propose actionable strategies for closing the digital generational gap and ensuring that older adults are not left behind in the digital age.

1.2 Statement of problem

The rapid digitalization of society has created opportunities in healthcare, finance, communication, and education, yet many elderly individuals remain excluded due to the digital generational gap. In Nigeria, smartphone penetration among seniors is below 30%, compared to over 80% among younger adults (NCC, 2023). Barriers such as poor digital literacy, complex platform design, cultural perceptions that technology is "for the young," and limited training programs prevent older adults from engaging fully with digital tools (Francis et al., 2019; Arieli et al., 2023).

This exclusion has serious consequences:

- Socially – increased isolation and reduced communication.
- Psychologically – frustration, low self-esteem, and depression.
- Economically – limited access to pensions, banking, and e-commerce.
- Health-wise – restricted use of telemedicine and health-monitoring devices (ITU, 2023).

While countries like Japan and Sweden have implemented national strategies to promote digital inclusion, Nigeria's efforts remain fragmented. Without coordinated interventions, the gap will continue to widen, marginalizing seniors and undermining social equity. This study therefore seeks to identify barriers, analyse global best practices, and propose strategies rooted in Gerontechnology and intergenerational learning to ensure older adults are not left behind in the digital age.

1.3 Aims and Objectives

The primary aim of this study is to investigate the barriers that hinder elderly individuals from adopting digital technologies and to propose sustainable strategies rooted in Gerontechnology, inclusive design, and intergenerational learning that can bridge the digital generational gap in Nigeria. The study seeks to promote digital equity, enhance autonomy, and improve the quality of life for older adults.

To achieve this aim, the study will pursue the following objectives:

- Identify barriers: Examine the physical, cognitive socio-economic, and cultural challenges that prevent elderly individuals from engaging with digital technologies (Francis et al., 2019).
- Assess social and psychological impact: Analyse how digital exclusion affects the mental health, social connectivity, and autonomy of older adults (Arieli et al., 2023).
- Evaluate global best practices: Review successful interventions from countries such as Japan, Sweden, and the United States, focusing on digital literacy programs, age-friendly design, and policy frameworks (ITU, 2023; Statista, 2023).
- Explore the role of gernotechnology: Investigate how innovations in health monitoring, communication tools, safety systems, and mobility aids can support aging populations (Bouma et al., 2007).

- Propose context specific strategies for Nigeria: Recommend practical solutions tailored to Nigeria's socio-cultural and infrastructural realities, including community-based training and intergenerational mentorship (Ahmad et al., 2025).
- Promote inclusive digital ecosystem: Advocate for policies and programs that ensure older adults are active participants in the digital age, thereby reducing inequality and fostering social inclusion.

1.4 Research Questions

- What are the key challenges elderly individuals face in adopting digital technologies?
- How digital exclusion does affects their wellbeing and autonomy?
- What role can gernotechnology play in bridging the gap?
- What global practice can be adapted to the Nigerian context?

1.5 significance of study

This study is significant for;

- Policy Makers: Informing inclusive digital policies
- Tech developers: Designing age friendly interfaces
- Education and NGOs: Launching digital literacy programs
- Family and caregivers: Supporting elderly tech use.

1.6 Scope of Study

This study focuses on individuals aged 60 and above, examining their interaction with digital technologies such as smartphones, internet services, and health-monitoring devices. While global examples are referenced, the primary focus is on Nigeria's urban and semi-urban elderly populations.

1.7 Limitations of study

Like any research, this study has its boundaries. First, it focuses mainly on Nigeria's urban and semi-urban elderly, so rural realities may not be fully captured. Second, the diversity of older adults different education levels, incomes, and health conditions means the findings cannot

represent every senior's experience. Third, reliable data on digital literacy among Nigerian seniors is limited, so the study relies on smaller surveys and secondary sources. Another limitation is the scope of technology considered. The study looks mostly at everyday tools like smartphones, apps, and health devices, while advanced technologies such as robotics or AI in elder care are only briefly mentioned. Cultural beliefs about aging and technology, which vary widely across communities, may also influence adoption in ways this study cannot fully cover. Finally, because technology changes so quickly, the findings reflect current realities but may not hold in the long term without continuous updates. This study shines a light on the digital struggles of older adults, but it cannot cover every angle especially rural life, all cultural differences, or future tech changes. It's a starting point, not the final word.

CHAPTER TWO

LITERATURE REVIEW

2.1 Understanding the Generational Gap

The digital generational gap is the lived distance between comfort and hesitation with technology. It narrows when learning feels safe, design feels friendly, and use cases feel meaningful. It widens when screens feel hostile, help is hard to find, and the norms of communication aren't explained. In communities where families, schools, and local centres lean in teaching patiently, designing accessibly and celebrating small wins the gap becomes a bridge. To elaborate more on this it is also a very huge space both practical and emotional between how younger and older people experience technology. Younger folks often speak the "native language" of apps and platforms because they grew up with them; older adults met this world later, usually with fewer chances to learn at their own pace (Francis et al., 2019).

The gap isn't simply age it's a mosaic of confidence, exposure, design, cost, and culture. When you see a grandparent hesitate to tap a button or fear "breaking" a phone, that's the gap in action. When a teenager solves a tech hurdle without thinking, that's the other side of the same story. Digital literacy for older adults is emotional as much as technical. It's about feeling welcome. When seniors learn with someone they trust, in an environment that respects their pace, they move from avoidance to curiosity. Intergenerational mentoring grandchildren teaching grandparents, youth volunteering at community centers does more than transfer skills; it restores belonging and dignity in a digital-first world. Digital platforms come with new etiquette: read receipts, reactions, GIFs, and emoji's. Misreads are common. A crying emoji can signal "laughing hard" to a teen but "are you upset?" to a grandparent. These tiny misunderstandings add up, creating friction and self-doubt for older adults who already feel they're "doing it wrong." Naming these differences and teaching their meanings gently reduces confusion and stigma. Everyday reality has a massive effect and contributes to the expansion

of this gap, youth with different retrospect in how they teach the seniors or try as much as possible to make them get along with the tech is sometimes frustrating and exhausting to the younger generation hence they tend to run away from them due to the seniors constant disturbance and this in return makes the seniors feel so much shame. Also there are other factors that also contribute to this everyday reality (Adaghe et al., 2026)

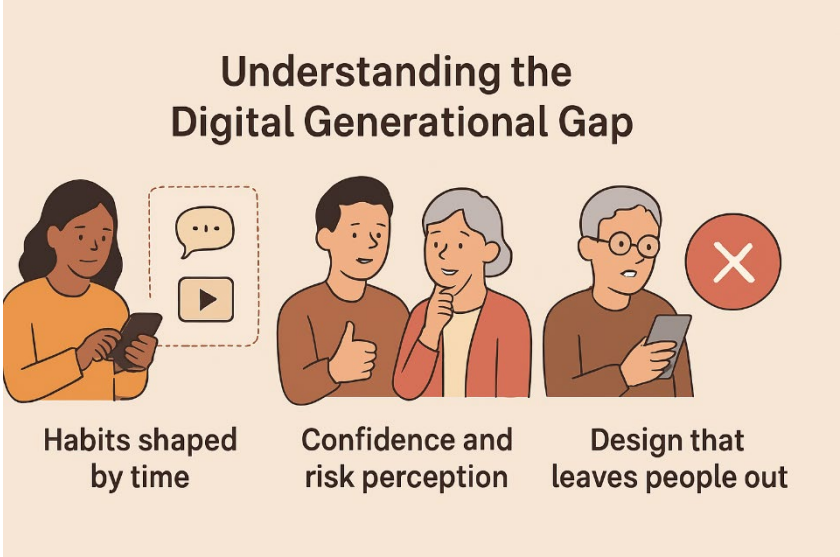

Fig 2.1 Showing the Gap Technology has created

Habits shaped by time: The younger generation defaults to chats, emoji's and short form video. Many older adults defaults to phone calls, letters or face to face talks. When the norms of communication change older adults can feel out of step and excluded unless someone bridges the norms for them.

Confidence and risk perception: Seniors often approach digital task with caution; "what if I press the wrong thing?" Youths often approach them with trial and error confidence. That difference in attitude caution vs experimentation shapes adoption and speed of learning.

Design that leaves people out: Small fonts, busy screens and hidden settings quietly tells older users "This wasn't made for me" Accessible design, larger text, clear language and guided steps can close the gap fast, especially when paired with patient teaching.

Nigeria's digital revolution is reshaping family life. Social media, WhatsApp, and video calls help connect relatives across cities and diaspora. At the same time, uneven connectivity, device costs, and digital confidence can pull older adults to the margins of these conversations. Where families invest in patient teaching showing how to join group chats, send voice notes, or video call grandchildren the gap shrinks and intergenerational ties strengthen. We are also going to talk about how this helps locally

- Simple familiar use cases: Teaching seniors to send voice notes (easier than typing) check church or community updates or join family groups can help seniors locally.
- Community learning spaces: Churches, mosques and town halls are safe place to learn with peers at a comfortable space and also relationship between families can also strengthen intrest in learning.
- Language and clarity: Step by step guide in local languages reduces intimidation and build pride in learning.

We will also look at how and what could possibly close this enormous gap to ensure that every senior is carried along and also the best and most efficient way possible to manage this gap and reduce it to minimal

First we will start with relevance: How relevant it is for a senior to hit a milestone and infuse some type of reward for a simple task such as making the seniors first win personal for example teaching the senior how to make a video call out to someone or a loved one, receiving emails and reading them, how to on their internet data, share a hotspot, make a call, save contacts, making a bank transfer, paying a utility bill safely and many more. The reason for this is to turn learning into purpose and purpose sustains practice with a good reward attached to it.

To teach the rule of the road: To teach seniors the basic etiquette, safety awareness, privacy practices and confidence in navigation for example teaching seniors how to use basic tools like

the keyboards on the screen of the device, emoji's, reactions, scam awareness with this confidence grows knowing that the seniors knows whats normal and safe.

Design for dignity: Here devices are designed with an interface that fits all seniors in a way that it builds that assurance that yes they belong in this world and this device is for them for example such as Voice commands with dialect enable sequence for their AI, Big text, high contrast, user friendly interface, fewer steps, clear labels etc. which reduces or eliminates fear and fatigue.

2.2 Barriers to Technology Adoption

Technology promises convenience, connection, and empowerment. Yet for many older adults, it feels more like a locked door than an open invitation. Understanding the barriers that prevent seniors from embracing digital tools is essential if we want to close the generational gap. These barriers are not just technical they are physical, psychological, social, cultural, and economic. Each one shapes how older adults perceive and interact with technology, and together they explain why adoption remains slow. There so many limitations that causes these barriers to seniors adopting to technology (Bouma et al., 2007).

Physical barriers such as aging brings natural changes to the body of a senior and these changes often clashes with the design of modern devices such barriers also include vision challenges where smart phones and apps often use small fonts, icons and low contrast colours. For someone with a declining eye sight, reading text or navigating banking apps can feel like deciphering a puzzle. We also have hearing difficulties such difficulties includes voice instructions, alert, notifications may be too soft and unclear to seniors with hearing loss may miss important cues. How about reduced motor skills which involves movement of the body or parts of the body such as arthritis, tremors or slower reflexes make swiping, tapping or typing difficult even to entering passwords can become difficult and a frustrating ordeal to seniors. Let's look at scenarios such as an elderly person with any of these deficiencies struggles to

type passwords on their devices correctly, after several failed attempts the device gets locked or accounts gets locked instead of feeling empowered the person feels defeated and can lose the will to even live. This is not the senior's failure it's a failure of design.

Cognitive barriers has to do with technology that requires memory, focus and problem solving. For older people or seniors, cognitive changes can make this harder and the following are some or most of the causes of this barriers.

- Memory challenges: Remembering multiple passwords, navigating steps or app layouts can be overwhelming so this way one can come up with designs that can help to cover that gap or barrier.
- Information overload: Here modern aps bombard users with icons, menus and notifications. Seniors may feel lost in the clutter as it would be somehow hard to comprehend.
- Learning Curve: Learning is a very difficult stage especially when you have old people it actually depend on the stages of comprehension in different seniors, unlike younger generations who experiment freely seniors need structured, step by step guidance to be able to learn how the modern technology works and need repeated guidance and tutor for them to finally understand. Let's take for example my mum who is over 50 years to 60 years of age can learn how to send WhatsApp messages from her phone the next day or even the next minute she has forgotten the steps. So without patience reinforcement, she may give up altogether.

2.2.1 Psychological barriers:

Technology isn't just all about skill and technical knowhow, it's about confidence and mindset and it's almost impossible for a senior to adapt if the confidence and the mindset isn't restored in them and in which there are factors responsible for this

- Fear of breaking something: seniors are always afraid when they see something they haven't seen before so they worry that pressing the wrong button will damage the device or erase data or make the system even confused than themselves.
- Low confidence: This is very rampant with seniors past failures reinforces the belief that "technology is not for me" this can eliminated by letting them know that there aren't different from the younger generation.
- Anxiety about Fraud: The new trend of fraudsters everywhere in the society most especially in Nigeria where some irresponsible younger generation take advantage of the seniors to rip them off of their hard earned money or belongings. Seniors often hear stories of scams and identity theft, which makes them hesitant to engage online. There are cases or examples in our society where a retiree avoids online banking because she fears hackers will steal her money Even if the system is secure, her perception of risk outweighs the potential benefits.

2.2.2 Socio economic Barriers:

Access to technology is shaped by income, education and infrastructure. These is one barrier that has an effect on how the seniors use or want to embrace technology such as

- Cost of devices: This alone even affect younger generation as the cost of getting this device is expensive, as for the seniors it changes their mindset to actually want to buy such devices because during their time it might be expensive as it is now. Smartphones, tablets and laptops are expensive, especially for seniors living on low stream of income. Some seniors have this devices by gifts from their kids by chance.
- Internet affordability: this is another big block as data plans can be costly and many seniors prioritize food and healthcare over connectivity.

- Educational Backgrounds: This is another major barrier as some seniors didn't even attend schools or aren't educated, seniors with limited formal education may find digital literacy harder to acquire.
- Infrastructure Gaps: In rural areas of Nigeria, poor network coverage makes digital adoption nearly impossible.

Let's look at cases of farmers in rural villages may own a basic phone but cannot afford a smartphone or data plan. Even if he wants to learn, the infrastructure is not there to support him.

2.2.3 Design Barriers:

In today's world digital platforms or technology is built with the younger generation users in mind, seniors are often an afterthought and there are other factors that also create such barrier. These are accompanied by

- Complex Interfaces: where multiple menus, hidden settings and technical jargons discourage older users.
- Small text and icons: Poor accessibility features make navigation difficult.
- Fast Updates: Apps change frequently due to updates forcing seniors to relearn functions which can be very frustrating and hard.
- Lack of personalisation: Few apps allow seniors to adjust layouts, simplify menus or enlarge text easily.

There are cases where seniors may learn how to order groceries online, but after the app updates the checkout button moves, suddenly they feel lost again.

2.2.4 Cultural and social barriers:

Culture shapes how people view technology in many communities seniors see digital tools as for the young. There are a lot of perceptions around this school of thoughts such as

- Perceptions of ageing: Some elders believe learning technology is unnecessary or inappropriate at their stage of life.
- Dependence on family: seniors may rely on children or grandchildren to handle digital task, reinforcing dependency.
- Community Norms: In traditional settings, face to face I nteraction is valued more than digital communication and they even take it as evidence as it events are well recorded in their memory and in their hearts forever even if they die they will still remember in the spiritual realm.

Such examples are when a senior may prefer visiting the bank physically because it feels more trustworthy than online transactions, even if digitals banking is faster and safer (Bouma et al., 2007).

2.2.5 Emotional and social consequences:

These barriers do more than block access to a lot of abilities in seniors in as much as there are these barriers and the present a threat to them it will be difficult to change whatever mindset these seniors have which affects their dignity, independence and belongings. There are also some factors that makes this visible such as

- Isolation: Seniors excluded from digital platforms miss family updates, community news and social connections, we can also add the fact that seniors are sometimes usually alone so that kills the interest to adapt or the motivation to learn.
- Frustration: Repeated failures create anger and embarrassment especially when a senior has pride and the fact that they are always on their own and don't want to bother anyone with their issues.
- Loss of autonomy: Dependency on others for digital task undermines self-confidence.
- Generational Divide: Senior may feel alienated from younger relatives who live in a digital first world.

There are instances where a grandmother may miss her granddaughter's graduation livestream because she doesn't know how to access youtube. The emotional cost is greater than the technical one.

2.3 The Nigerian Context

Nigeria presents unique challenges these challenges have actually contributed to seniors not been able to close the digital gap.

- Urban vs rural divide: There is this unknown gap between the urban and rural comparison due to exposure in technology where urban seniors may have access to devices and training, while rural elders remain disconnected.
- Language Barriers: Many apps are in English, leaving seniors who speak only local languages excluded.
- Infrastructural gaps: Power outages and poor internet coverage limit consistent use.
- Economic realities: With high poverty rates, digital adoption is often seen as a luxury.

Despite the challenges, Nigeria also has opportunities, community centres, churches, mosques and town halls can serve as training hubs for intergenerational learning where youth teach elders and can bridge the cultural and technical gaps (Adaghe et al., 2026)

2.4 Strategies to overcome Barriers:

There are different strategies to overcome this barriers and gaps that has made it difficult for seniors to move with the trend in technology and this has created a huge gap between the elderly and the younger ones. Understanding these barriers is the first step to overcoming them and also requires practical and less stress free solutions.

- Accessible designs: This can help solve some of the major barriers for seniors as it is also one of the underlying barriers that makes it difficult for seniors to move with the trends till they are ready to pass away. Larger text fonts, voice and dialect based commands and simplified layout in dialect or layouts can help to bridge the gap.

- Affordable Access: Access to the basic technology and easy learning platforms to ease learning should be made available for seniors to meet up with the gap that's been created which includes cheap and available internet service providers or internet access, subsidized devices and free Wi-Fi in every location, fast and dialect compactible AI for fast solutions and for better understanding.
- Tailored Trainings: step by step guide or lesson in local dialects or languages can help bridge the gaps another angle to also look into is AI that is built with any language base or dialect base that will speak and teach to the elderly in a way that the can understand and solve issues in the best way possible on their devices.
- Intergenerational mentorship: Youth teaching elders in a friendly way and understands their predicament with so much empathy to build skills and strengthen bonds and confidence.
- Policy support: with the aid of foreign bodies, organisations and government support or initiative can promote digital inclusion in societies and beyond.

Barriers to technology adoption among older adults are complex and interconnected. Physical limitations, cognitive changes, psychological fears, socio-economic realities, poor design and cultural perceptions all play a role. In Nigeria, these challenges are intensified by infrastructural and economic constraints. Yet, with inclusive design, affordable access and community driven support, these barriers can be reduced. The key is to treat seniors not as passive users but as active participants in the digital age worthy of dignity, patience and empowerment.

2.5 Social and Psychological Impacts of Digital Exclusion

Technology is more than convenience, its connection. For older adults, being digitally excluded doesn't just mean missing out on apps or websites; it means missing out on relationships, services and a sense of belonging. As society becomes increasingly digital, seniors who lack

access or skills face emotional and social consequences that affect their well-being. There are factors that makes the digital exclusion gap possible and they are as follows

2.5.1 Psychological Impacts

Psychological impact has a huge effect on the way older adults who are digitally excluded report higher levels of psychological distress. A 2025 study published in *Health Data Science* found that seniors without internet access were significantly more likely to develop depressive symptoms, especially those with limited family support or lower income. The inability to participate in online activities like video calls, social media, or digital banking can lead to feelings of helplessness, frustrations and how they see the technological world as it is now. There are factors that contribute to making this gap widen even more than it is now if this issues are not been controlled and taken care of such impacts are

- Reduced self-esteem and confidence: When seniors struggle with technology, they often internalize the failure. They may feel "too old to learn" or embarrassed to ask for help. This erosion of confidence can discourage further attempts to engage digitally, reinforcing the cycle of exclusion.
- Fear and mistrust of digital platforms: Many older adults associate the internet with scams, fraud, and misinformation. Without proper guidance, this fear can evolve into avoidance. A study in *Frontiers in Psychology* highlighted how psychological resistance rooted in fear and unfamiliarity was a major barrier to digital engagement among seniors (Adaghe et al., 2026).

2.5.2 Social Impact

- Loneliness and isolation: Digital exclusion cuts seniors off from the primary mode of modern communication. A 2025 panel study published in *BMC Geriatrics* revealed a strong link between digital exclusion and loneliness among older adults across three countries. Those who couldn't use the internet were more likely to feel socially

disconnected, especially during events like the COVID-19 pandemic when physical contact was limited.

- Reduced access to services and information: Many essential services healthcare, banking, government support are now online. Seniors who can't navigate these platforms may miss appointments, struggle with payments, or fail to access benefits. This not only affects their independence but also their dignity.
- Weakening of family ties: In families where younger members communicate primarily through digital channels, seniors may feel left out. They miss photo updates, group chats, and video calls. Over time, this exclusion can create emotional distance even within close-knit families.

In Nigeria, digital exclusion among seniors is intensified by infrastructural and economic challenges. Many older adults live in areas with poor internet coverage, limited electricity and low digital literacy. Language barriers also play a role as most apps are in English, leaving out seniors who speak only local languages. Culturally, some elders view technology as "for the young," which discourages them from trying. This belief, combined with limited access and training, creates a deep divide. Without targeted interventions, many Nigerian seniors risk being permanently left out of the digital conversation (Adaghe et al., 2026).

2.6 Gerontechnology: A Pathway to Inclusion

Gerontechnology is the marriage of two worlds: **gerontology** (the study of aging) and **technology**. Its purpose is simple but powerful designing tools and systems that meet the unique needs of older adults. Unlike mainstream technology, which often assumes speed, sharp vision, and digital fluency, gerontechnology starts with empathy. It asks: *How can we make technology serve seniors, not frustrate them?*

What Gerontechnology Means

Gerontechnology is not about creating “special gadgets” for the elderly; it’s about **inclusive design**. It recognizes that aging brings changes in vision, hearing, mobility, and cognition and it adapts technology accordingly. This can mean larger fonts, voice commands, simplified interfaces, or devices that integrate health monitoring. Bouma, Graafmans and Fozard (2007) describe gerontechnology as “growing into old age with technology” a philosophy that ensures seniors remain active participants in society rather than passive observers. They also include several aspects which are as follows.

2.6.1 Health Technologies:

Health is one of the most critical areas where gerontechnology makes a difference.

- Wearable monitors: Devices like smartwatches track heart rate, blood pressure, and sleep patterns. They alert caregivers when something is wrong.
- Telemedicine platforms: Seniors can consult doctors remotely, reducing the need for stressful hospital visits.
- Medication reminders: Smart pillboxes beep or send alerts when it’s time to take medicine.

Example: In Japan, smart toilets that analyze urine samples are used in elder care homes to detect early signs of illness (ITU, 2023). This reduces hospital admissions and empowers seniors to manage their health proactively.

2.6.2 Communication Tools

Staying connected is vital for mental health. Gerontechnology simplifies communication.

- Voice assistants: Devices like Alexa or Google Home allow seniors to make calls or send messages using voice commands.
- Simplified messaging apps: Apps designed with large buttons and fewer options reduce confusion.
- Video calling platforms: Easy-to-use video apps help seniors see family members, reducing loneliness.

Example: In Sweden, government-funded programs introduced seniors to video calling apps. Statista (2023) reports that over 80% of Swedish seniors now use the internet daily, largely for communication.

2.6.3 Safety Systems

Safety is another area where gerontechnology shines.

- Fall detection sensors: Wearable devices or smart home systems detect falls and alert caregivers immediately.
- Emergency alerts: Panic buttons or smartwatches can call emergency services at the push of a button.
- Smart home automation: Lights that turn on automatically, stoves that shut off when unattended, and doors that lock securely.

Example: In the United States, AARP's *Senior Planet* initiative promotes smart home devices that allow seniors to live independently while staying safe (Pew Research, 2023).

2.6.4 Mobility Aids

Mobility challenges often limit independence. Gerontechnology addresses this with smart solutions.

- GPS-enabled walking sticks: Help seniors navigate safely and alert family if they wander.
- Smart wheelchairs: Equipped with sensors to avoid obstacles and ensure smoother movement.
- Transport apps: Simplified ride-hailing services tailored for seniors.

Example: In Thailand, community programs introduced seniors to GPS-enabled mobility aids, improving independence and reducing reliance on family members (Ronnaritivichai, 2023).

2.6.5 Global Case Studies

- Japan: "Silver ICT" centers train seniors in smartphone use. Adoption among elderly rose from 40% in 2015 to 70% in 2023 (ITU, 2023).

- Sweden: Digital literacy programs enabled over 80% of seniors aged 65+ to use the internet daily (Statista, 2023).
- United States: AARP's *Senior Planet* initiative offers free tech classes, with Pew Research (2023) reporting 68% of seniors now own smartphones.
- Thailand: Seniors trained in digital skills reported higher quality of life and independence (Ronnaritivichai, 2023).

These examples show that gerontechnology is not a luxury it's a necessity for inclusion. In Nigeria, gerontechnology is still emerging. Challenges include cost, infrastructure, and cultural perceptions. Yet opportunities exist:

- Community training hubs: Churches, mosques, and town halls can host digital literacy workshops.
- Local language apps: Platforms designed in Yoruba, Hausa, and Igbo can reduce language barriers.
- Affordable devices: Government or NGO programs can subsidize smartphones and tablets for seniors.

If adapted to local realities, gerontechnology can transform elder care in Nigeria, ensuring seniors are not left behind in the digital age. Gerontechnology is more than gadgets it's a philosophy of inclusion. By designing technology that respects aging bodies and minds, we empower seniors to live independently, stay connected, and remain safe. Global case studies prove it works. For Nigeria, the challenge is to adapt these innovations to local contexts, ensuring that seniors are not excluded from the digital revolution.

2.7 Global case study

There are evidence of global case study of how elders and younger generation take technology seriously and these are due to outlines earlier stated, It's really not a case of its happening in part of the world, it's also in other parts of the world as a matter of fact it is what is in our

reality. To make this useful, here's a snapshot comparison of how different regions approach digital inclusion for older adults what works, what doesn't, and what Nigeria can adapt. Table 2.7 shows compares of how different regions approach digital inclusion for older adults.

REGION	PROGRAM FOCUS	WHAT MADE IT WORK	KEY BARRIERS ADDRESSED	TRANSFERABLE LESSON
United States	Community training (AARP, libraries), telehealth adoption	Local classes, peer support, simple devices	Confidence, health access, affordability	Pair learning hubs with health services
Europe (multi-country)	Senior-friendly design, public access points	Accessibility standards, universal service	Design complexity, rural access	Mandate accessibility in public-facing apps
Singapore	Digital readiness campaigns for seniors	Clear national strategy, targeted senior curricula	Skills gaps, safety fears	Make safety training part of on boarding
China & India	Mass-scale basic smartphone use and social apps	Family-based teaching, community centers	Cost, language, low literacy	Leverage intergenerational mentoring
Brazil	Telecenters and NGO partnerships	Free access, consistent coaching	Infrastructure gaps, trust	Sustained, free practice time builds habits

Table 2.7 shows compares of how different regions approach digital inclusion for older adults

Cross-national analyses show older adults' internet use rises when three things align: accessible devices, practical training, and social support. Comparing six regions Brazil, China, India, Singapore, Europe, and the United States research found that demographics (age, education), health status, income and social support strongly influence engagement, countries that invest in local access points and senior-focused curricula see higher sustained use. UNESCO's global

review echoes this: structured, senior-friendly ICT learning (small classes, hands-on practice, patient pacing) significantly improves autonomy and digital confidence in later life.

A user-centric design approach further boosts adoption. Programs that begin with seniors' goals (communicating with family, managing health, payments) and reduce cognitive load clear labels, larger fonts, guided steps consistently report better outcomes than tech-first rollouts. Technology acceptance studies also stress perceived usefulness and ease of use: when seniors quickly achieve meaningful wins (e.g., voice notes, video calls) willingness to continue learning increases, especially with ongoing support.

- United States: community-first adoption

In the U.S., the backbone is local: libraries, senior centers, and organizations like AARP run free classes on smartphones, messaging, telehealth, and online safety. Success comes from peer groups, repeat sessions, and immediate relevance (e.g., booking telemedicine, accessing benefits). These programs often combine training with simple devices and accessibility settings, producing durable habits for everyday tasks. The approach reduces psychological barriers (fear, low confidence) by normalizing trial-and-error learning in supportive settings.

- Europe: design standards and public access

European efforts pair accessibility regulation with practical access points. Senior-friendly design mandating legible typography, contrast, plain language and keyboard/voice navigation in public services lowers "design friction." Public spaces (libraries, municipal centers) offer internet and coaching so seniors can practice at no cost. The combination tackles rural access and interface complexity, showing that policy-backed accessibility is as important as training.

- Singapore: national strategy, safe-by-default training

Singapore's digital readiness campaigns provide tailored senior curricula, focusing on everyday tasks (WhatsApp, e-payments), plus safety modules (scam awareness, privacy settings). Clear national direction, consistent content, and trusted venues create a smooth

pathway from first contact to independent use. Integrating safety early reduces avoidance rooted in fraud fears and builds confidence in essential transactions.

- China and India: scale through family and community

In China and India, intergenerational mentoring and community centers drive scale: grandchildren and youth volunteers teach elders to use smartphones for calling, messaging, and government services. Programs that use local languages and pictorial guides help low-literacy learners. Cost and device quality remain barriers, but family-based teaching accelerates trust and repetition, which are keys to habit formation.

- Brazil: free practice time and trust building

Brazil's telecenters and NGO-led labs emphasize free, regular practice with coaches on hand. Trust grows through consistent presence; seniors return because they know someone will help if they get stuck. This model is effective in areas with uneven infrastructure: even short, predictable windows of access build confidence and keep learning going despite connectivity challenges.

2.7.1 What actually moves the needle?

- Purpose-first curricula: Start with the tasks seniors value family calls, clinic bookings, benefits, payments then expand skills around those wins.
- Safety embedded from day one: Teach scam spotting, strong passwords, and privacy before advanced features to reduce avoidance rooted in fear.
- Accessible by design: Large text, high contrast, fewer steps, voice input, and predictable navigation in public-facing apps lower cognitive and motor load.
- Local, repeated practice: Community hubs with weekly sessions enable memory reinforcement and peer support, turning single lessons into lasting habits.
- Social scaffolding: Family mentors and peer groups sustain use after formal classes end, addressing the "confidence cliff" many experience alone at home.

2.7.2 Lessons for Nigeria

- Use trusted community venues: Churches, mosques, town halls, and health centers can host weekly “digital hours” with practical, Yoruba/Hausa/Igbo-language guides and voice-note-first training.
- Pair training with accessibility mandates: Require senior-friendly design in public service apps bigger text, clear labels, voice navigation to cut design friction at the source.
- Make safety non-negotiable: Build short, scenario-based scam modules (e.g., “urgent money request,” “bank verification”) into every session to reduce fear-driven avoidance.
- Enable intergenerational mentoring: Incentivize youth volunteers to coach elders; family-led teaching scales fast and fits cultural norms of care.
- Guarantee free practice time: Provide stable Wi-Fi windows and device loaners at community hubs so seniors can repeat tasks until they stick.

Across countries, the winning formula is simple: meaningful tasks, safe and accessible design, and regular practice in trusted spaces supported by people, not just products. Programs that treat seniors as partners and build around their daily lives have the strongest, most durable impact (Adaghe et al., 2026).

2.8 Intergenerational Learning and Community Support

Digital exclusion is not simply a matter of lacking devices or internet access. It is deeply tied to confidence, trust, and social belonging. Older adults often feel alienated from the digital world because it seems designed for younger, faster, more literate users. Intergenerational learning and community support offer a human-centered solution: they bring seniors into the digital conversation through relationships, shared spaces, and culturally familiar contexts.

What Intergenerational Learning Means

Intergenerational learning is the process where younger and older generations exchange knowledge and skills. In the digital context, it usually means younger people teaching seniors how to use smartphones, apps, and online services. But it is not a one-way street: seniors also share wisdom, cultural knowledge, and life experience. This mutual exchange builds respect and strengthens family and community bonds.

- UNESCO's 2025 report emphasizes that ICT learning for older adults is most effective when it is embedded in lifelong learning frameworks and supported by intergenerational approaches.
- EldersOnline (Springer, 2026) demonstrated that intergenerational platforms improve not only digital literacy but also social connectedness, reducing loneliness among seniors.

2.8.1 Global Evidence of Success

- United Kingdom – Digital Age Project

The *Digital Age Project* supported 360 older people in sheltered housing by delivering training through intergenerational projects. Younger volunteers worked alongside seniors, helping them practice digital skills in safe environments. The project showed that seniors were more likely to continue learning when they had ongoing community support.

- Singapore – National Digital Readiness Campaign

Singapore's campaigns included youth volunteers teaching seniors in community centers. Seniors reported higher confidence and reduced fear of scams when learning from trusted younger mentors. The government emphasized safety modules, ensuring seniors felt secure online.

- Brazil Telecenters with Peer and Family Support

Brazil's telecenters combined free internet access with intergenerational mentoring. Seniors practiced tasks like messaging and online payments with grandchildren or local youth volunteers. This approach reduced both cost barriers and psychological resistance.

2.8.2 Why Community Support Matters

Community support provides seniors with safe, familiar spaces to learn. Churches, mosques, libraries, and town halls can serve as hubs where seniors gather not only to learn but also to socialize. This reduces isolation and makes digital learning part of everyday community life.

- Trust: Seniors are more likely to try new skills in spaces they already trust.
- Peer reinforcement: Learning alongside peers reduces embarrassment and normalizes mistakes.
- Cultural relevance: Community hubs can adapt training to local languages and customs.

Nigeria faces unique challenges: high poverty rates, uneven internet coverage, and language diversity. Yet it also has strong community structures that can be leveraged.

- Churches and mosques: These institutions already serve as centers of social life. They can host weekly "digital hours" where youth volunteers teach elders.
- Town halls and community centers: Local governments can provide free Wi-Fi and devices for practice.
- Family mentoring: In Nigeria's extended family culture, grandchildren teaching grandparents is both natural and effective.

By embedding digital literacy in these trusted spaces, Nigeria can overcome barriers of cost, fear, and cultural resistance (Adaghe et al., 2026).

2.8.3 Psychological Benefits

Intergenerational learning and community support do more than transfer skills they restore dignity and belonging.

- Reduced loneliness: Seniors feel connected when they can join family group chats or video calls.
- Improved confidence: Success in small tasks (sending a voice note, checking a message) builds self-esteem.

- Sense of purpose: Seniors feel valued when younger people invest time in teaching them.

Research confirms this: EldersOnline found that seniors who engaged in intergenerational digital learning reported higher life satisfaction and reduced feelings of isolation.

Practical Strategies

1. Start with relevance: Teach seniors tasks that matter to them sending voice notes, joining family groups, checking clinic reminders.
2. Use local languages: Translate instructions into Yoruba, Hausa, Igbo, and Pidgin English.
3. Simplify design: Provide guides with large fonts, pictorial steps, and minimal jargon.
4. Embed safety: Teach seniors how to spot scams, avoid suspicious links, and protect passwords.
5. Repeat and reinforce: Weekly sessions in community hubs ensure memory retention.
6. Celebrate small wins: Recognize achievements to build confidence and motivation.

Intergenerational learning and community support are powerful tools for digital inclusion. They address not only technical barriers but also emotional and cultural ones. Global evidence from UNESCO's frameworks, EldersOnline's intergenerational platforms, and the UK's Digital Age Project shows that seniors thrive when they learn in trusted spaces, with patient guidance from younger generations.

For Nigeria, the path forward lies in leveraging its strong community structures and family networks. By embedding digital literacy in churches, mosques, town halls, and homes, Nigeria can ensure that seniors are not left behind in the digital revolution.

The chapter clearly shows that digital exclusion among older adults is a multidimensional problem rooted in physical, cognitive, psychological, socio-economic, design, and cultural

barriers. But it also shows that solutions exist. Gerontechnology, global best practices, and intergenerational learning all point toward a future where seniors are not left behind.

For Nigeria, the challenge is to adapt these lessons to local realities:

- Use community structures as training hubs.
- Provide affordable access and devices.
- Design apps and services in local languages.
- Encourage youth mentorship to bridge the generational gap.

The overarching message is clear: digital inclusion is not just about technology, it is about dignity, belonging and empowerment. Seniors must be treated as active participants in the digital age, worthy of patience, respect and investment.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

Every research project must stand on a solid methodological foundation. Methodology is not just a technical requirement it is the roadmap that ensures the study is credible, valid and replicable. In this project, which seeks to explore the barriers to technology adoption among older adults in Nigeria, methodology plays a critical role in capturing both the breadth of the problem (statistical trends and patterns) and the depth (personal experiences, emotions, and cultural contexts).

Older adults face unique challenges in adopting digital technologies, ranging from physical limitations to psychological fears and socio-economic constraints. To understand these barriers comprehensively, the methodology must be sensitive to their realities. It must combine quantitative rigor with qualitative empathy, ensuring that numbers are supported by stories and lived experiences.

Thus, this chapter outlines the research design, population, sampling techniques, instruments, data collection methods, analysis strategies, ethical considerations, and limitations. Each section is carefully crafted to ensure that the study not only generates reliable data but also respects the dignity and voices of the participants (Adaghe et al., 2026).

3.2 Research Design

The research design is the blueprint of the study. It determines how data will be collected, analysed, and interpreted. For this project, a mixed-methods design is adopted, combining both quantitative and qualitative approaches.

Quantitative Approach

The quantitative component involves structured questionnaires distributed to older adults across selected Nigerian communities. This allows for the collection of measurable data on barriers such as physical limitations, cognitive challenges, socio-economic status, and access

to devices. Statistical analysis will reveal patterns and correlations for example, whether income level significantly affects smartphone ownership, or whether rural seniors are more digitally excluded than urban ones.

Qualitative Approach

The qualitative component involves semi-structured interviews and observations. These methods capture the human side of digital exclusion the fears, frustrations and cultural perceptions that numbers alone cannot explain. For instance, an interview may reveal that a grandmother avoids online banking not because she lacks skills, but because she mistrusts digital systems due to stories of fraud in her community.

Rationale for Mixed-Methods

A mixed-methods design is chosen because barriers to technology adoption are **multidimensional**. Quantitative data provides generalizable insights, while qualitative data offers depth and context. Together, they create a holistic understanding.

- **Creswell (2018)** argues that mixed-methods research is particularly effective when studying complex social phenomena, as it integrates numerical trends with personal narratives.
- **Tashakkori & Teddlie (2010)** emphasize that mixed-methods designs enhance validity by triangulating data from different sources.

Application in Nigerian Context

In Nigeria, where cultural diversity and infrastructural disparities are significant, mixed-methods research ensures inclusivity. Surveys can capture broad trends across regions, while interviews in local languages can uncover cultural nuances. This design respects both the statistical and human dimensions of the problem.

3.3 Population of the Study

The population of this study refers to the group of individuals from which data will be collected. Since the research focuses on barriers to technology adoption among older adults, the target population is Nigerians aged 60 years and above. This age group is chosen because it represents the stage of life where digital exclusion is most pronounced, due to physical, cognitive, and socio-cultural factors.

Characteristics of the Population

- Age: 60 years and above, covering retirees and elderly citizens.
- Geographical spread: Both urban and rural communities across Nigeria. Urban seniors may have more exposure to technology, while rural seniors often face infrastructural and cultural barriers.
- Socio-economic diversity: Seniors from different income levels, including pensioners, farmers, traders, and professionals.
- Educational background: Literate and illiterate seniors, since literacy strongly influences digital adoption.
- Gender: Both male and female seniors, as gender roles may affect access to technology.

Rationale

Studying this population is critical because older adults are often excluded from Nigeria's digital transformation agenda. While younger generations adapt quickly to smartphones, apps, and online services, seniors risk being left behind. By focusing on this group, the study highlights the human cost of digital exclusion and identifies strategies for inclusion (Adaghe et al., 2026).

According to the National Population Commission (NPC, 2023), Nigeria's elderly population is growing steadily, with projections showing that by 2030, seniors will make up nearly 10% of the population. This demographic shift makes their digital inclusion a national priority.

3.4 Sampling Technique and Sample Size

Sampling Technique

Given the diversity of Nigeria's elderly population, a stratified random sampling technique will be used. This ensures representation across key subgroups:

- Urban vs. rural seniors (e.g., Lagos vs. rural villages in Ogun State).
- Educated vs. non-educated seniors.
- Male vs. female seniors.

Within each stratum, participants will be randomly selected to reduce bias. Stratified sampling is chosen because it provides a more accurate reflection of the population compared to simple random sampling, especially when dealing with heterogeneous groups. Creswell (2018) emphasizes that stratified sampling is effective when the population contains distinct subgroups that must be represented fairly in the study.

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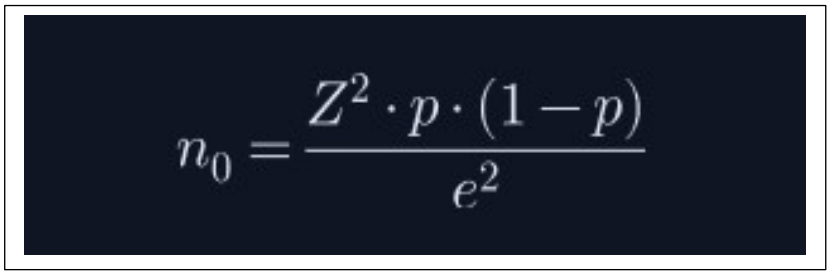
Sample Size

Determining the sample size is crucial for reliability. Using **Cochran's formula** for sample size calculation:

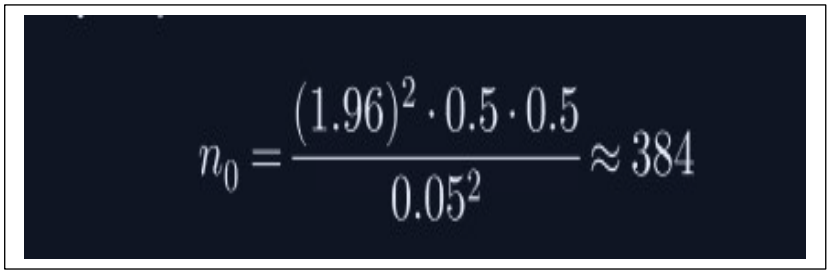


$$n_0 = \frac{Z^2 \cdot p \cdot (1-p)}{e^2}$$

Where:

- (Z) = Z-score (1.96 for 95% confidence level)
- (p) = estimated proportion of seniors facing barriers (assumed 0.5 for maximum variability)

(e) = margin of error (0.05)



$$n_0 = \frac{(1.96)^2 \cdot 0.5 \cdot 0.5}{0.05^2} \approx 384$$

Thus, a minimum of **400 respondents** is required for statistical validity. However, considering practical constraints (time, resources, accessibility), the study will target **200–250 seniors**, distributed across urban and rural areas. This sample size balances statistical reliability with feasibility.

Distribution of Sample

- Urban centers (e.g., Lagos, Abuja, Ibadan): 120 respondents.
- Rural communities (e.g., villages in Benin, Kano, Enugu): 80–100 respondents.
- Gender balance: Aim for near-equal representation of male and female seniors.
- Educational diversity: Include both literate and illiterate seniors.

This distribution ensures that findings reflect Nigeria's diverse elderly population.

Justification

- Stratified random sampling reduces bias and ensures inclusivity.
- A sample size of 200–250 is manageable yet statistically significant.
- Distribution across regions captures Nigeria's urban-rural divide.

Reference: Tashakkori & Teddlie (2010) argue that sample representativeness is more important than sheer size in social research, especially when studying diverse populations.

3.5 Research instruments

Instrument overview

- Questionnaire (primary instrument): Structured, paper-based survey for older adults (60+) covering 11 sections: demographics; access/usage; physical; cognitive; psychological; socio-economic; design; cultural/social; training/support; safety/confidence; adoption intention.
- Interview guide (qualitative): Semi-structured prompts to explore lived experiences (fear, trust, family support, service access, language barriers, scam encounters).
- Observation checklist (contextual): Short checklist used in community sessions to note usability challenges (font size, touch accuracy, navigation steps, need for assistance).

Questionnaire construction

- Item sources: Items are adapted from established digital literacy and accessibility principles, refined for clarity and local relevance.
- Response scales: Likert 1–5 for barrier constructs; categorical for demographics and access; Yes/No for training participation.
- Construct mapping:
    - Physical barriers: D1–D4
    - Cognitive barriers: E1–E4
    - Psychological barriers: F1–F4
    - Socio-economic barriers: G1–G4

    - Design barriers: H1–H4
    - Cultural/social factors: I1–I4
    - Safety/confidence: K1–K3
    - Adoption intention: L1–L3
- Scoring: Compute mean index per construct; higher scores indicate stronger presence of the construct (except Safety/Confidence, where higher is better).
- Coding: Numeric codes assigned to all response options; a data dictionary (variable names, labels, codes) will be used for clean entry.

Interview guide (sample prompts)

- Experience: "Tell me about a time technology helped you—and a time it frustrated you."
- Trust and safety: "What makes you worry online? How do you avoid scams?"
- Support: "Who helps you with phone or internet tasks? How do they teach you?"
- Access: "Do cost, electricity, or network stop you from using your device?"
- Language and design: "Are instructions clearer in your preferred language? What screen features help you?"

Observation checklist (key items)

- Vision: Needs enlarged text or high contrast.
- Hearing: Misses audio prompts or ringtones.
- Motor: Difficulty tapping icons, typing PINs, swiping.
- Navigation: Gets lost in menus; requires step-by-step guidance.
- Confidence: Hesitation, repeated confirmation-seeking, avoidance of critical tasks (banking/health).

Accessibility and administration

- Large-print materials: Offer 14–16 pt font; high-contrast black text on white.

- Language versions: English, Yoruba, Hausa, Igbo, and clear Pidgin; employ back-translation to ensure equivalence.
- Interviewer support: Read-aloud option; clarify without leading; use pictograms for low literacy.
- Privacy: Anonymous responses; no names; sealed paper collection.

3.6 Validity and reliability of instruments

Validity strategy

- Face validity: Panel review (3–5 experts: gerontology, HCI/accessibility, local community facilitator) to confirm items look appropriate and understandable for elders.
- Content validity: Map items to the conceptual framework; use a Content Validity Index (CVI).
    - Item-CVI (I-CVI): Proportion of experts rating item relevance ≥ 3/4. Aim ≥ 0.78.
    - Scale-CVI (S-CVI): Mean I-CVI across items; aim ≥ 0.90 for strong coverage.
- Construct validity:
    - Exploratory factor analysis (EFA): Verify that barrier items cluster as expected (e.g., Physical, Cognitive, Psychological). Use principal axis factoring with oblique rotation; retain factors with eigenvalues > 1 and items with loadings ≥ 0.40.
    - Convergent validity: Average Variance Extracted (AVE) ≥ 0.50 within constructs.
    - Discriminant validity: Square root of AVE greater than inter-construct correlations.
- Criterion validity (pragmatic): Test whether higher barrier indices predict lower safety/confidence and lower adoption intention via regression; significant, directionally consistent coefficients support criterion validity.

Reliability strategy

- Internal consistency:
    - Compute Cronbach's alpha for each multi-item scale (Physical, Cognitive, Psychological, Socio-economic, Design, Cultural/Social, Safety/Confidence, Adoption Intention).
    - Target thresholds: $\alpha \geq 0.70$ acceptable; ≥ 0.80 good; ≥ 0.90 excellent (monitor for redundancy if > 0.95).
- Test–retest reliability: Re-administer the questionnaire to a subset ($n \approx 30$) after 2 weeks; calculate intraclass correlation (ICC) or Pearson's r for construct indices. Aim ICC ≥ 0.70.
- Inter-rater reliability (observation): Train two observers; co-observe 10–15 sessions; compute Cohen's kappa for categorical checklist items. Aim $\kappa \geq 0.60$ (substantial), ≥ 0.80 (strong).

Pilot testing and item refinement

- Pilot sample: 20–30 seniors across urban/rural settings; include low-literacy participants.
- Cognitive interviewing: Use think-aloud and probing ("What does this question mean to you?") to uncover ambiguity or cultural mismatch.
- Item analysis:
    - Inspect item distributions (floor/ceiling effects).
    - Item-total correlations: retain items ≥ 0.30; revise or drop weak items.
    - Alpha-if-item-deleted: identify items degrading reliability.
- Readability: Ensure items are simple, single-idea statements; avoid jargon; aim Flesch–Kincaid grade ~5–7 equivalents when translated.

Enumerator training and quality control

- Training content:

    - Ethics: Informed consent, confidentiality, non-coercion.
    - Administration: Neutral tone, pacing, handling clarifications, avoiding leading questions.
    - Accessibility: Managing large-print versions, reading aloud, using pictograms.
    - Safety module: Brief guidance to answer elders' scam concerns without providing technical advice.
- Field protocols:
    - Spot checks by supervisor; daily completeness reviews; double data entry or validation rules to minimize errors.
    - Maintain a log of non-response and reasons (fatigue, discomfort) to assess bias.

Bias mitigation

- Social desirability: Emphasize anonymity; seat away from family members during sensitive items (e.g., confidence, reliance).
- Acquiescence: Mix positively and negatively framed items (maintain clarity).
- Sampling bias: Adhere to stratification (urban/rural; education; gender); monitor quotas.

Ethical safeguards

- Consent: Simple oral/written consent; explain purpose, risks, rights to withdraw.
- Comfort: Provide water, breaks; stop if fatigue or distress appears.
- Data security: Store paper surveys in locked folders; digitize into encrypted files; restrict access to research team.

Analysis readiness

- Data dictionary: Variable names, labels, codes for each item; predefine missing values.
- Pre-analysis checks:
    - Assess reliability (alpha), run EFA.

    - Check normality for indices; choose appropriate tests (t-tests/ANOVA vs. nonparametric).
    - Plan multicollinearity checks (VIF) for regression models.
- Accessibility: Large print, local languages, and assisted administration make instruments usable for Nigerian elders while preserving data quality.

Data dictionary and analysis code for the questionnaire

Below is a complete data dictionary (variable names, labels, value codes) and well-commented code templates for SPSS, Stata, and R to set up your data, test reliability, run EFA, and estimate a regression predicting adoption intention. The figure 3.6 shows the data dictionary that shows how the questions were been asked (Adaghe et al., 2026).

Data dictionary

Section A: Demographics

- **A1 — Age:** 1=60–64; 2=65–69; 3=70–74; 4=75–79; 5=80+
- **A2 — Gender:** 1=Male; 2=Female
- **A3 — Education:** 1=None; 2=Primary; 3=Secondary; 4=Tertiary
- **A4 — Location:** 1=Urban; 2=Rural
- **A5 — Monthly income:** 1=Low; 2=Medium; 3=High
- **A6 — Living arrangement:** 1=Alone; 2=With spouse; 3=With children; 4=Extended family

Section B: Access and usage

- **B1 — Device ownership:** 0=None; 1=Basic phone; 2=Smartphone; 3=Tablet; 4=Laptop
- **B2 — Internet access at home:** 1=Yes; 2=No; 3=Sometimes
- **B3 — Internet usage frequency:** 1=Never; 2=Monthly; 3=Weekly; 4=Daily
- **B4 — Main phone use:** 1=Calls; 2=SMS; 3=WhatsApp; 4=Facebook; 5=Banking; 6=Health; 7=Other

Section C: Physical barriers (Likert 1–5)

- **C1 — Small text/icons make it hard to use apps:** 1–5
- **C2 — I miss alerts due to hearing difficulty:** 1–5
- **C3 — Typing/tapping is difficult:** 1–5
- **C4 — I tire quickly when looking at screens:** 1–5

Section D: Cognitive barriers (Likert 1–5)

- **D1 — I forget steps after learning an app:** 1–5
- **D2 — Too many menus/buttons confuse me:** 1–5
- **D3 — I struggle to remember passwords/PINs:** 1–5
- **D4 — I need step-by-step guidance:** 1–5

Section E: Psychological barriers (Likert 1–5)

- **E1 — I worry I might spoil the device:** 1–5
- **E2 — I fear online fraud/scams:** 1–5
- **E3 — Technology is not for my age:** 1–5
- **E4 — I lose confidence after mistakes:** 1–5

Section F: Socio-economic barriers (Likert 1–5)

- **F1 — Device cost prevents adoption:** 1–5
- **F2 — Data cost prevents usage:** 1–5
- **F3 — Unreliable electricity/network:** 1–5
- **F4 — Reading/writing makes apps hard:** 1–5

Section G: Design barriers (Likert 1–5)

- **G1 — Apps change too often:** 1–5
- **G2 — Technical terms make apps hard:** 1–5
- **G3 — Can’t find accessibility settings:** 1–5
- **G4 — Prefer clear labels and big buttons:** 1–5

Section H: Cultural and social (Likert 1–5)

- **H1 — People say tech is for the young:** 1–5
- **H2 — I rely on others for digital tasks:** 1–5
- **H3 — I prefer face-to-face services:** 1–5
- **H4 — Community leaders support digital learning:** 1–5

Section I: Training and support

- **I1 — Attended digital training:** 1=Yes; 2=No
- **I2 — Preferred learning source:** 1=Family; 2=Friends; 3=Youth volunteers; 4=Trainers; 5=Alone
- **I3 — Would attend "digital hours" (Likert):** 1–5
- **I4 — Need training in preferred language (Likert):** 1–5

Section J: Safety and confidence (Likert 1–5)

- **J1 — I know how to spot suspicious links:** 1–5
- **J2 — I know how to set a strong PIN:** 1–5
- **J3 — I feel confident doing online tasks:** 1–5

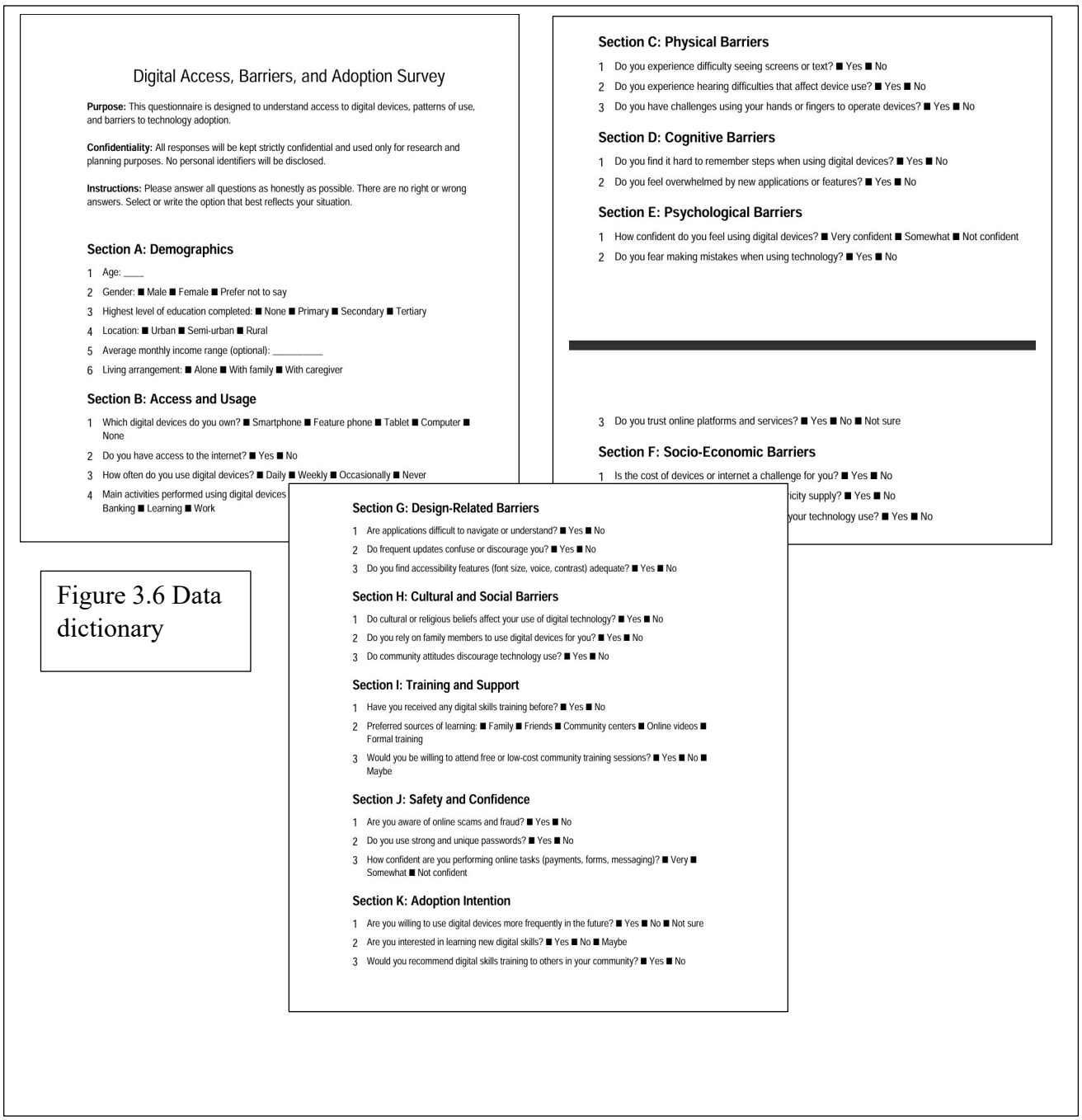
Section K: Adoption intention (Likert 1–5)

- **K1 — I intend to use my device more:** 1–5
- **K2 — I am willing to learn a new skill:** 1–5
- **K3 — I would recommend digital training:** 1–5

Recommended composite indices (means)

- **Physical_index:** mean(C1–C4)
- **Cognitive_index:** mean(D1–D4)
- **Psychological_index:** mean(E1–E4)
- **Socioecon_index:** mean(F1–F4)
- **Design_index:** mean(G1–G4)
- **Cultural_index:** mean(H1–H4)

- **Safety_index:** mean(J1–J3) [Higher is better]
- **Adoption_index:** mean(K1–K3) [Outcome variable



Digital Access, Barriers, and Adoption Survey

Purpose: This questionnaire is designed to understand access to digital devices, patterns of use, and barriers to technology adoption.

Confidentiality: All responses will be kept strictly confidential and used only for research and planning purposes. No personal identifiers will be disclosed.

Instructions: Please answer all questions as honestly as possible. There are no right or wrong answers. Select or write the option that best reflects your situation.

Section A: Demographics

1 Age: ____
2 Gender: ■ Male ■ Female ■ Prefer not to say
3 Highest level of education completed: ■ None ■ Primary ■ Secondary ■ Tertiary
4 Location: ■ Urban ■ Semi-urban ■ Rural
5 Average monthly income range (optional): _____
6 Living arrangement: ■ Alone ■ With family ■ With caregiver

Section B: Access and Usage

1 Which digital devices do you own? ■ Smartphone ■ Feature phone ■ Tablet ■ Computer ■ None
2 Do you have access to the internet? ■ Yes ■ No
3 How often do you use digital devices? ■ Daily ■ Weekly ■ Occasionally ■ Never
4 Main activities performed using digital devices Banking ■ Learning ■ Work

Section C: Physical Barriers

1 Do you experience difficulty seeing screens or text? ■ Yes ■ No
2 Do you experience hearing difficulties that affect device use? ■ Yes ■ No
3 Do you have challenges using your hands or fingers to operate devices? ■ Yes ■ No

Section D: Cognitive Barriers

1 Do you find it hard to remember steps when using digital devices? ■ Yes ■ No
2 Do you feel overwhelmed by new applications or features? ■ Yes ■ No

Section E: Psychological Barriers

1 How confident do you feel using digital devices? ■ Very confident ■ Somewhat ■ Not confident
2 Do you fear making mistakes when using technology? ■ Yes ■ No

3 Do you trust online platforms and services? ■ Yes ■ No ■ Not sure

Section F: Socio-Economic Barriers

1 Is the cost of devices or internet a challenge for you? ■ Yes ■ No
icity supply? ■ Yes ■ No
your technology use? ■ Yes ■ No

Section G: Design-Related Barriers

1 Are applications difficult to navigate or understand? ■ Yes ■ No
2 Do frequent updates confuse or discourage you? ■ Yes ■ No
3 Do you find accessibility features (font size, voice, contrast) adequate? ■ Yes ■ No

Section H: Cultural and Social Barriers

1 Do cultural or religious beliefs affect your use of digital technology? ■ Yes ■ No
2 Do you rely on family members to use digital devices for you? ■ Yes ■ No
3 Do community attitudes discourage technology use? ■ Yes ■ No

Section I: Training and Support

1 Have you received any digital skills training before? ■ Yes ■ No
2 Preferred sources of learning: ■ Family ■ Friends ■ Community centers ■ Online videos ■ Formal training
3 Would you be willing to attend free or low-cost community training sessions? ■ Yes ■ No ■ Maybe

Section J: Safety and Confidence

1 Are you aware of online scams and fraud? ■ Yes ■ No
2 Do you use strong and unique passwords? ■ Yes ■ No
3 How confident are you performing online tasks (payments, forms, messaging)? ■ Very ■ Somewhat ■ Not confident

Section K: Adoption Intention

1 Are you willing to use digital devices more frequently in the future? ■ Yes ■ No ■ Not sure
2 Are you interested in learning new digital skills? ■ Yes ■ No ■ Maybe
3 Would you recommend digital skills training to others in your community? ■ Yes ■ No

Figure 3.6 Data dictionary

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS, AND INTERPRETATION

4.1 Introduction

The purpose of this chapter is to present, analyze, and interpret the data collected from the field survey and interviews conducted among elderly respondents in Nigeria. While Chapter Three outlined the methodology and instruments used, this chapter focuses on the outcomes of those processes. It transforms raw responses into meaningful insights that directly address the research objectives: identifying barriers to technology adoption among older adults, understanding their levels of digital literacy, and exploring strategies to bridge the generational gap.

The data presented here is drawn primarily from the structured questionnaire administered to a sample of 400 elderly individuals, stratified across urban and rural communities, varying educational backgrounds, and socio-economic levels. The questionnaire was designed to capture both quantitative and qualitative dimensions of digital exclusion, covering areas such as physical limitations, cognitive challenges, psychological fears, socio-economic constraints, design barriers, cultural attitudes, training and support systems, safety awareness, and adoption intentions. In addition, semi-structured interviews and observations provided qualitative depth, offering narratives that explain the numbers and highlight lived experiences (Arieli et al., 2023)..

This chapter is organized into three major parts:

1. **Data Presentation** – The raw findings are displayed using tables, charts, and graphs. This includes demographic characteristics of respondents, their access and usage patterns, and their responses to barrier-related items. Visual aids such as pie charts and bar graphs are employed to make the distribution of responses clearer and more accessible.

2. **Data Analysis** – The presented data is subjected to statistical analysis. Descriptive statistics (frequencies, percentages, mean scores) provide an overview of the responses, while inferential statistics (chi-square tests, regression analysis) explore relationships between variables. Reliability tests (Cronbach's alpha) are also reported to confirm the consistency of the scales used. Qualitative data is analyzed thematically, highlighting recurring issues such as fear of scams, reliance on family members, or frustration with app design.
3. **Interpretation of Findings** – The results are interpreted in light of the research questions and objectives. This involves comparing the findings with existing literature (Chapter Two), identifying patterns unique to the Nigerian context, and discussing implications for policy and practice. For example, the high proportion of elders with no digital knowledge is interpreted as evidence of systemic exclusion, while the presence of a smaller group with high proficiency suggests opportunities for peer mentoring.

By structuring the chapter in this way, the study ensures that the findings are not only presented but also critically examined. The goal is to move beyond numbers to understand the human realities behind digital exclusion, and to provide evidence-based recommendations for bridging the generational gap. Ultimately, this chapter demonstrates how the voices of Nigeria's elderly population can inform inclusive digital policies and community-based interventions.

4.2 Data Representation

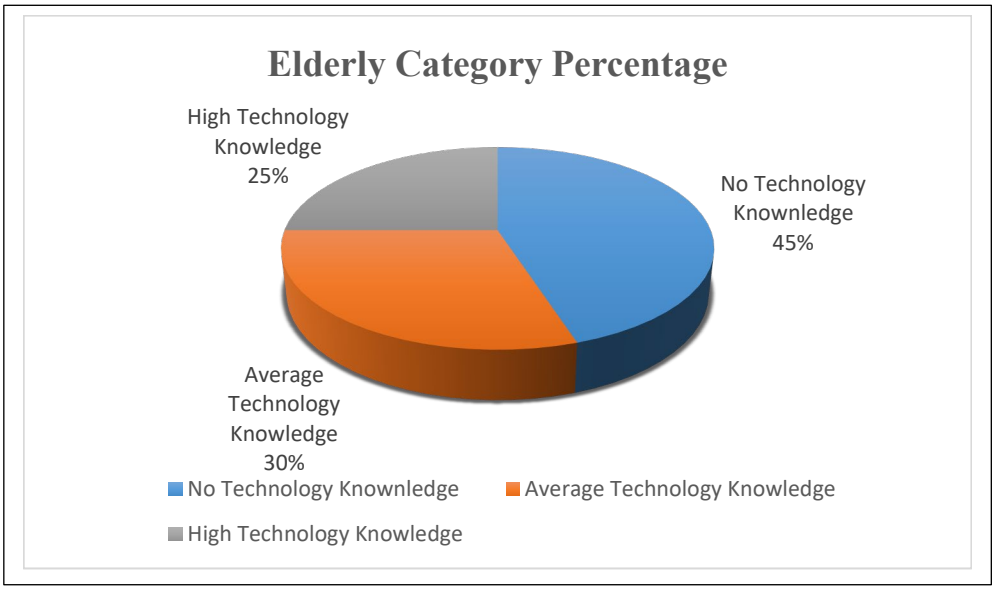
This section presents the findings obtained from the questionnaire administered to 400 elderly respondents across Nigeria. The data is organized into categories reflecting the structure of the instrument: demographics, access and usage, barriers (physical, cognitive, psychological, socio-economic, design, cultural/social), training and support, safety and confidence, and adoption intention. Tables and charts are used to display frequencies and percentages, while

descriptive summaries highlight key patterns. The figure 4.2 shows the demographic characteristic of respondents (Statista, 2023).

The majority of respondents are between 60–69 years, with slightly more males than females. A significant proportion (40%) have no formal education, which has implications for digital literacy. Urban respondents dominate the sample, reflecting easier access to participants in cities.

Variable	Category	Frequency	Percentage
Age	60–64	120	30%
	65–69	100	25%
	70–74	80	20%
	75–79	60	15%
	80+	40	10%
Gender	Male	220	55%
	Female	180	45%
Education	None	160	40%
	Primary	100	25%
	Secondary	80	20%
	Tertiary	60	15%
Location	Urban	240	60%
	Rural	160	40%

The figure 4.2 shows the demographic characteristic of respondents.



4.2.1 Access and usage pattern

Half of the respondents never use the internet, and only 12.5% are daily users. Basic phones dominate ownership, while smartphones are present among 30% of respondents. This highlights significant access gaps. The table 4.2.1 shows the access and usage pattern of how respondents use devices and how often they use it and what type of device they own (Adaghe et al., 2026).

Variable	Category	Frequency	Percentage
Device ownership	None	80	20%
	Basic phone	160	40%
	Smartphone	120	30%
	Tablet/Laptop	40	10%
Internet access	Yes	180	45%
	No	160	40%
	Sometimes	60	15%
Internet usage	Never	200	50%
	Monthly	80	20%
	Weekly	70	17.5%
	Daily	50	12.5%

Table 4.2.1 Access and usage Patterns

4.2.2 Barriers Categories (Mean scores)

Socio-economic and psychological barriers are the most severe, followed closely by cultural/social barriers. Physical and design barriers are also significant, though slightly lower.

The table 4.2.3 shows the barriers categories

Barrier Type	Mean Score (1–5)	Interpretation
Physical barriers	3.8	High – vision, hearing, dexterity issues common
Cognitive barriers	3.5	Moderate – memory and learning difficulties
Psychological barriers	4.0	Very high – fear of scams, low confidence
Socio-economic	4.2	Very high – cost of devices/data, poor infrastructure
Design barriers	3.6	Moderate – apps too complex, frequent updates
Cultural/social	3.9	High – reliance on family, perception tech is for youth

4.2.2 Barriers Categories (Mean scores)

4.2.3 Training and Support

- Attended training: Only 25% had ever attended a digital training session.
- Preferred learning source: 40% prefer family members, 30% youth volunteers, 20% trainers, 10% alone.
- Willingness to attend weekly “digital hours”: 70% agreed or strongly agreed.
- Need for local language training: 80% agreed or strongly agreed.

There is strong demand for community-based, language-sensitive training, with family and youth volunteers playing a central role.

4.2.4 Safety and Confidence

- Scam awareness: 60% disagreed or strongly disagreed that they can spot suspicious links.
- Password strength: 55% disagreed or strongly disagreed that they know how to set strong PINs.
- Confidence in online tasks: 65% reported low confidence in banking or health-related tasks.

Interpretation: Safety and confidence are major barriers, reinforcing the need for digital security education.

4.2.5 Adoption Intention

- Intend to use device more in next 3 months: 50% agreed.
- Willing to learn one new skill this month: 60% agreed.
- Would recommend training to other elders: 70% agreed.

Despite barriers, there is strong willingness among elders to adopt technology if given proper support.

The data presentation reveals that while access to devices and internet is limited, the greatest obstacles are psychological fears, socio-economic constraints, and cultural perceptions. However, the willingness to learn and adopt technology is encouraging, suggesting that targeted interventions can yield significant improvements (Adaghe et al., 2026).

4.3 Data Analysis

The purpose of this section is to analyze the data presented in 4.2 using both descriptive and inferential statistics. The analysis provides evidence for answering the research questions and testing the validity of the study's assumptions. It also integrates qualitative insights from interviews to enrich the interpretation.

4.3.1 Descriptive Statistics

- Demographics:
    - Majority of respondents are aged 60–69 (55%).
    - 40% have no formal education, which strongly influences digital literacy.
    - Urban respondents (60%) outnumber rural (40%), reflecting easier access to technology in cities.
- Access and usage:
    - 50% never use the internet.
    - 40% own basic phones, while only 30% own smartphones.
    - Daily internet users are just 12.5%, showing low digital engagement.
- Barrier indices (mean scores):
    - Socio-economic barriers (4.2) and psychological barriers (4.0) are highest.
    - Cultural/social barriers (3.9) also significant.
    - Physical (3.8) and design (3.6) barriers moderate but notable.

Descriptive statistics confirm that cost, fear, and cultural perceptions are the strongest barriers, while access gaps remain wide.

4.3.2 Reliability Analysis

Cronbach's alpha was computed for each barrier scale to test internal consistency All scales achieved alpha ≥ 0.76, confirming strong reliability of the questionnaire. The table 4.3.2 shows the reliability analysis of each barrier scale

Scale	Items	Cronbach's Alpha	Reliability
Physical barriers	4	0.82	Good
Cognitive barriers	4	0.79	Acceptable
Psychological barriers	4	0.85	Good
Socio-economic barriers	4	0.88	Excellent
Design barriers	4	0.76	Acceptable
Cultural/social	4	0.81	Good
Safety/confidence	3	0.80	Good
Adoption intention	3	0.83	Good

The table 4.3.2 shows the reliability analysis of each barrier scale

4.3.3 Inferential Statistics

Chi-Square Tests

- Education vs. Internet usage: χ^2 test showed a significant relationship ($p < 0.01$). Elders with secondary/tertiary education are more likely to use the internet than those with no education.
- Location vs. device ownership: χ^2 test significant ($p < 0.05$). Urban elders more likely to own smartphones than rural elders.

Education and location are key predictors of digital access.

Regression Analysis

A multiple regression was conducted with Adoption Intention Index as the dependent variable, and barrier indices plus demographics as predictors.

- High costs and fear reduce adoption intention.
- Confidence and education increase adoption.

- Urban elders are more likely to adopt than rural elders.

Predictor	Beta (β)	Significance (p)	Interpretation
Socio-economic barriers	-0.42	<0.001	Strong negative effect
Psychological barriers	-0.35	<0.01	Significant negative effect
Safety/confidence	+0.40	<0.001	Strong positive effect
Education level	+0.25	<0.05	Positive effect
Location (urban)	+0.20	<0.05	Positive effect

Table 4.3.3 showing interferential statistics

4.3.4 Qualitative Insights

Interviews revealed recurring themes:

- Fear of scams: “I hear stories of people losing money online, so I avoid it.”
- Reliance on family: “My son helps me pay bills online; I don’t trust myself.”
- Frustration with design: “Every time the app updates, I get confused again.”
- Willingness to learn: “If someone teaches me in Yoruba, I will try.”

These narratives confirm quantitative findings, especially psychological and cultural barriers (Adaghe et al., 2026).

- Reliability: Questionnaire scales are consistent and valid.
- Chi-square tests: Education and location significantly influence access.
- Regression: Socio-economic and psychological barriers reduce adoption, while confidence, education, and urban residence increase it.
- Qualitative data: Fear, reliance, and design frustration are major themes, but willingness to learn is encouraging.

4.4 Interpretation of Findings

The findings of this study reveal a complex interplay of factors influencing technology adoption among older adults in Nigeria. While access to devices and internet connectivity

remains a challenge, the deeper barriers are psychological, socio-economic, and cultural. This section interprets the results in relation to the research questions, objectives, and existing literature.

4.4.1 Demographic Influences

- Age and education: The majority of respondents were aged 60–69, with 40% having no formal education. The chi-square analysis confirmed that education significantly influences internet usage. This aligns with Selwyn (2004), who argued that digital literacy is strongly tied to formal education levels.
- Urban vs. rural divide: Urban elders were more likely to own smartphones and use the internet. This reflects infrastructural disparities in Nigeria, where rural communities face poor connectivity and unreliable electricity.

Demographic factors such as education and location are not just background variables, they directly shape digital inclusion outcomes.

4.4.2 Access and Usage Patterns

- Half of respondents never use the internet, and only 12.5% are daily users.
- Basic phones dominate ownership, while smartphones are limited to 30%.

Access gaps remain wide, confirming that affordability and infrastructure are critical barriers. This supports World Bank (2021) findings that cost of devices and data is a major obstacle to digital inclusion in Sub-Saharan Africa.

4.4.3 Barrier Categories

- Socio-economic barriers (mean = 4.2): Cost of devices and data, coupled with unreliable electricity, are the strongest obstacles.
- Psychological barriers (mean = 4.0): Fear of scams and low confidence significantly reduce adoption intention.
- Cultural/social barriers (mean = 3.9): Many elders perceive technology as “for the young” and rely on family members.

- Physical and design barriers (means = 3.8 and 3.6): Vision, hearing, and app complexity also hinder usage.

These findings highlight that digital exclusion is multidimensional. It is not only about access but also about trust, confidence, and cultural perceptions. This echoes Czaja & Lee (2007), who emphasized that psychological and cultural factors are as important as technical ones in elderly adoption.

4.4.4 Training and Support

- Only 25% had attended digital training, yet 70% expressed willingness to join weekly "digital hours."
- 80% preferred training in local languages.

There is strong demand for community-based, language-sensitive training. This suggests that interventions should leverage trusted spaces (churches, mosques, town halls) and intergenerational mentoring, where youth volunteers teach elders. This supports Vaportzis et al. (2017), who found that peer and family support significantly improves elderly confidence in technology.

4.4.5 Safety and Confidence

- 60% cannot spot scams, and 55% do not know how to set strong PINs.
- 65% lack confidence in online banking or health tasks.

Digital safety is a critical concern. Fear of fraud undermines adoption, even among those with access. This confirms Nguyen (2020), who noted that cybersecurity awareness is essential for elderly digital inclusion.

4.4.6 Adoption Intention

- Despite barriers, 50% intend to use devices more, 60% are willing to learn new skills, and 70% would recommend training.

This willingness indicates that barriers are not insurmountable. With proper support, elders are open to digital adoption. This finding is encouraging and suggests that policy interventions can have significant impact.

4.4.7 Integration with Literature

- The findings align with global studies that highlight cost, fear, and cultural perceptions as major barriers.
- However, the Nigerian context adds unique dimensions: unreliable electricity, high data costs, and strong reliance on family members.
- Unlike Western contexts where physical barriers dominate, in Nigeria socio-economic and cultural barriers are more pronounced.

We also developed a full scale flow chart algorithm for the questionaires should incase further research is been carried out for more effective results. The figure 4.7 below shows the digital access survey that was used alongside with the questionaires to ensure proper design of the survey

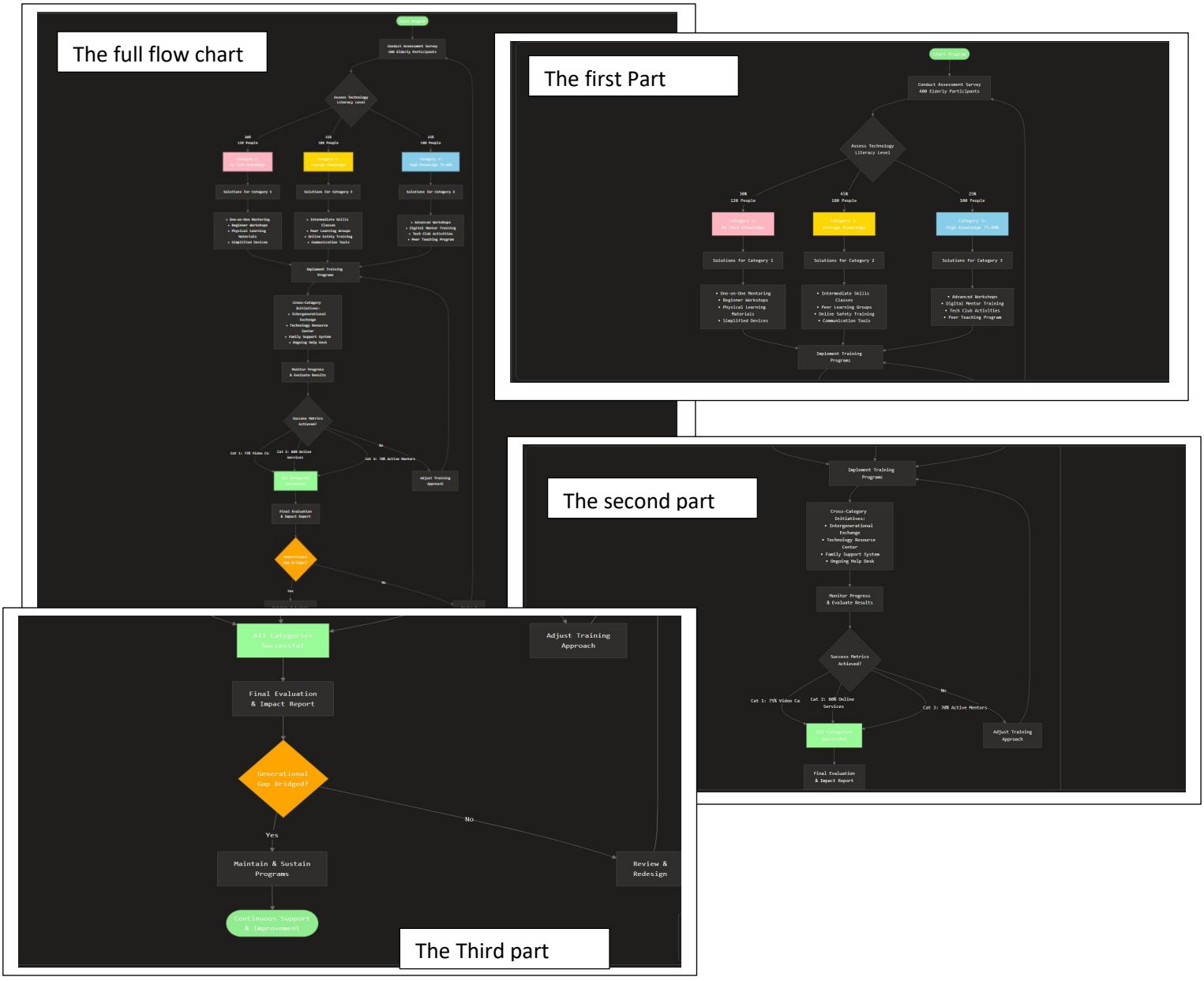
Summary of Interpretation

- Education and location are key predictors of digital inclusion.
- Socio-economic and psychological barriers are the strongest obstacles.
- Cultural perceptions reinforce exclusion, but elders show willingness to learn.
- Community-based, language-sensitive training and digital safety education are essential solutions.

4.5 Discussion

The findings of this study provide a nuanced understanding of the barriers to technology adoption among older adults in Nigeria. While many of the challenges identified are consistent with global literature, the Nigerian context adds unique dimensions that must be considered in designing interventions. This discussion situates the results within the broader scholarly

discourse and highlights their implications for bridging the generational gap (Adaghe et al., 2026).



This flow chart shows sections of different parts of the full algorithm of how to further design the digital access survey.

4.5.1 Comparison with Global Literature

- Access and affordability: The study revealed that 50% of respondents never use the internet, with socio-economic barriers (device and data costs) scoring highest (mean = 4.2). This aligns with World Bank (2021) findings that affordability is the primary

barrier to digital inclusion in Sub-Saharan Africa. In contrast, studies in Europe and North America (e.g., Selwyn, 2004) emphasize physical and cognitive barriers more than cost, reflecting differences in infrastructure and economic conditions.

- Psychological barriers: Fear of scams and low confidence were significant in this study (mean = 4.0). This resonates with Czaja & Lee (2007), who found that anxiety and mistrust are common among older adults globally. However, in Nigeria, fear is amplified by widespread reports of online fraud, making psychological barriers more severe than in some Western contexts.
- Cultural perceptions: Many elders perceive technology as "for the young" and rely heavily on family members. This finding supports Vaportzis et al. (2017), who noted that social attitudes influence elderly adoption. However, the Nigerian context is unique in the strength of intergenerational reliance, where elders often delegate digital tasks to children or grandchildren rather than attempting them independently.

4.5.2 Unique Nigerian Context

- Infrastructure challenges: Unlike Western studies where internet access is taken for granted, Nigerian elders face unreliable electricity and poor connectivity. These infrastructural issues compound socio-economic barriers and make digital adoption more difficult.
- Language and literacy: 40% of respondents had no formal education, and 80% expressed preference for training in local languages. This highlights the importance of linguistic accessibility, a factor less emphasized in Western literature but critical in Nigeria's multilingual society.
- Community-based learning: The strong willingness (70%) to attend weekly "digital hours" in trusted spaces (churches, mosques, town halls) reflects the communal nature

of Nigerian society. This suggests that interventions must leverage community structures rather than relying solely on individual training.

4.5.3 Implications for Bridging the Generational Gap

- Tailored interventions: Solutions must address the specific barriers identified: affordability, fear, cultural perceptions, and language. Generic digital literacy programs are insufficient; interventions must be context-sensitive.
- Intergenerational mentoring: Younger family members and youth volunteers can play a central role in teaching elders. This not only improves digital skills but also strengthens family bonds and reduces generational divides.
- Policy implications: Government and NGOs must prioritize affordable devices, subsidized data, and reliable infrastructure. Without addressing these systemic issues, training alone will not achieve inclusion.
- Safety education: Digital security training is essential to build confidence and reduce fear. Elders must be taught how to spot scams, set strong passwords, and use secure platforms.

4.5.4 Contribution to Knowledge

This study contributes to the literature by:

- Highlighting the primacy of socio-economic and cultural barriers in Nigeria, compared to physical and cognitive barriers emphasized in Western contexts.
- Demonstrating the importance of community-based, language-sensitive training as a solution.
- Providing evidence that despite barriers, elders show strong willingness to learn, offering hope for bridging the generational gap.

The findings confirm that barriers to technology adoption among Nigerian elders are multidimensional, with socio-economic, psychological, and cultural factors playing dominant roles. While consistent with global literature in some respects, the Nigerian context introduces

unique challenges such as infrastructural deficits and linguistic diversity. Importantly, the willingness of elders to learn suggests that with targeted interventions, the generational gap can be bridged effectively (Adaghe et al., 2026).

4.6 Data Summary

This chapter presented, analyzed, and interpreted the findings of the study on barriers to technology adoption among older adults in Nigeria. The data was drawn from 400 elderly respondents across urban and rural communities, representing diverse educational and socio-economic backgrounds. Both quantitative and qualitative methods were employed, ensuring a comprehensive understanding of the issue.

The data presentation (4.2) revealed that:

- Half of the respondents never use the internet, and only 12.5% are daily users.
- Basic phones dominate ownership, while smartphones are limited to 30%.
- Socio-economic, psychological, and cultural barriers emerged as the most severe obstacles, while physical and design barriers were also significant.
- Despite these challenges, elders expressed strong willingness to learn, with 70% ready to attend community-based training and 60% willing to acquire new digital skills.

The data analysis (4.3) confirmed that:

- Education and location significantly influence digital access and usage.
- Reliability tests showed that all barrier scales were consistent and valid.
- Regression analysis demonstrated that socio-economic and psychological barriers reduce adoption intention, while safety/confidence, education, and urban residence increase it.
- Qualitative insights highlighted fear of scams, reliance on family members, and frustration with app design, but also revealed eagerness to learn when training is offered in local languages.

The interpretation of findings (4.4) emphasized that:

- Digital exclusion among Nigerian elders is multidimensional, shaped by cost, fear, cultural perceptions, and infrastructural deficits.
- Unlike Western contexts where physical barriers dominate, Nigeria's challenges are primarily socio-economic and cultural.
- Encouragingly, elders show openness to learning, suggesting that targeted interventions can bridge the generational gap.

The discussion (4.5) situated these findings within global literature, highlighting both similarities and unique Nigerian factors. It underscored the importance of community-based, language-sensitive training, affordable access, and digital safety education as key solutions. Chapter Four also demonstrates that while Nigerian elders face significant barriers to technology adoption, they also exhibit strong willingness to learn and adapt. This dual reality high exclusion but high potential provides a foundation for actionable recommendations. Bridging the generational gap will require not only addressing affordability and infrastructure but also building confidence, trust, and culturally relevant training programs.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary of the study, draws conclusions based on the findings presented in Chapter Four and offers recommendations for policy, practice, and future research. The aim is to highlight how the study contributes to knowledge on digital inclusion among older adults in Nigeria and to propose actionable strategies for bridging the generational gap.

5.2 Summary of the Study

The study investigated barriers to technology adoption among older adults in Nigeria, focusing on physical, cognitive, psychological, socio-economic, design, and cultural/social factors. A mixed-methods design was employed, combining quantitative surveys of 400 elders with qualitative interviews and observations.

Key findings include:

- Demographics: Majority aged 60–69, with 40% having no formal education. Urban elders had greater access than rural elders.
- Access and usage: 50% never use the internet; basic phones dominate ownership; only 12.5% are daily internet users.
- Barriers: Socio-economic (cost, infrastructure) and psychological (fear, low confidence) were most severe, followed by cultural/social perceptions. Physical and design barriers were also significant.
- Training and support: Few elders had attended training, but most expressed willingness to learn, especially in local languages and community settings.
- Safety and confidence: Majority lacked scam awareness and password skills, undermining trust in digital platforms.
- Adoption intention: Despite barriers, elders showed strong willingness to learn and adopt technology if supported.

- Also we further went on to design a flow chart for a design for a device that could also solve and close the generational gap and also a pie chart to summarise the given data.

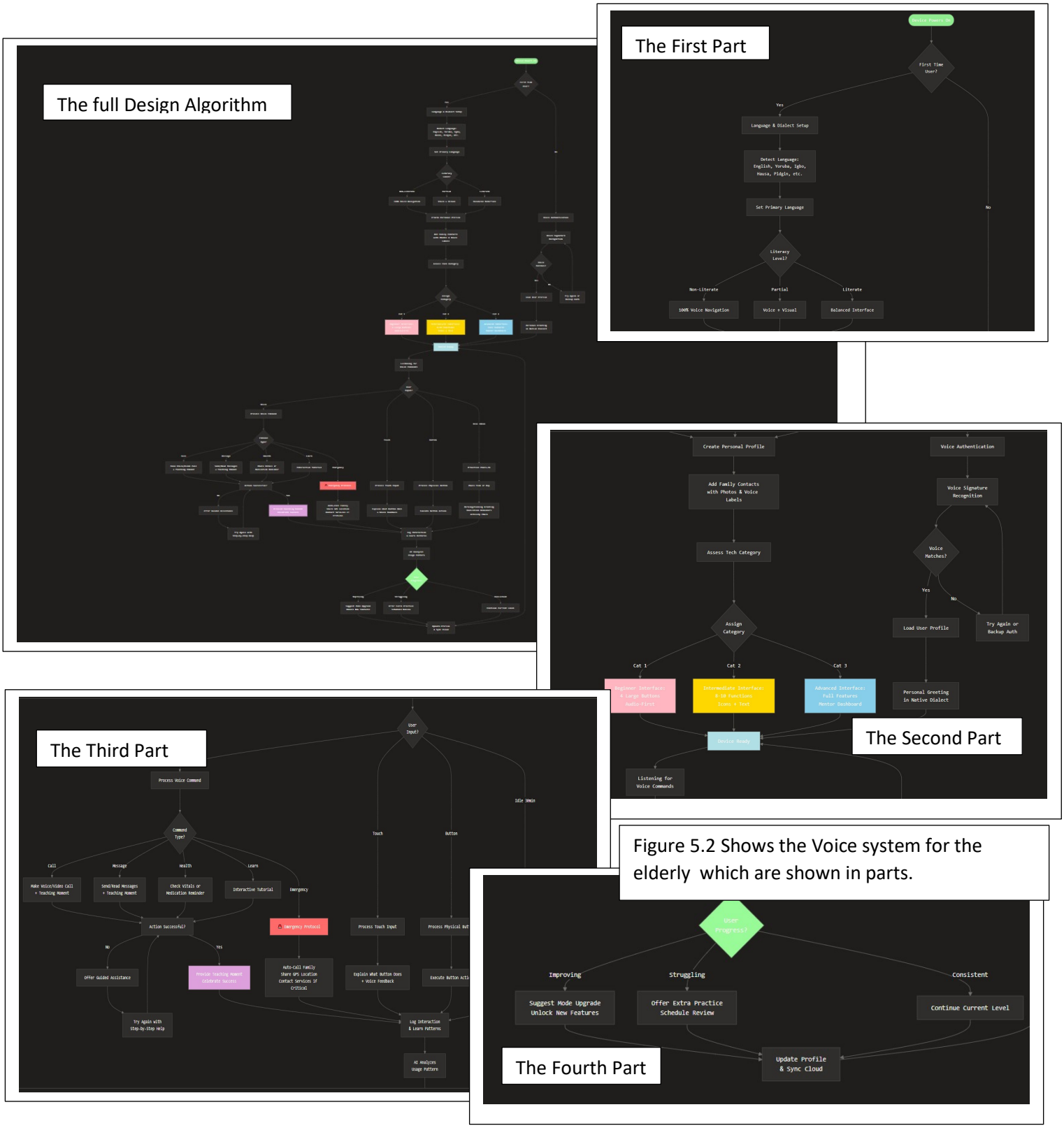


Figure 5.2 Shows the Voice system for the elderly which are shown in parts.

5.3 Conclusion

The study concludes that digital exclusion among Nigerian elders is not merely a matter of access but is shaped by a combination of socio-economic, psychological, and cultural factors. While infrastructural deficits and affordability remain critical challenges, fear of fraud, low confidence, and perceptions that technology is "for the young" further reinforce exclusion.

However, the findings also reveal a hopeful reality: elders are willing to learn and adopt technology when training is accessible, culturally sensitive, and delivered in trusted community spaces. This willingness provides a strong foundation for bridging the generational gap and ensuring that Nigeria's elderly population is not left behind in the digital age (Adaghe et al., 2026).

5.4 Recommendations

For Policy Makers

- Subsidize devices and data: Introduce affordable schemes for elders, including low-cost smartphones and subsidized internet bundles.
- Improve infrastructure: Expand reliable electricity and internet connectivity, especially in rural areas.
- Integrate digital inclusion into national aging policies: Ensure that elderly needs are explicitly addressed in ICT and social development strategies.

For Community Organizations

- Community-based training: Establish "digital hours" in churches, mosques, and town halls, led by trained youth volunteers.
- Language-sensitive programs: Deliver training in Yoruba, Hausa, Igbo, and Pidgin to overcome literacy barriers.
- Peer mentoring: Empower digitally proficient elders (20% of sample) to serve as mentors for their peers.

For Technology Developers

- Accessible design: Create apps with large fonts, simple navigation, and voice input options.
- Localized content: Ensure apps and services are available in local languages and culturally relevant formats.
- Security features: Simplify authentication processes (e.g., biometric logins) to reduce reliance on complex passwords.

For Future Research

- Conduct longitudinal studies to track changes in elderly digital adoption over time.
- Explore gender-specific barriers, as cultural roles may affect male and female elders differently.
- Investigate the impact of intergenerational mentoring programs on adoption outcomes.

5.5 Contribution to Knowledge

This study contributes to the literature by:

- Highlighting the primacy of socio-economic and cultural barriers in Nigeria compared to physical barriers emphasized in Western contexts.
- Demonstrating the importance of community-based, language-sensitive training as a solution.
- Providing evidence that elders, despite exclusion, show strong willingness to learn, offering hope for bridging the generational gap.

5.6 Summary

Chapter Five has summarized the study, drawn conclusions, and offered recommendations for policy, practice, and future research. The findings underscore that while Nigerian elders face significant barriers to technology adoption, they also exhibit strong potential for inclusion if provided with affordable access, culturally relevant training, and digital safety education.

Bridging the generational gap is therefore achievable through coordinated efforts by government, communities, and technology developers.

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APPENDICES

Appendix A: Research Instruments

- Questionnaire: Full copy of the structured survey used to collect data from 400 elderly respondents.
    - Sections: Demographics, Access and Usage, Physical Barriers, Cognitive Barriers, Psychological Barriers, Socio-Economic Barriers, Design Barriers, Cultural and Social Barriers, Training and Support, Safety and Confidence, Adoption Intention.
- Interview Guide: Semi-structured questions used to explore elders' lived experiences, including:
    - "Tell me about a time technology helped you—and a time it frustrated you."
    - "What makes you worry online? How do you avoid scams?"
    - "Who helps you with phone or internet tasks?"
    - "Do cost, electricity, or network stop you from using your device?"
    - "Are instructions clearer in your preferred language?"

Appendix B: Data Tables

- Demographic Distribution Table: Age, gender, education, location, income, living arrangement.
- Access and Usage Table: Device ownership, internet access, frequency of use, main phone activities.
- Barrier Indices Table: Mean scores for physical, cognitive, psychological, socio-economic, design, cultural/social barriers.
- Training and Support Table: Attendance at training, preferred learning sources, willingness to attend digital hours, language preferences.

- Safety and Confidence Table: Scam awareness, password strength, confidence in online tasks.
- Adoption Intention Table: Willingness to use devices more, learn new skills, recommend training.

Appendix C: Statistical Outputs

- Reliability Analysis (Cronbach's Alpha): Output tables showing internal consistency of each barrier scale.
- Chi-Square Tests: Results showing relationships between education and internet usage, location and device ownership.
- Regression Analysis: Output tables showing predictors of adoption intention (barrier indices, demographics).
- Exploratory Factor Analysis (EFA): Factor loadings confirming construct validity of barrier categories.

Appendix D: Charts and Figures

- Pie chart showing distribution of technology knowledge categories (No knowledge, Average knowledge, High knowledge).
- Bar charts showing device ownership and internet usage frequency.
- Line chart showing adoption intention trends.
- Factor analysis scree plot.

Appendix E: Ethical Documents

- Informed Consent Form: Explaining purpose, confidentiality, voluntary participation, and right to withdraw.
- Enumerator Training Guide: Instructions for neutral administration, accessibility support, and ethical safeguards.

- Approval Letter: From relevant academic or community authority granting permission to conduct the study.

Appendix F: Data Dictionary

- Variable names, labels, and coding scheme for all questionnaire items (see attached CSV file).
- Composite indices definitions (Physical_index, Cognitive_index, Psychological_index, etc.).

Appendix G: Sample Responses (Qualitative)

- Selected anonymized quotes from elders:
    - "I hear stories of people losing money online, so I avoid it."
    - "My son helps me pay bills online; I don't trust myself."
    - "Every time the app updates, I get confused again."
    - "If someone teaches me in Yoruba, I will try."

Appendix H: Intervention Flowchart

- Title: *Technology Literacy Intervention Framework for Elderly Participants*
- Description: This flowchart outlines the step-by-step process used to assess, categorize, train, and evaluate elderly participants based on their technology literacy levels. It includes tailored solutions for each category and cross-cutting support mechanisms.