A Functional Study of NVDA for Visually Impaired Learners in Digital Learning

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***Abstract*—In today's digitally driven education landscape, the availability of accessible learning resources is crucial for ensuring equitable participation among students of all abilities. Visually impaired learners, however, continue to encounter notable challenges in engaging with digital content, which often restricts their academic progress and overall learning experience. Assistive technologies such as screen readers offer critical support by translating on-screen text, images, and interfaces into speech or Braille output. These tools help users with visual impairments interact with educational platforms and content with greater independence.**

One of the most widely recognized tools in this space is NonVisual Desktop Access (NVDA), a free and open-source screen reader designed for Microsoft Windows. NVDA stands out for its flexibility, ease of use, and strong community-based development, which continuously enhances its features. Unlike commercial alternatives that may be cost-prohibitive, NVDA's accessibility and adaptability make it particularly valuable in educational settings with limited technological resources.

This study provides a detailed assessment of NVDA's functionality, focusing on its utility in academic environments. It explores the software's performance in carrying out routine educational tasks such as navigating web pages, reading documents, and accessing learning management systems. The evaluation also includes a comparative analysis between NVDA and proprietary screen reading solutions, highlighting both its advantages and areas needing improvement. The findings suggest that NVDA is an effective and inclusive digital tool that significantly contributes to the empowerment of visually impaired students in modern education.

***Index Terms*—NonVisual Desktop Access (NVDA), assistive technology, visual impairment, accessible e-learning, inclusive digital education, screen reading softwareassistive software**

I. Introduction

The rise of digital education has dramatically transformed the ways students learn and access information, offering flexible opportunities beyond traditional classroom settings. However, for students with visual impairments, many digital learning platforms, websites, and documents remain difficult to use because they are not always designed with accessibility in mind. This creates obstacles that prevent these learners from fully engaging with educational content and activities. Assistive technologies called screen readers play a vital role in overcoming these barriers. Screen readers work by translating the information displayed on a computer screen—such as text, menus, and buttons—into speech or Braille output.

This allows visually impaired users to listen to or feel the content, enabling independent navigation and interaction with digital materials. Among the different screen reader programs available, NVDA (NonVisual Desktop Access) stands out as a popular choice due to its free availability, open-source development model, and compatibility with Windows operating systems.Its no-cost availability and open-source model make NVDA highly accessible, especially for users or institutions with limited financial means, and it supports a wide range of languages and applications. This paper presents an in-depth examination of NVDA's key features and how it supports visually impaired students in digital learning environments. It evaluates NVDA's usability across different academic tasks, such as browsing educational websites, reading electronic documents, and interacting with learning management systems. In addition, this study com- pares NVDA with commercial screen readers, highlighting its benefits as well as potential challenges faced by users. By providing this comprehensive analysis, the research aims to emphasize NVDA's significance in fostering inclusive educa- tion and to offer insights that could guide improvements in assistive technology and digital accessibility.

II. NVDA Overview

NonVisual Desktop Access (NVDA) is a no-cost, open-source screen reading software built to help visually impaired individuals interact effectively with Windows-based computer systems. Created and maintained by NV Access, this tool is praised for being lightweight, easy to install, and compatible with a wide range of applications and accessibility devices. NVDA has gained traction as a practical solution for promot- ing digital equity, particularly in educational and workplace settings where cost-effective tools are essential. A. Speech Output and Voice Synthesis Features NVDA integrates multiple speech synthesis engines, includ- ing eSpeak and Microsoft's SAPI5, alongside other third-party solutions. This versatility allows users to tailor their listening experience by adjusting speech rate, pitch, and voice type, as well as by choosing among numerous language options. Such customization enhances user comfort, particularly for those in multilingual environments or with specific auditory preferences. B. Braille Display Support The software is also compatible with various Braille dis- plays, making it accessible for users who rely on tactile feedback. NVDA utilizes standard communication protocols to connect with popular Braille hardware. This feature is espe- cially useful for individuals who are both visually and hearing impaired or those who prefer Braille for reading complex material, such as academic content or technical documents. C. Efficient Keyboard Navigation NVDA enables streamlined access to information through an extensive array of keyboard shortcuts. These allow users to perform essential tasks, such as reading by character, word, or line, moving between headers and hyperlinks, navigating lists and tables, and entering data into forms. Such keyboard-centric navigation enhances overall user efficiency and is critical for power users who require fast and accurate control. D. Web and Document Compatibility A major strength of NVDA lies in its ability to navigate diverse content types, including websites and documents. It functions effectively with popular web browsers like Firefox, Chrome, and Edge, and provides seamless integration with office productivity tools such as Microsoft Word, Excel, and Outlook. This capability allows users to independently manage emails, read academic texts, fill out forms, and engage with digital learning platforms, promoting greater inclusion in both school and work environments. E.Open-Source Flexibility and Community Contributions Since NVDA is open-source, it invites contributions from developers and users worldwide. This community-driven ap- proach has led to the creation of plugins and add-ons that enhance its core capabilities. Examples include optical char- acter recognition (OCR) tools, advanced speech features, and utilities for reading mathematical content or navigating code. The ability to extend and modify NVDA makes it adaptable for specialized educational fields, from science and technology to language studies.

III. Literature Review

The growing emphasis on digital inclusivity has led to the development of assistive tools that enable individuals with visual impairments to interact effectively with digital platforms. Among these tools, screen readers hold a pivotal position by converting visual content into auditory or tactile formats. One of the most recognized tools in this domain is NonVisual Desktop Access (NVDA), a no-cost, open- source screen reader designed for Microsoft Windows. NVDA facilitates access to a wide range of software applications, including web browsers, word processors, spreadsheets, and communication tools, thereby promoting autonomy among users in academic and professional settings [1].

Commercial solutions like JAWS have traditionally dominated the screen reader market; however, their high cost presents a barrier, particularly in economically disadvantaged areas. NVDA addresses this concern by offering free access and extensive community-driven support, making it a practical choice for schools, NGOs, and government institutions seeking to bridge accessibility gaps [2], [3]. Over the years, NVDA has been enhanced through contributions from a global community, resulting in multilingual support, plugin flexibility, and consistent updates tailored to evolving user needs [4]. In comparative studies, NVDA has demonstrated effective- ness similar to proprietary software. Evaluations conducted in real-world contexts have shown NVDA's capability to handle standard tasks such as navigating websites, managing documents, and accessing interactive forms [5]. Moreover, within digital learning platforms, NVDA has enabled visually impaired students to participate in virtual classes, access course materials, and complete assessments on platforms like Google Classroom and Moodle, thereby reinforcing its value in inclusive education [6]. Global education policies and frameworks, such as the United Nations' Sustainable Development Goal 4 (SDG 4), advocate for inclusive learning opportunities. NVDA serves as a practical enabler of this goal by allowing visually impaired students to engage with educational content independently and at scale [7]. Numerous case reports have documented successful NVDA deployments in underfunded schools, particularly in regions like South Asia and sub-Saharan Africa, where traditional assistive tools are financially out of reach [8]. Teachers and institutions that prioritize accessible pedagogy often rely on NVDA for lesson planning and content delivery. Research has indicated a strong correlation between instructor familiarity with screen readers and positive student learning outcomes [9]. NVDA's adaptability also allows for discipline-specific extensions, supporting mathematical expressions, scientific notations, and even programming environments. This flexibility makes it highly relevant for learners in technical domains [10]. The functionality of NVDA is further enhanced by its grow- ing library of community-developed add-ons. These extensions provide capabilities such as advanced speech synthesis, con- tent recognition, and image-to-text conversion. For example, integrations with AI-based speech engines like WaveNet have significantly improved reading clarity, offering a more nat- ural and comfortable listening experience during prolonged usage [11], [12]. These developments suggest that NVDA is evolving not just as a tool for accessibility, but as a comprehensive learning companion for students with visual impairments. Nevertheless, certain limitations persist. Users occasionally encounter difficulties when interacting with dynamic con- tent, especially in frequently updated commercial applications. Compatibility issues may arise in systems that deploy propri- etary interface elements or custom web controls [13]. Despite these drawbacks, NVDA's development team remains actively engaged in ensuring compatibility with modern standards such

as WCAG and Section 508 compliance guidelines [14]. The role of NVDA became even more critical during the COVID-19 pandemic, which necessitated a sudden shift to online learning across the globe. In this context, NVDA proved to be an indispensable asset, enabling continuity of education for visually impaired learners without imposing additional financial burdens on families or institutions [15]. Reports from international organizations and educational NGOs highlight NVDA's role in safeguarding equitable access to remote learn- ing environments during crisis periods [16]. Beyond academic institutions, NVDA is increasingly uti- lized in workforce training, public libraries, and government digital inclusion programs. In several countries, it forms part of national accessibility toolkits promoted by ministries and policy bodies aiming to improve digital equity [17]. These applications demonstrate NVDA's relevance beyond the classroom, reinforcing its importance in fostering long-term social inclusion. In sum, the academic and institutional literature clearly illustrates NVDA's transformative impact on accessible digital learning. Its affordability, versatility, and community-driven innovation make it a sustainable and scalable solution for visually impaired learners worldwide. While continuous im- provement is required to address technical limitations, NVDA's evolution reflects a broader shift toward inclusive design and participatory technology development. Its integration into educational policy and classroom practice is a promising step toward achieving truly equitable learning environments.

IV. Dataset Collection and Preprocessing

Understanding the functionality and effectiveness of NVDA (NonVisual Desktop Access) in educational settings requires access to empirical data that accurately mirrors the experiences of visually impaired users. This section discusses the origins and structure of the data used, methods adopted for preparing the data for analysis, challenges encountered during the process, and possible future directions for enhancing the dataset. The aim is to ensure that the foundation of this research is both ethically sound and methodologically robust.

A. Source of Dataset

The data employed in this research comes from secondary sources, primarily the **WebAIM Screen Reader User Survey #10 (2023–2024)**. WebAIM (Web Accessibility in Mind) is a highly respected global organization that frequently gathers user feedback regarding the performance of screen readers and other accessibility technologies.

The specific dataset consists of compiled survey responses from over 1,500 visually impaired individuals who actively use screen readers, including NVDA. The survey captures critical insights into the users' preferences, difficulties, and interaction patterns with screen readers in real-world digital contexts. Although the raw response data is not made publicly available for privacy reasons, the published summaries, graphs, and tables offer a structured and reliable source of information suitable for academic analysis.

Source Referenced: WebAIM Screen Reader Survey #10 (2023–2024)

B. Dataset Composition and Key Features

The dataset includes a variety of user-centric variables that reflect screen reader use in digital learning. Key insights include:

- **Preferred Tools:** Whether NVDA is the primary or secondary screen reader.
- **Usage Frequency:** How often users rely on NVDA.
- **Functional Role:** Whether NVDA is used alone or alongside other tools.
- **System Context:** Devices and operating systems (e.g., Windows).
- **Navigation Techniques:** Methods such as heading navigation and keyboard shortcuts.
- **Accessibility Issues:** Challenges like unlabeled buttons or broken form fields.
- **Satisfaction Metrics:** User ratings on ease of use and reliability.
- **Demographics:** Educational background, profession, and location.

C. Dataset Scope and Diversity

This dataset is both broad and diverse, which enhances its validity for research purposes:

- **Participants:** 1,539 users from various regions.
- **Demographic Spread:** Covers different age groups and skill levels.
- **Format:** Structured tables and charts published online.
- **Data Types:** Categorical, ordinal, and qualitative inputs.

D. Analytical Parameters

To evaluate NVDA's performance, the following criteria were extracted and analyzed:

- Navigation efficiency
- Accuracy of content reading
- Usability across learning platforms
- Reported barriers and user frustrations

E. Data Preprocessing Methodology

To make the structured survey data analysis-ready, the following steps were undertaken:

- **Standardizing Terms:** Common phrases were unified for consistency.
- **Formatting Tables:** Graphs and data tables were transcribed into spreadsheet form.
- **Labeling Data:** Each parameter was assigned a clear analytical tag.
- **Ethical Validation:** Public data only, with no personal identifiers.
- **Supplemental Testing:** Manual trials were conducted using NVDA on LMS platforms like Moodle.

F. Observed Limitations

While the dataset is valuable, the following challenges were noted:

- **Absence of Raw Logs:** No user-level interaction logs available.
- **Subjective Feedback:** Possible bias in self-reported satisfaction.
- **Platform Gaps:** Limited LMS-specific data (e.g., on Moodle or Google Classroom).
- **Tech Evolution:** Ongoing web updates may affect some results.

G. Future Expansion Opportunities

To enhance future research outcomes, the following data collection strategies are proposed:

- **NVDA Output Logging:** Use of NVDA's Speech Viewer for real-time data.
- **Accessibility Audits:** Employing tools like WAVE or Axe for technical evaluations.
- **User Testing:** Observation-based testing with actual NVDA users in LMS environments.

V. Background and Related Work

The development of assistive technologies has significantly improved digital accessibility for individuals with visual impairments. Among these, screen readers have emerged as essential tools, enabling non-visual access to content via audio output or Braille devices. Over the years, multiple screen readers have been introduced, each tailored to different platforms and user needs.

JAWS (Job Access With Speech), developed by Freedom Scientific, is widely known for its extensive feature set and advanced scripting capabilities. It supports a wide range of desktop applications and is highly customizable. However, its high cost and proprietary licensing make it less accessible to users in low-income regions and publicly funded educational systems [18].

Microsoft Narrator, included free with the Windows operating system, provides basic screen reading functionality and supports essential navigation tasks. While it is beneficial for simple interactions, its limitations become apparent when handling dynamic web content or complex interfaces, and it lacks extensibility features necessary for advanced educational use [19].

VoiceOver, Apple's built-in screen reader for macOS and iOS devices, is praised for its smooth integration across Apple platforms and user-friendly interface. Although it offers robust accessibility within the Apple ecosystem, its lack of compatibility with non-Apple platforms limits its usability in multi-operating system environments often found in schools and universities.

NVDA (NonVisual Desktop Access), developed by NV Access, is a free and open-source screen reader for Windows systems. It supports widely used applications such as Microsoft Office, Chrome, Firefox, and Adobe Reader, and is compatible with many Braille displays. Its lightweight structure, multilingual support, and low system requirements have made it particularly suitable for educational use in developing regions.

A notable strength of NVDA is its active community support, which fosters the continuous development of new plugins and improvements. Features such as enhanced speech synthesis, OCR capabilities, and support for specialized file formats have increased its relevance in academic settings [11]. Despite its growing popularity, limited scholarly attention has been given to NVDA's effectiveness within structured learning environments, particularly its integration with learning management systems (LMS) or its role in supporting online learning.

This lack of empirical research is concerning, especially given the increased reliance on digital education platforms during the COVID-19 pandemic. The shift to online teaching and assessment has highlighted the urgent need for accessible technologies that ensure all students, including those with disabilities, can participate fully in digital education.

Global initiatives such as the United Nations Sustainable Development Goal 4 (SDG 4), which promotes inclusive and equitable education, and India's National Education Policy (NEP) 2020, which emphasizes digital inclusion, reinforce the need for adopting accessible solutions like NVDA [25]. Given its affordability, open-source model, and adaptability, NVDA represents a promising option for supporting inclusive digital learning.

This research aims to fill existing gaps in the literature by evaluating NVDA's practical use in academic contexts and its role in enabling digital equity for visually impaired learners.

VI. Methodology

This study adopts a **functional evaluation methodology** supported by a **user-focused, real-world perspective** to assess the performance of NVDA in educational environments. Rather than relying solely on laboratory experiments, the research incorporates findings from secondary data sources, including accessibility forums, technical documentation, user feedback platforms, and academic reviews of screen readers. This mixed-method approach offers a more authentic understanding of how NVDA performs in live digital learning situations.

A. Evaluation Dimensions

The assessment is guided by four key parameters that are especially critical for learners with visual impairments in academic contexts:

1) Accuracy of Text-to-Speech Rendering: This metric assesses NVDA's capacity to interpret and vocalize digital content clearly and correctly. The evaluation focuses on various textual elements such as paragraphs, headers, tables, and field labels. The tool's ability to maintain logical reading order, proper pronunciation, and contextual emphasis is examined—factors that are especially vital for students interpreting structured academic material.

2) Navigation Efficiency in Digital Learning Platforms: NVDA's usability is tested across popular educational platforms like **Moodle**, **Google Classroom**, and **Microsoft Teams**. The analysis considers responsiveness to keyboard commands, ease of locating content, and the effectiveness of navigating through menus, quizzes, assignments, and grades using screen reader shortcuts.

3) Compatibility with Document Formats in Education: The study evaluates NVDA's ability to process and read various academic document types including **PDFs**, **Word documents**, **EPUB files**, and **Excel spreadsheets**. The focus is on how consistently NVDA reads these formats and whether any accessibility issues arise during transitions between them.

4) Community-Based User Feedback: Beyond technical testing, qualitative insights are extracted from public feedback available on user forums (like NVDA User Groups), GitHub discussions, accessibility blogs, and screen reader review articles. These user-generated reports highlight lived experiences, pain points, and feature requests that help contextualize NVDA's performance from an end-user perspective.

VII. Results and Discussion

Based on secondary analysis, documentation reviews, and user-reported experiences, the performance of NVDA was evaluated across several practical scenarios relevant to digital learning. The results indicate that NVDA is a reliable, adaptable tool capable of supporting inclusive education when implemented thoughtfully.

A. Performance in Reading Structured Text

NVDA demonstrated outstanding competence in interpreting structured content, particularly in Word and Excel documents. It was able to read in logical order, recognize headings, interpret formatting, and provide appropriate pauses and intonations. On a qualitative scale, it received a **top score of 5/5** for clarity, reading flow, and textual comprehension—making it highly suitable for academic reading.

B. Web Navigation and Accessibility

When navigating through web content, NVDA earned a score of **4.5 out of 5**. It integrates smoothly with browsers like **Chrome** and **Firefox**, enabling users to move through headings, links, lists, and forms efficiently using keyboard commands. However, some challenges were observed on websites with dynamic content or poorly labeled elements, often caused by heavy JavaScript or inaccessible HTML structures.

C. Integration with Learning Management Systems (LMS)

NVDA displayed strong performance on widely used platforms such as **Moodle**, **Google Classroom**, and **Khan Academy**, achieving a usability rating of **4/5**. It allowed users to interact with assignments, download materials, access quizzes, and participate in forums. The experience depended largely on the underlying accessibility compliance of the LMS platform itself. Well-coded platforms performed better, while inconsistencies emerged in poorly structured systems.

D. Handling of PDF Documents

The tool's ability to interpret PDFs received a score of **4/5**. NVDA performed well with tagged PDFs, where headings, alternative text, and reading order were properly defined. However, with untagged or image-only documents, performance was reduced. In such instances, OCR support (via NVDA plugins) enabled recovery of otherwise unreadable content—though with variable success depending on content quality.

E. Customization and Plugin Support

NVDA achieved a full **5/5** in this category due to its open-source framework and vibrant plugin ecosystem. Users can install custom extensions for tasks such as **math content reading**, **programming code navigation**, and **language translation**. Its Python-based plugin model allows for deep customization, making NVDA a flexible tool adaptable to diverse learning needs.

VIII. Basis for Functional Ratings Assigned to NVDA

The functional ratings provided in Table II were determined through a detailed evaluation process combining experimental testing and user-based insights. These scores reflect the effectiveness of NVDA in assisting visually impaired learners across typical academic activities, such as reading documents, navigating online resources, and interacting with educational platforms.

A. Evaluation Framework

To ensure accuracy and practical relevance, the following sources were considered while assigning scores:

- **Survey-Based Feedback:** User responses from the WebAIM Screen Reader Survey #10 (2023–2024), which includes feedback from over 1,500 users of screen readers with varying levels of experience and diverse educational backgrounds.
- **Hands-On Testing:** Experimental trials conducted using NVDA in different digital learning scenarios and document formats, simulating actual academic tasks.
- **Public User Insights:** Data gathered from community discussions, GitHub repositories, user forums, and blogs that helped validate experimental observations and provided additional real-world context.

B. Rating Scale Description

NVDA's functionality was evaluated using a standardized 1-to-5 rating scale as described below:

TABLE I
Rating Scale Criteria

Score	Description
5	Outstanding — Performed flawlessly across all tested scenarios.
4.5	Very Strong — Minor limitations in only complex cases.
4	Good — Generally reliable, with occasional issues in specific contexts.
¡4	Moderate or below — Notable challenges or inconsistent performance.

C. Summary of Experimental Activities

The following tests were conducted to evaluate NVDA's practical performance in educational tasks:

- **Text Reading:** Assessed NVDA's clarity and accuracy in reading structured text documents, including Word files and plain text academic material.

- **Web Navigation:** Tested NVDA's ability to interpret web structures, headings, tables, links, and form fields on educational websites using keyboard navigation.
- **LMS Access:** Measured usability within platforms such as Moodle and Google Classroom, including assignment handling and forum interactions.
- **PDF Support:** Compared NVDA's ability to read properly tagged versus image-based PDFs, both with and without OCR plugin support.
- **Customization & Add-ons:** Evaluated the flexibility of NVDA through its plugin system, including features like OCR tools, language packs, and voice customization.

D. Consolidation of Scores

Final ratings were assigned based on a weighted combination of the following sources:

1) Measured outcomes from experimental assessments.
2) Quantitative data extracted from large-scale user surveys.
3) Community insights reflecting long-term usage patterns and user adaptability.

This comprehensive scoring approach ensures that both technical functionality and practical usability are reflected in NVDA's performance evaluation, providing a realistic benchmark for its adoption in educational environments.

TABLE II
FUNCTIONAL RATINGS FOR NVDA FEATURES

Functionality	Rating (1–5)	Remarks
Text Reading	5	Accurate and fast reading across academic formats.
Web Navigation	4.5	Performs well with standard web structures; may encounter minor challenges on pages with complex or dynamic layouts.
LMS Integration	4	Effective on accessible platforms; limited on poorly labeled interfaces.
PDF Accessibility	4	Works best with tagged PDFs; OCR improves usability on unstructured files.
Customization Options	5	Extensive plugin support; adaptable for specialized educational needs.

IX. Benefits of NVDA in Academic Environments

NVDA (NonVisual Desktop Access) offers a variety of advantages that make it especially useful in education for students with visual impairments. Its accessibility features, design flexibility, and support ecosystem contribute significantly to fostering inclusive digital learning.

A. Zero-Cost Accessibility

NVDA is distributed free of charge, eliminating financial hurdles that often prevent students in underserved areas from obtaining assistive tools. By being cost-free, NVDA encourages equitable learning by allowing widespread access regardless of economic background.

B. Ease of Transport and Setup-Free Use

Unlike many software programs that require full installation, NVDA can be launched directly from external storage devices like pen drives. This means students can use their personalized NVDA setup on multiple systems—home, school, or library—without altering those machines.

C. Flexibility Through Open Development

As an open-source tool, NVDA provides the freedom for educators, developers, and institutions to customize its functions. This includes developing subject-specific plugins, translating the interface into local languages, or tailoring features for students studying complex subjects like science or computing.

D. Wide Language Availability

NVDA supports more than 50 international languages, allowing learners to operate it in the language they are most comfortable with. This multilingual compatibility supports inclusion in diverse classrooms and global education initiatives.

E. Seamless Integration with Educational Systems

NVDA works effectively with widely adopted academic tools such as Microsoft Office, PDF viewers, and learning platforms like Moodle or Google Classroom. Its ability to navigate these platforms allows visually impaired learners to fully engage with learning materials and classroom interactions.

X. Challenges and Areas for Improvement

Despite its strengths, NVDA faces a few limitations that can impact its overall efficiency and user experience in academic setups.

A. Difficulty Interpreting Visual Data

NVDA struggles with reading visual elements like graphs, diagrams, and complex mathematical symbols, which are common in subjects like science, math, and economics. Although some plugins offer partial support, full interpretation remains a technical gap.

B. Complex Learning for New Users

Getting started with NVDA often requires understanding specific keystrokes and navigation logic, which can overwhelm first-time users. Without proper orientation or training, learners may not fully benefit from its features.

C. Reliance on Software Updates

To remain compatible with modern websites and apps, NVDA must be kept up-to-date. Users without internet access or system-level permissions may find it hard to install updates, leading to performance issues over time.

D. Limited Compatibility with Dynamic Web Pages

While NVDA handles most static and well-coded pages well, it may encounter challenges on websites that use complex JavaScript or poorly labeled components. This can disrupt smooth navigation and comprehension.

E. Feature Expansion Requires Add-ons

Advanced functions such as recognizing scanned PDFs or reading mathematical equations depend on additional plugins. While these tools increase capability, managing them can be difficult for users who are not technically skilled.

XI. Final Reflections and Conclusion

The transition toward digital education makes accessible technologies like NVDA more essential than ever. NVDA stands out for its affordability, functionality, and flexibility, making it a strong choice for promoting inclusive learning, especially in resource-limited settings.

Its ability to operate without installation, its multilingual support, and its smooth compatibility with key learning tools provide students with the independence to access educational materials in various environments. The active open-source community ensures that the tool continues to grow and adapt to evolving digital needs.

Challenges still exist—especially regarding visual data interpretation and web content variation—but these can be addressed through thoughtful implementation, supplemental tools, and dedicated training.

In essence, NVDA is more than just a screen reader. It serves as a vital tool in promoting fair and inclusive access to education. Aligned with global goals like SDG 4 and national policies like India's NEP 2020, NVDA represents a strategic tool for institutions committed to inclusive education for all learners, regardless of ability.

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