
Effectiveness of Nvda Software in Improving Quality of Life for Individual with Low Vision

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Abstract

Purpose: To evaluate the effectiveness of NVDA (Non-Visual Desktop Access) screen reading software to improve daily life task and enhance independence.

Material and Methods: A quasi-experimental study was conducted at LRBT Hospital, Lahore which took 4 months (March to June). 34 participants between the ages 18 to 50 are taken through purposive sampling who are visually impaired and never had used any assistive technology. Participants are guided about the NVDA software and then installed it on their PCs or tablets according to their need. A systematic questionnaire according to WHO guidelines was used to gather data. SPSS version 25.0 was used to analyze the responses, and the findings were presented as percentages and frequencies.

Results: Among the 34 people who participated, 23.5% were women and 76.5% were men. 67.6% of those who responded agreed or strongly agreed that NVDA enhanced their capacity to carry out everyday duties on their own. Furthermore, 64.7% of respondents said that the visually impaired population might greatly benefit from inexpensive assistive technology. The Achieved Functioning domain had the highest mean score (3.87), suggesting a favorable influence on self-assurance and independence regarding technology use.

Conclusion: By allowing digital access, increasing independence in performing everyday tasks, and encouraging social participation, NVDA software considerably improved the standards of life for people with impaired vision. It is a useful assistive device for low vision rehabilitation because of its inexpensive cost, verbal assistance, and simplicity of use.

Keywords: Low Vision, NVDA Software, Visual Impairment, Assistive Technology, Screen Reader, Digital Accessibility, Quality of Life

Introduction

Low vision refers to a significant visual impairment that limits daily functioning and after best possible and surgical correction visual acuity less than 6/18 to light perception and visual field less than 10 degree from point of fixation (1). A range of visual impairments that can't be fully corrected with standard eyewear or medical treatments. The World Health Organization categorizes low vision

based on the severity of visual impairment, including VA less than 6/24 to light perception and VF loss (2). In Oman, a prevalence survey shows that individuals were suffering from low vision and blindness which are mostly older and aged above 45 years. The survey revealed a blindness prevalence of 8.4 % and a low vision prevalence of 47.12% in this age group (3). In 2020, cataracts and poorly corrected refractive errors were the most common causes of blindness and moderate to severe vision loss. Glaucoma, age-related macular degeneration, and diabetic retinopathy also caused a lot of vision loss in about 20 million people aged 50 and older. These diseases are often hard to treat well. The World Health Organization (WHO) states that cataracts and refractive errors are avoidable causes of vision loss because they can be treated with surgery and glasses that correct vision, respectively (5). A survey in Kaduna state looked at 8,400 people in 120 randomly chosen communities. It found that 0.8% of them were blind and 3.0% had low vision (6). In the Galle district, about 37% of adults aged 40-60 years had uncorrected low vision, with most individuals not having addressed their visual impairments. Visual impairment affected 37.7% of the study sample due to uncorrected vision, with 37.1% having low vision and 0.6% having blindness. Notably, corrective measures had already been taken by 24.3% of those with visual impairment (7). The primary causes of low vision in children were identified as Stargardt's maculopathies (15%), maculopathies (13%), and myopic macular degeneration (11%), with nystagmus accounting for 14% of cases. Other significant contributors included oculocutaneous albinism (7%) and amblyopia (6%). Among retinal diseases; retinitis pigmentosa was identified in 5% of cases (8). Cataracts emerged as the predominant cause of visual impairment among the elderly, impacting nearly 35% of individuals (9). Additionally, other notable causes of visual impairment included vitreo-retinal disorders, which accounted for 12.3% of cases, corneal opacities at 12%, and diabetic retinopathy at 4.95%. These outcomes emphasize the need of treating age-related eye disorders and the requirement for comprehensive eye care services targeted to the older population, with a focus on early identification, prevention, and treatment of these disorders in order to reduce their negative effects on vision and quality of life (10). Non Visual Desktop Access, or NVDA, is a free, open-source screen reader that helps blind and visually impaired people use computers effectively (11). NVDA, the second most widely used screen reader, is accessible in 62 languages and supports the e-Speak speech converter. NVDA works with every version of Windows in addition to JAWS (Job Access with Speech). They are different in terms of settings, operations, costs, features, and languages, yet having certain commonalities. In order to enable people with visual impairments to freely access computers, browse the web, and communicate, screen readers such as NVDA are essential (12). Participants in the software training received personalized mobile applications with features for mobility, orientation, and daily chores. The training program was designed with inclusivity in mind, offering affordable rates and free training for those who couldn't afford it (13). People with visual impairments can connect with technology, use digital content, and traverse digital interfaces independently with the use of screen reading software.

(14). NVDA is essential to enhancing digital accessibility because it facilitates user navigation by presenting intractable objects in a list format or through a review cursor. NVDA has this great feature where you can move around tables in any direction side to side, up and down without getting stuck. That makes dealing with complicated web layouts a whole lot easier (15). Additionally, when you're working through tables, NVDA actually tells you what row and column you're in, which helps you keep track of everything (16). All of this makes digital life more organized and accessible, so you don't feel lost or overwhelmed trying to find what you need. Screen readers like NVDA, Apple's Voice Over, and Google's Talk Back have come a long way. They're way better at making digital spaces accessible for everyone. But, let's be honest, using touchscreens is still tricky if you can't see the screen (17). According to assistive technologies like JAWS and NVDA, people who are blind or have low vision can jump into mainstream education, pick up computer skills, start new careers, and

get the information they need. This kind of access opens up all sorts of possibilities, letting people use their skills in all kinds of jobs. It's not just about getting online it's about independence, being able to do things on your own, and connecting with others. (18). People with visual impairments can now simply access and interact with Windows computer operating systems on their desktops or laptops thanks to the free, open-source screen reader program "Nonvisual Desktop Access" (NVDA). NVDA, for example, is free and open-source. Anyone can download it and use it on their Windows computer, whether it's a desktop or laptop. It reads out everything you type or see on the screen, making it possible to read documents, send messages, or browse the web without needing to see what's on the monitor. You don't need to rely on someone else, or on visual cues, to use your computer. That kind of freedom really boosts confidence and helps people feel more at home in the digital world. Overall, this level of accessibility isn't just useful it's life changing (19).

Rationale

The purpose of this research is to address or investigate the impact of NVDA software on daily life task of individual with low vision. This study is useful for the visually impaired persons to enhance their independence with the help of technology.

In October 2019, Sejam et al. conducted a study at a Delhi tertiary eye care institution to examine young patients with visual impairments' awareness of and use of assistive devices. The purpose of the study was to learn about assistive technology utilization, awareness, and obstacles. 85 patients from a visual rehabilitation clinic 69.5% of them were men were included in the study. The majority of patients (83%) had eyesight that was less than 6/18 to 1/60. The findings indicated that patients had a moderate awareness of ten assistive devices; however they were only aware of two (near optical magnifiers and walking long canes). But most assistive technology were not widely recognized or used (14).

A research by Nida Amin et al. evaluated how NVDA software affected students with visual impairments' academic achievement. The purpose of the study was to compare how well two well-known screen readers, JAWS and NVDA, improved visually impaired students' academic performance. The research design was analytical prospective. Students with significant visual impairments who were age-matched were divided into two groups for the study: Group A used NVDA, and Group B used JAWS. The M notation Reading acuity chart was used to measure critical print size, maximum reading speed, and reading acuity. The results showed that NVDA outperformed JAWS in improving the academic achievement of visually impaired students. Because NVDA can fulfill individual student demands, improve learning processes, and achieve high user satisfaction, it was the superior choice. By using assistive technologies like NVDA, visually impaired students can actively participate in academic activities, promoting inclusivity and empowerment (19).

In 2019, Kaulu et al. carried out a study at the Zambia Library, Cultural and Skills Centre for the Visually Impaired (ZLCSCVI) to identify the various assistive technologies available to individuals with visual impairments. They didn't just collect numbers they talked to people, too. Seventeen students and three tech instructors took part. The whole idea was to figure out how these students use things like JAWS and NVDA, which are screen readers, to get through their classes. Turns out, giving students access to digital stuff e-books, PDFs, websites, emails, music made a real difference. JAWS and NVDA helped them chase their academic goals. What really stood out? Schools need to weave assistive tech right into the way they teach. And it's not enough just to have the tools; instructors need to know how to use them. The researchers made it clear: the government should step up and get more of this tech, especially JAWS, into Zambian schools for visually impaired students. Plus, teachers should get proper training so they can help students use these tools and do better both socially and academically. (20).

Material and Methods

Study Design: quasi experimental

Settings: The study was conducted at, LRBT and UOLTH Hospital.

Duration of Study: 4 months

Sample Size: 34 patients by using formula

Sampling Technique: Purposive Sampling Technique

Inclusion Criteria:

- Both Genders
- Age above 15 years
- Low vision patients

Exclusion Criteria:

- Blind person
- Children undergoing orthodontic children
- VA better than 6/18
- Those patients which are already used assistive technologies

Equipment:

- NVDA Software
- Computer or Tablets
- Snellen Chart

Tests include:

- NVDA software
- Mobile phones/ Tablets
- Snellen chart for measuring visual acuity
- Computer or Laptops

Data Collection Procedure

Assent has been acquired from the University of Lahore's IRB (Institutional Review Board). A well-crafted questionnaire that includes details about name, age, gender, ocular history, and medical history will be used to gather data in accordance with the inclusion criteria. This study has been conducted on the low vision persons in the Mayo and LRBT Hospital. The next patient will be chosen for inspection if the patient refuses. Effectiveness of NVDA software in improving daily life functioning for individuals with low vision with the help of the following

NVDA Software

Mobile Phones/ Tablets

Logmar Chart for measuring visual acuity

Identification of study variables

Outcome measurements:

Effectiveness of NVDA Software in improving daily life task for people with low vision

Conflict of interest: There is no conflict of interest among all authors

Data Analysis Procedure: The data will be shown based on the category of variable and as actual numbers. Data analysis will be done using social science software (SPSS). The outcome will be shown as a percentage and proportions using a pie chart or bar.

Ethical Considerations

- The rules and regulations set by the ethical committee of university of Lahore will be followed while conducting the research and the rights of the research participants will be respected.
- Every participant will be required to provide written informed permission (attached).
- All data and information generated will be kept hidden.
- The study's participants will maintain their privacy.
- The participants will be made aware that the study's methodology carries no risks or drawbacks.
- They will additionally be told that they can leave the study at any point while it is being conducted.
- Every effort will be made to ensure your privacy. No publication associated with this research will disclose your identity.
- You are not required to participate in this research project. You have the option to decline participation and to change your mind at any moment. If you choose not to participate in this study or to withdraw from it, you won't face any consequences.

Results

Total four age groups were used to analyze 34 low vision patients including both males and females. 44.1% were patients that were in group 18-28 years. 26.5% of patients ranged between 29-38 years. 17.6% of patients were between the ages 39-48 years. 11.8% of patients that were in the age group of above 49 years.

Table 5.1:

These challenges significantly affect my ability to perform daily activities.

Frequency			Percent
Valid	strongly disagree	12	35.3
	Disagree	8	23.5
	Neutral	4	11.8
	Agree	3	8.8
	strongly agree	7	20.6
	Total	34	100.0

The table 5.1 shows the result of a survey question regarding the impact of challenges on daily activities.

Table 5.2:

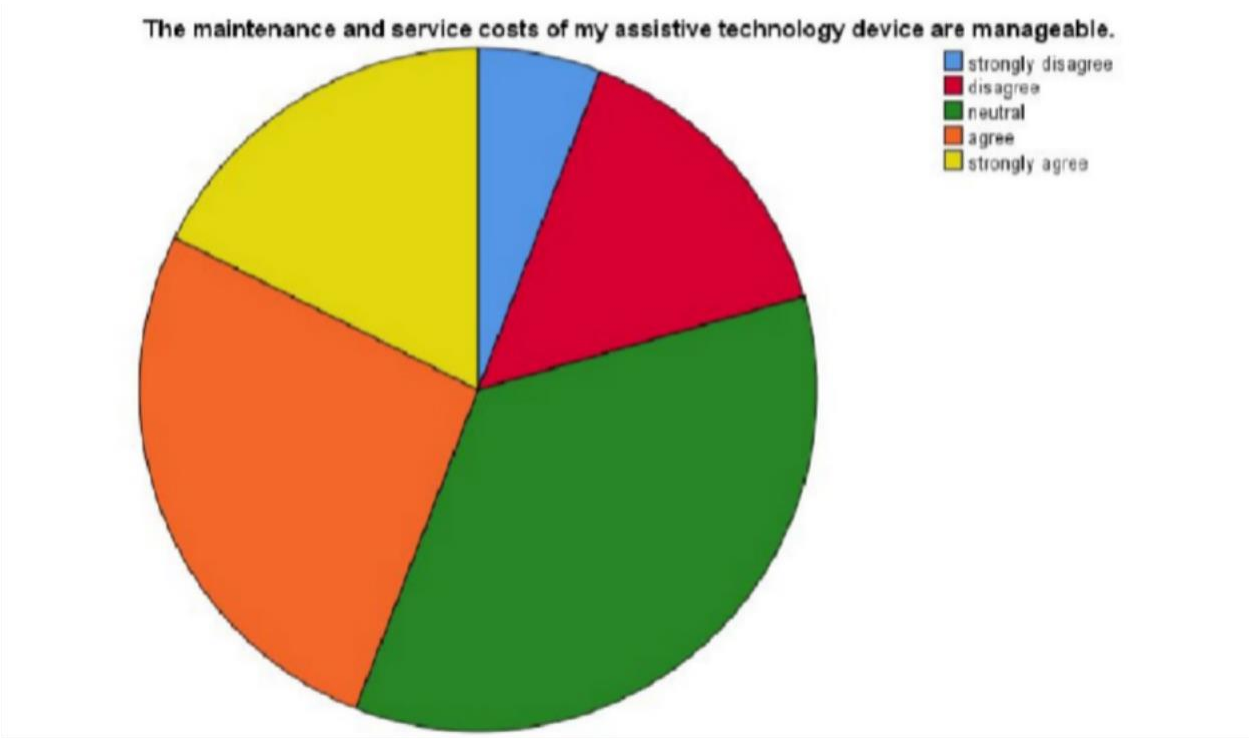
Frequency			Percent
Valid	strongly disagree	9	26.5
	Disagree	4	11.8
	Neutral	10	29.4
	Agree	8	23.5

strongly agree	3	8.8
Total	34	100.0

istive technology device I use is suitable for my daily activities.

The table 5.2 shows the results survey question regarding the suitability of assistive technology devices for daily activities

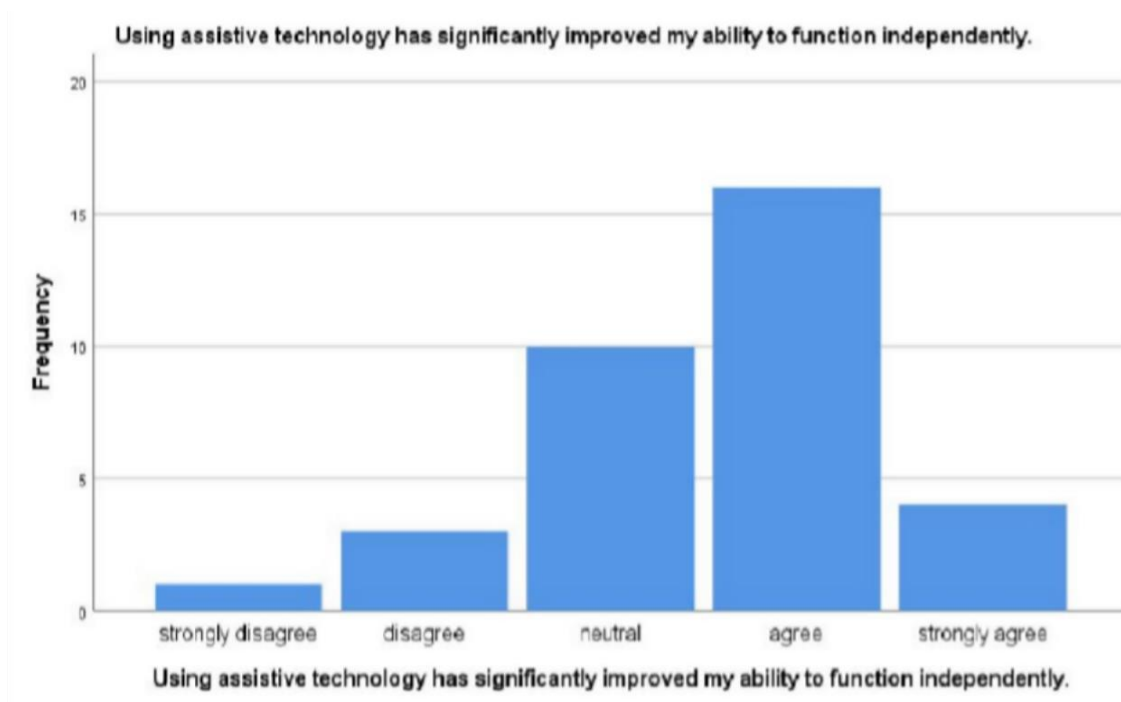
Figure.5.1:



The maintenance and service costs of my assistive technology device are manageable.

Figure.5.2:

Using assistive technology has significantly improved my ability to function independently.



The bar graph shows the frequency of responses to a survey question about the impact of assistive technology on individuals' independence.

Table.5.3:

Frequency			Percent
Valid	Disagree	2	5.9
	Neutral	10	29.4
	Agree	15	44.1
	strongly agree	7	20.6
	Total	34	100.0

The table presents survey results on the willingness to use a technology-based navigation system for visual tasks.

Table.5.4:

Frequency			Percent
Valid	Disagree	2	5.9
	Neutral	8	23.5
	Agree	13	38.2
	strongly agree	11	32.4
	Total	34	100.0

The table shows survey results on whether assistive technology creates new opportunities for visually impaired individuals.

Table.5.5:

N		Range	Minimum	Maximum	Mean	Std. Deviation	Variance
CF_Average	34	2.50	2.25	4.75	3.5441	.66135	.437
PF_Average	34	2.33	2.33	4.67	3.8137	.56967	.325
AC_Average	34	3.50	1.50	5.00	3.8676	.81006	.656
Valid N (list wise)	34						

The CF Average, PF Average, and AC Average are the three variables for which these tables offer statistical data. Each variable had 34 participants. Out of the three, the AC Average came out on top, followed by PF Average, then CF Average. The mean values landed between 3.5441 to 3.8676. Standard deviation ranged from about .56967 to .81006, which shows there's some variety in how people responded, indicating different degrees of variation around the mean values.

Breaking it down, the results fell into three categories: Conversion Factors (CF), Potential Functioning (PF), and Achieved Functioning (AC). Achieved Functioning got the highest mean score at 3.87. That's not just a number—it means people actually felt their daily lives improved. They felt more confident choosing assistive tech, and they started finishing tasks on their own more often.

Potential Functioning came next, with an average of 3.81. People felt NVDA opened up new possibilities and made everyday tasks less of a hassle. As for Conversion Factors, the average was 3.54. So, people generally leaned toward using these features, but the impact wasn't as strong as in the other two categories.

Discussion

The 2021 case study by Reima AI-Jarf examined the use of assistive technology by blind Saudi female college students. This study's main goal was to assess how a blind student used assistive technologies more especially, NVDA software to improve her everyday activities and handle her academic obligations. The student's academic experience and everyday life were improved by her efficient use of NVDA

software Office, her university portal, the internet, and social media platforms. She was able to handle her obligations more easily and independently because to this technology, which made it easier for her to communicate, conduct research, and organize. Furthermore, the student's capacity to walk around and took pictures on her own device

shows a notable improvement in her general mobility and communication abilities to gain access to necessary resources like Microsoft. The study demonstrates how assistive technologies can empower people with visual impairments by developing self-assurance, independence, and involvement in daily activities and education, ultimately reducing the gap between capacity and opportunity (17).

In order to ascertain the various assistive technology options available to visually impaired individuals at the Zambia Library, Cultural and Skills Center that serves the Visually Impaired, Kaulu et al. conducted another comparative study in 2019. The study employed a mixed-methods approach

with a case study design to investigate the use of assistive technologies among visually impaired students at ZLCSCVI. It comprised 17 visually impaired students and 3 technology instructors. The findings demonstrated that by providing students with access to a range of digital content, including e-books, PDF papers, websites, emails, and music, Job Access with Speech (JAWS) and Non-Visual Desktop Access (NVDA) facilitated their pursuit of academic objectives.

The findings highlighted the need of integrating assistive technologies into instructional strategies and the need for instructors to receive training on these tools. The government should buy assistive technology, particularly JAWS, for Zambian schools and institutions that cater to individuals with visual impairments, according to the findings. In order to help pupils use new tools and enhance their social and academic performance, teachers should also get training (21).

Conclusion

Our study's findings indicate that the NVDA genuinely improves quality of life for people with low vision. It lets them read digital content, move around with more confidence, manage everyday tasks, and keep in touch with others. NVDA stands out because it's easy to get, works on lots of devices, and adapts to different needs. The accessibility, adaptability, and compatibility of NVDA make it easy for someone with vision impairment to use, despite some disadvantages and challenges.

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