ENHANCING DISTANCE LEARNING FOR ADULT LEARNERS THROUGH ELECTRONIC DEVICES

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Abstract

This study examines the technical challenges encountered by adult learners in the Puttalam Educational Zone, Sri Lanka, within the context of distance learning. It focuses on key issues including device usability, internet accessibility, software compatibility, digital literacy, and disparities across urban–rural settings, age groups, and gender. Employing a mixed-methods approach that combines surveys and interviews, the research explores how these challenges affect the effectiveness of distance education. Findings indicate that 40% of learners face device usability difficulties, particularly with smartphones and tablets, while 35% experience unreliable internet connections, predominantly in rural areas. Software compatibility issues affect 30% of learners, largely due to outdated devices and non-mainstream operating systems, and over 25% report insufficient digital literacy. The study further reveals notable disparities in device usage: rural learners rely more heavily on smartphones, whereas younger learners prefer them for portability, and older learners favor laptops for their larger screens and multitasking convenience. Gender differences are also observed, with males reporting slightly better internet access than females. Based on these findings, the study proposes strategies to enhance the distance learning experience, including optimizing educational platforms for diverse devices, strengthening rural internet infrastructure, improving software compatibility, addressing gender disparities, and offering targeted digital literacy programs. Overall, the research provides practical recommendations for overcoming technical barriers and improving the quality and inclusivity of distance learning among adult learners in the region.

Keywords: Distance Learning, Adult Learners, Electronic Devices, Digital Literacy, Urban-Rural Disparities

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Introduction

In recent years, the education system in Sri Lanka has faced significant scrutiny, particularly in its ability to meet the needs of a rapidly changing global educational landscape. Despite the establishment of free education in 1945, there remains a wide disparity in the quality of education, especially in rural and underdeveloped areas. The unequal distribution of resources and a lack of sufficient teacher training have been identified as key factors contributing to this inequality (Visakaruban et al., 2024). To bridge these gaps, improving resource allocation and enhancing teacher training programs are critical steps toward ensuring that all students have equal opportunities to succeed (Tholappan & Begam, 2024).

The rapid advancement of technology has significantly impacted education, making distance learning a crucial avenue for adult learners in Sri Lanka, particularly those in the Puttalam Educational Zone. With the rise of online learning platforms, adult learners are now able to pursue higher education while managing work and family responsibilities. However, this shift towards technology-driven learning is not without its challenges. One promising solution that has emerged in response to these challenges is blended learning, which combines traditional in-person classes with e-learning components. This hybrid approach not only addresses the need for flexibility but also enhances student engagement and learning outcomes (Tholappan & Begam, 2024). As Piratheeban (2023) emphasizes, fostering self-directed learning readiness is critical for improving student performance in blended learning environments, as students who are ready for independent learning are more likely to succeed.

Despite its potential, distance learning remains constrained by significant technical challenges. The reliance on electronic devices, the internet, and digital tools has exposed several barriers that affect the overall effectiveness of online education. Key challenges include poor device usability, slow or unreliable internet access, software incompatibility, and low levels of digital literacy. For adult learners, especially those with limited experience with technology, these issues are particularly exacerbated, making engagement with distance learning platforms more difficult. Moreover, inconsistent network coverage in rural areas has

further disrupted the use of smart classrooms, leading to a widening digital divide in educational opportunities. As noted by Paunanthie (2020), inadequate network infrastructure in underserved regions has significantly hindered the ability of both teachers and students to make full use of digital learning tools, limiting the overall effectiveness of smart classrooms and e-learning technologies.

Literature Review

Distance learning has become increasingly important for adult learners, offering flexibility to balance personal, professional, and academic responsibilities. As technology evolves, electronic devices, such as smartphones, tablets, and laptops, offer significant opportunities for accessing education. However, this shift to technology-based learning also introduces challenges, including limited device usability, poor internet access, software compatibility issues, and low digital literacy (Visakaruban et al., 2024). The Andragogy Theory by Knowles (1980) provides a crucial theoretical foundation for understanding adult education. It emphasizes self-directed learning, highlighting the importance of autonomy in the learning process, which is especially relevant in distance education. In the context of technology-enhanced learning, adult learners can use smartphones, laptops, and other electronic devices to access educational content in a flexible and independent manner. These tools not only facilitate access to information but also help increase motivation and engagement among adult learners (Knowles, 1980).

The Technology Acceptance Model (TAM), introduced by Davis (1989), has been widely applied in the field of distance education to explore how adult learners adopt technology. According to TAM, learners are more likely to embrace technology if they perceive it as easy to use and beneficial for their educational goals. Venkatesh and Bala (2008) extended this model by emphasizing that the perceived relevance and accessibility of technology play crucial roles in sustaining engagement. Given the diverse digital environments faced by adult learners, these

factors must be considered when integrating technology into distance learning.

The Community of Inquiry (CoI) Framework, developed by Garrison, Anderson, and Archer (2000), identifies three critical elements cognitive presence, social presence, and teaching presence that contribute to effective distance learning. Electronic devices play a pivotal role in enhancing these components by enabling seamless communication, providing access to a variety of educational resources, and fostering collaborative and interactive learning environments. By promoting these aspects, technology contributes to a more engaging and dynamic learning experience for adult learners (Garrison et al., 2000).

Empirical studies have consistently highlighted the positive impact of electronic devices on adult learners in distance education. Gikas and Grant (2013) explored the advantages of mobile devices, which offer flexibility, real-time information, and interactive learning experiences. These findings align with the needs of adult learners, who often require accessible and convenient learning methods that fit into their busy schedules. Furthermore, research by West, Waddoups, and Graham (2007) demonstrated that integrating laptops into adult education settings significantly improved learning outcomes, including enhanced understanding, retention, and the practical application of knowledge. These studies underscore the transformative potential of technology in adult education.

However, the integration of technology in distance learning is not without its challenges. Combes and O'Reilly (2013) pointed out that digital literacy is crucial for the successful engagement of adult learners in online education. Many adult learners struggle with using digital tools effectively, highlighting the need for targeted training programs to improve digital literacy. Such programs enable learners to navigate technology, access resources, and engage with content more effectively, ultimately enhancing their learning outcomes.

The integration of technology in education also varies by demographic factors such as age, gender, and geographic location. Studies by Molenaar et al. (2019) found that older adults tend to experience more difficulties with new technology compared to younger learners, largely due to generational differences in familiarity with digital tools. Gender-based

disparities in technology usage have also been identified, with male learners often having better access to devices and internet services compared to female learners, particularly in rural settings (Mahmood & Peddiboyina, 2018). Additionally, rural learners face unique challenges, including limited internet connectivity and reliance on smartphones, which affects their ability to engage with more resource-demanding educational tools (Visakaruban et al., 2024).

Objectives

This research aims to explore the technical and systemic factors affecting distance learning for adult learners in the Puttalam Educational Zone. The study further examines device usability, focusing on hardware limitations, operational difficulties, and malfunctions that interfere with the learning process. Internet accessibility is a critical aspect of this research, as it investigates issues related to the availability, reliability, and affordability of internet services, which are vital for students' participation in live sessions and access to online learning resources. Software compatibility challenges are also addressed, particularly in relation to learners' ability to access and effectively use educational platforms, which often require specific technical requirements that many learners in rural areas cannot meet due to outdated devices and operating systems. Additionally, this study investigates the digital literacy levels of adult learners, assessing how varying levels of digital proficiency impact learners' ability to engage with and benefit from online education.

Data and Methods

This study employed a mixed-methods design to comprehensively examine the factors influencing distance learning among adult learners in the Puttalam Educational Zone. Quantitative data were collected through structured questionnaires assessing device usability, internet accessibility, software compatibility, and digital literacy, while qualitative insights were obtained from semi-structured interviews and focus group discussions exploring learners' experiences and coping strategies. A combination of descriptive and exploratory approaches was used to document existing challenges and explore possible solutions. The study targeted adult learners enrolled in distance education programs, with a sample of 250 participants selected through stratified random sampling

for the quantitative phase and 25 purposively selected participants for the qualitative phase, guided by data saturation. Data were gathered using structured and semi-structured tools, and analyzed through descriptive statistics and narrative analyses for qualitative data, enabling a comprehensive understanding of the barriers and opportunities within digital learning environments.

Results and Discussion

Assessing Challenges in Device Usability

Device usability plays a key role in determining how effectively learners can engage with digital learning activities. The ease or difficulty of using devices directly affects participation, motivation, and learning outcomes. This section examines learners' perceptions of their device usability based on their self-reported ratings.

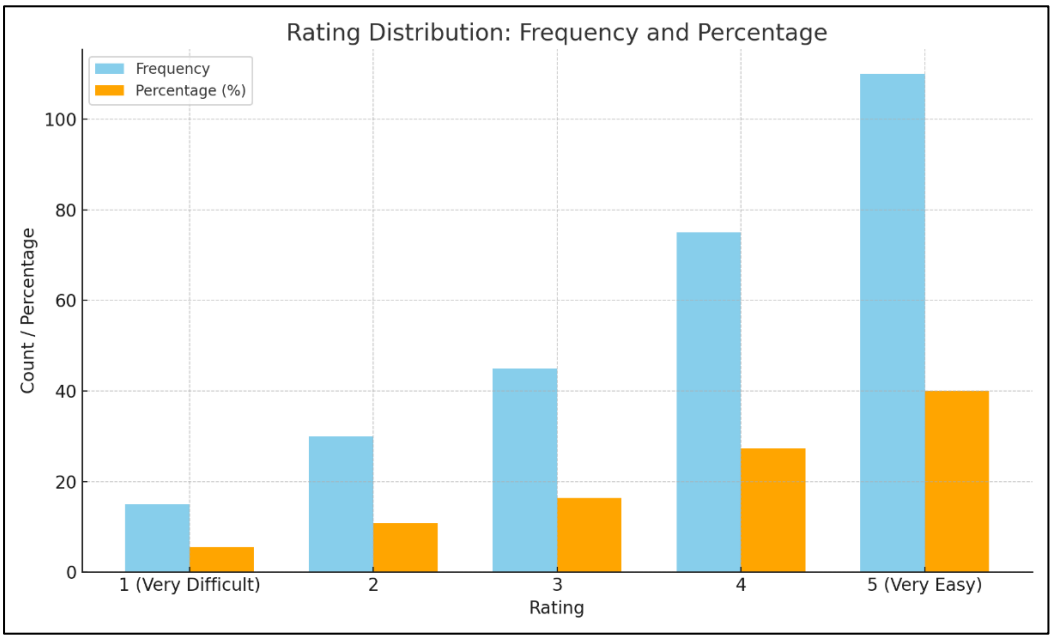
Table 01: Device Usability Ratings

Rating (1-5)	Frequency	Percentage (%)
1 (Very Difficult)	15	5.5
2 (Difficult)	30	10.9
3 (Neutral)	45	16.4
4 (Easy)	75	27.3
5 (Very Easy)	110	40

Source: Survey Data, 2024

According to the quantitative data, device usability ratings varied, with the majority of respondents (40percent) rating their devices as "very easy" to use for learning activities, followed by 27.3percent who rated usability as "4" on the five-point scale. However, a notable portion of learners (16.4percent) reported moderate usability, and 16.4percent rated it as difficult (ratings 1 or 2), indicating significant challenges in using devices effectively.

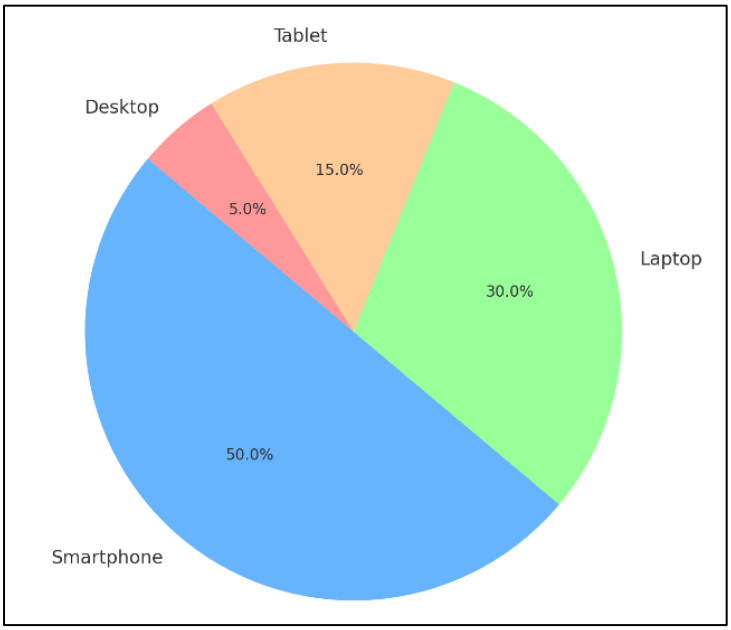
Figure 1: Device Usability Rating Distribution



Source: Field Survey 2024

In terms of device types, the figure 2 shows smartphones were the most commonly used (50percent), followed by laptops (30percent), tablets (15percent), and desktops (5 percent). This indicates a heavy reliance on mobile devices for distance education.

Figure 2**:** Device Type Distribution.



Source: Field Survey, 2024

Qualitative findings added depth to the data, revealing recurring issues such as difficulty navigating interfaces, especially on tablets and smartphones. Some learners reported that switching between tabs was challenging and that software was not optimized for small screens. Technical problems such as frequent device crashes, app freezes during screen sharing, and limited battery life were also commonly mentioned. These findings suggest that while many learners adapted well to their devices, technical limitations and usability issues posed serious barriers to effective participation in distance learning.

Internet Accessibility and Its Impact

Internet accessibility plays a vital role in ensuring the effectiveness of online learning, as uninterrupted connectivity directly influences learners' participation and engagement. Despite the growing reliance on digital platforms, many learners continue to face unstable network conditions that disrupt their academic activities. The table 2 exhibits the frequency

of issues of connectivity which is essential to evaluate their overall impact on the learning process.

Table 02: Internet Connectivity Issues:

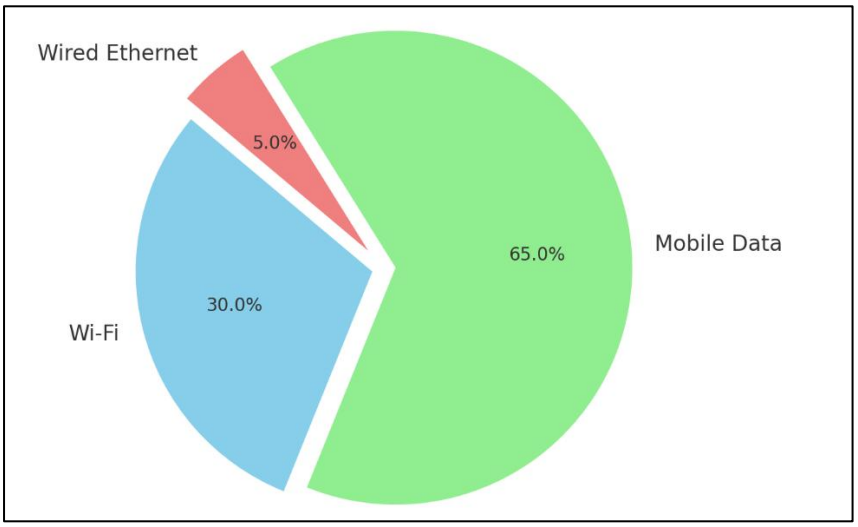
Frequency of Issues	Number of Responses
Never	30
Rarely	50
Sometimes	105
Often	65
Always	25

Source: Filed Survey, 2024

Table 02 further presents the frequency of internet connectivity issues reported by learners. Each participant selected only one response option. The findings show that 38.2percent of learners experienced connectivity issues “sometimes,” while 23.6percent reported them “often” and 9.1percent said they “always” faced disruptions. In contrast, 10.9percent indicated they “never” encountered such issues, and 18.2percent said they faced them “rarely.” These results indicate that a considerable proportion of learners experienced regular interruptions during their online learning sessions.

Figure 3 shows Internet access played a critical role in shaping learners’ experiences with distance education. Survey data revealed that the majority of respondents (65percent) relied on mobile data connections, followed by Wi-Fi (30percent) and wired Ethernet (5percent).

Figure 3: Internet Connection Types Among Adult Learners



Source: Field survey, 2024

Qualitative responses further highlighted the challenges of unstable internet connections. Many learners reported dropped connections during lectures, leading to missed content and disrupted learning. One participant noted, “The internet often cuts off during lectures, making it hard to follow along,” while another shared, “I lose connection during group discussions, so I miss out on important points.” Slow connection speeds also impacted participation, with common complaints about video freezing, audio lag, and difficulty engaging in discussions.

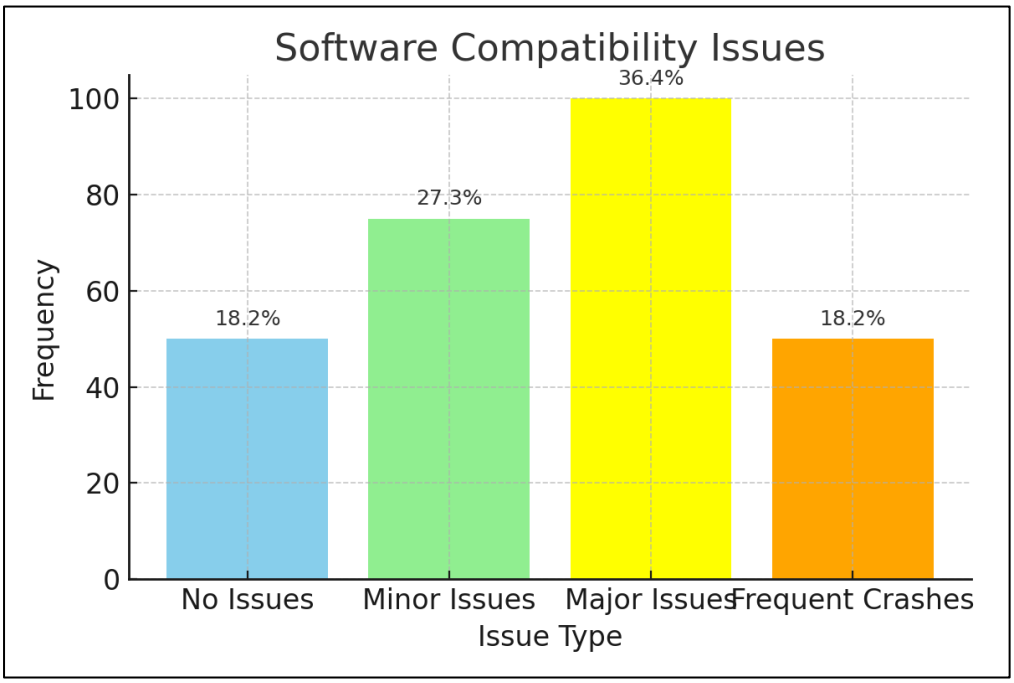
Overall, while most learners had some form of internet access, the type and quality of connectivity significantly affected the effectiveness of their distance learning experience, especially for those depending on less stable mobile data networks.

Software Compatibility Challenges

Software compatibility emerged as another significant barrier affecting the smooth operation of distance learning platforms. Many learners encountered difficulties when using educational applications across different devices and operating systems, which often disrupted their participation in online sessions. Variations in platform performance and

frequent technical glitches further limited the overall effectiveness of the learning experience. Figure 4 shows 36 percent encountered major issues while 27 percent shows minor issues.

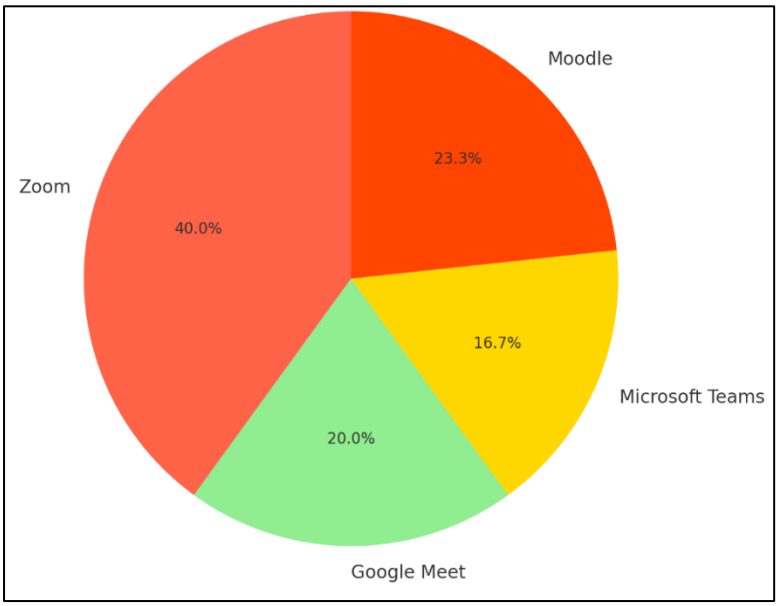
Figure 4**:** Software Compatibility Issues



Source: Field Survey, 2024

Figure 5 shows learning platform usage patterns of the respondents. Analysis of platform usage revealed that Zoom was the most commonly used platform (40percent), followed by Moodle (23.3 percent), Google Meet (20 percent), and Microsoft Teams (16.7 percent).

Figure 5: Learning Platform Usage Patterns



Source: Field Survey, 2024

Cross-tabulation analysis indicated that compatibility issues were often associated with specific combinations of platforms and device types. For instance, learners using tablets or smartphones reported more frequent problems with accessing Moodle or screen sharing on Zoom. These quantitative trends were supported by qualitative responses. Learners described situations where Zoom crashed during screen sharing, or Moodle failed to load materials properly on mobile devices. Others reported difficulties in accessing course content due to incompatibility between the learning software and their operating systems. Some expressed frustration over not being able to open certain files or navigate course platforms effectively on their devices. These findings highlight the need for software platforms used in distance learning to be better optimized for a wider range of devices and operating systems to ensure equitable access for all learners.

Disparities in Device Usage: Urban vs. Rural

The analysis further examined how learners' geographical location influenced their access to and use of digital devices for distance

education. Differences in device ownership and internet reliability emerged as significant factors shaping learning opportunities across regions. In particular, notable contrasts were observed between urban and rural learners in terms of the types of devices used and their overall accessibility.

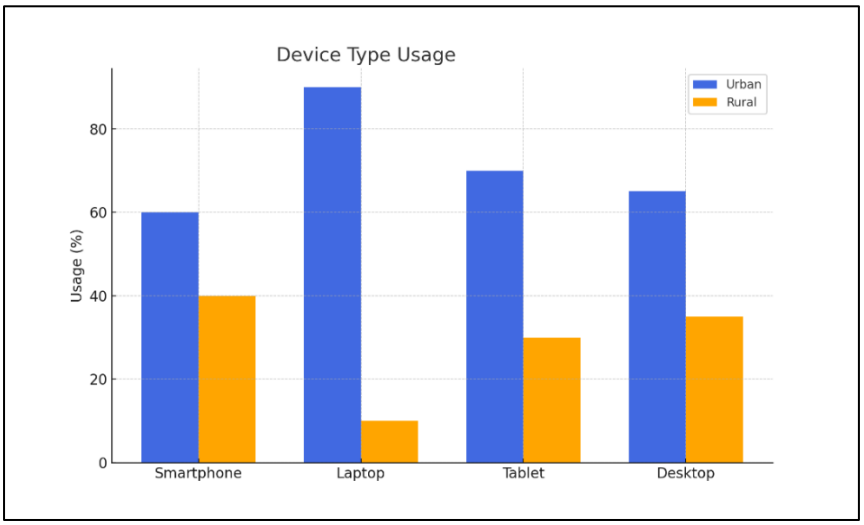
Table 03: Device Usage by Sector

Device Type	Urban Usage	Rural Usage
Smartphone	60	40
Laptop	90	10
Tablet	70	30
Desktop	65	35

Source: Field Survey, 2024

The study explored differences in device usage between urban and rural learners engaged in distance education as depicted in figure 6. The data showed clear disparities: urban learners reported significantly higher use of laptops (90 percent) and desktops (65 percent), whereas rural learners primarily relied on smartphones (40percent) and tablets (30percent).

Figure 6**:** Device Usage by Sector



Source: Source: Field Survey, 2024

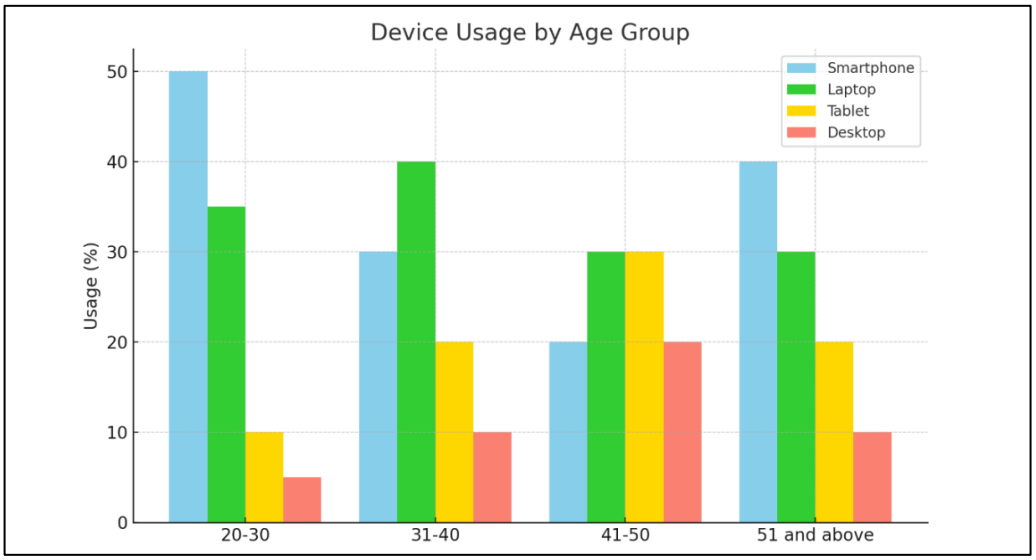
Qualitative responses reinforced these findings. Urban participants often reported better access to high-quality devices and stable internet, with one learner stating, *"I have a laptop that I use for all my courses."* In contrast, rural learners expressed limitations, frequently mentioning reliance on smartphones or tablets due to the unavailability of computers. One noted, *"It's hard to get fast internet, and many students only have smartphones."*

These results suggest that urban learners benefited from more reliable digital infrastructure and resources, while rural learners faced notable disadvantages, potentially affecting the quality and depth of their distance learning experience.

Patterns of Distance Learning Usage by Age

Age is an important factor influencing how learners engage with digital technologies in distance education. Variations in device preferences often reflect differences in technological familiarity, learning habits, and comfort levels across generations. Understanding these patterns helps identify how age-related preferences impact the effectiveness and accessibility of online learning environments as depicted in figure 7.

Figure 7: Device Usage by Age



Source: Field Survey, 2024

The study examined how age influenced the choice of devices used for distance learning. Frequency distribution analysis revealed notable trends across age groups. Learners aged 20–30 predominantly used smartphones (50percent), while laptop usage was more common among those aged 31–40 (40percent) and 41–50 (30percent). Among learners aged 51 and above, smartphone and laptop usage were nearly equal (40percent and 30percent respectively), with tablet and desktop use also present across all age groups to varying degrees.

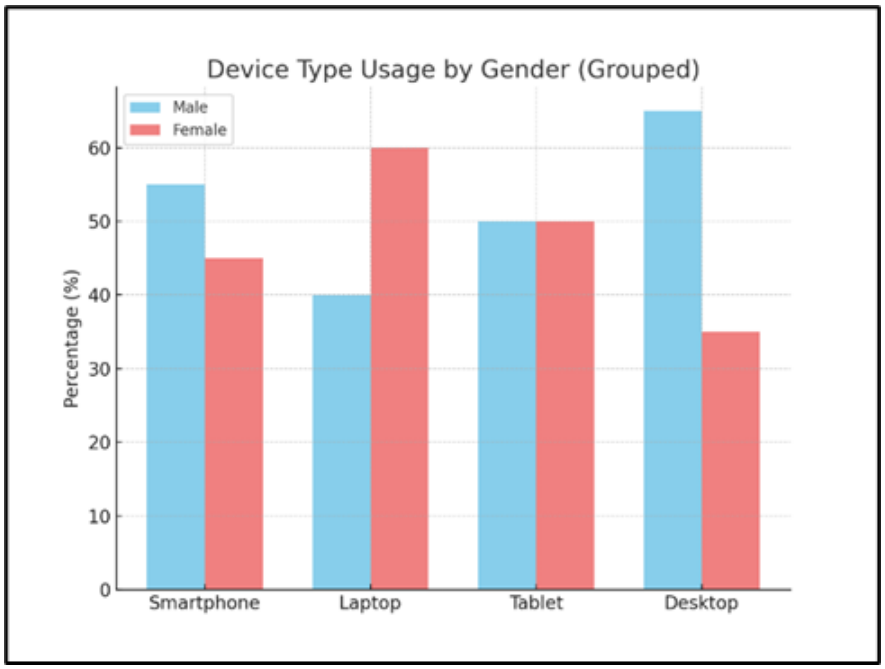
Qualitative insights supported these patterns. Younger participants emphasized portability and ease of use, stating, “I use my phone for everything, including classes,” and, “Smartphones are the most convenient device for students under 30.” In contrast, older learners preferred larger devices, with one noting, “I find it easier to focus on a laptop rather than a small screen,” and another explaining, “Laptops offer better multitasking for me when managing work and study.”

These findings suggest that age plays a significant role in shaping device preferences, with younger learners leaning toward mobile convenience and older learners favoring functionality and comfort for academic engagement.

Disparities in Device and Internet Access by Gender

Figure 8 shows device usage by gender. Gender differences play a significant role in shaping learners' access to digital resources and online learning experiences. Variations in device ownership and internet reliability often reflect broader social and geographical inequalities among adult learners. Understanding these disparities helps identify which groups face greater challenges in participating effectively in distance education.

Figure 8: Device Usage by Gender:



Source: Field Survey Data, 2024

Conclusion

The study revealed that while a majority of adult learners rated their devices as easy to use, a significant portion still faced challenges with device usability. Smartphones were the most commonly used device, yet many learners experienced difficulties navigating educational platforms, especially on smaller screens. Technical issues such as app freezes, limited battery life, and frequent crashes were frequently reported. These

problems hindered smooth participation in online classes and affected overall learning efficiency.

Internet connectivity was another major concern, with most learners relying on mobile data, which was often unstable. Many participants reported regular disruptions during online sessions, resulting in missed content and difficulties in communication. The type and quality of internet connection played a crucial role in shaping the learning experience, especially for those in rural areas. Software compatibility issues were also widespread, with major and minor problems reported across platforms such as Zoom, Moodle, and Google Meet. Learners using smartphones and tablets encountered the most challenges, including screen sharing failures and file access problems.

The study also highlighted disparities in device access and usage based on geography, age, and gender. Urban learners had better access to advanced devices like laptops and desktops, while rural learners depended more on smartphones and tablets. Age influenced device preference, with younger learners favoring smartphones and older learners preferring laptops for better usability. Gender differences were evident as well—females had higher laptop usage, while males used smartphones and desktops more frequently. These findings pointed to the need for targeted solutions to bridge digital gaps and create a more inclusive distance learning environment.

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