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Accessibility of Visual Content for University Students with Visual Impairment: Provisions and Challenges

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ABSTRACT

The aim of the study was to examine how university students with visual impairment face challenges in accessing educational materials especially visual content like graphics, charts, states, and complex images throughout their educational journey and how these challenges impact their lives, which may affect their social and emotional gatherings, self-confidence, independence also subject selection for higher studies. Furthermore, this study identifies the provision status of resources to access Visual Content in their educational material. A Qualitative research design was used for this study, and open-ended interviews were conducted to study this phenomenon, in addition to participants recruited from higher education institutions through convenience sampling for data collection: Face-to-face interviews and online interviews conducted by 10 university graduates with visual impairment. Each interview was transcribed and analyzed carefully using Thematic Analysis. This finding highlights that every student needs different learning support, especially students with VI. Although technology has improved their access to education, in Pakistan, students still find it difficult to access visual content due to inappropriate teaching methodology, lack of awareness of assistive technology (AT) among teachers and students with Visual Impairment (SWVI), some subject-related challenges, technical and financial issues and unavailability of resources which affect their social and educational participation and performance.

Keywords: *Visual Impairment, Accessibility, Visual Content, Challenges of students with VI, ICT for Students with VI*

INTRODUCTION

Educational accessibility for students with visual impairments is gaining attention around the world. It is believed that this educational accessibility can only be achieved through inclusive policies, equal educational opportunities, assistive technology, and specialized programs that support their unique needs. Many countries are adopting policies that provide accessible materials to students, such as large print, Braille books, audio material, tactile models, and descriptive text to students. The goal is to enhance learning opportunities and increase social integration (TFS HealthScience, 2024).

Information and communication technology (ICT) also play a role in educational accessibility. Instead of relying only on Braille, software such as Text to Speech Software is available to students with VI to access electronic information (Supporting Higher Education for Persons With Visual Impairment: the Nippon Foundation, 2024). According to Aslan & Yalçın, (2023) Assistive technologies such as JAWS, NVDA, Windows Eye, and Voice-over also enhance computer functioning for students with VI.

Article 24 of the Convention on the Rights of Persons with Disabilities (CRPD) also emphasizes the importance of providing educational support to students with special needs, by focusing on accessible teaching materials, appropriate equipment, accessible technology, accessible buildings and inclusiveness. Teachers' presentations, textbooks and other study course materials should be provided in a format that is legible and accessible to students. To provide accessible educational opportunities, the digital inclusion of students is essential, which can only be made possible by making their web resources and online learning plan forms accessible (Panda & Kaur, 2024). Despite all these, students still struggle to get a basic education due to a lack of specialized teachers, insufficient resources, and experiences of discrimination (Sukati, 2024).

Problem Statement: This research under the title of "Accessibility of Visual Content for University Students with Visual Impairment: Provisions and Challenges" was conducted to identify the challenges faced by University graduates with visual impairments in accessing Visual content and highlight the availability of accessible resources to these students.

The prime objective of this research is to analyse the status of the Provision level of visual content accessibility and specific challenges related to accessibility for university students with visual impairment in Punjab, lahore, Pakistan.

Significance of study: This study can create awareness among teachers, special educators, and students with visual impairment who can use technologies to make visual content accessible as well as help them in their subject selection in higher studies. The study provides insight to policymakers in developing policies to provide instructional materials in an accessible format and programs that educate teachers and students on integrating technology into learning. The main focus should be on the implementation of these policies.

Limitation: This study only describes the challenges faced by university students with visual impairment in accessing visual content in their academic task. It does not focus on other visual aspects of an individual's life with visual impairment.

Delimitation of the Study: Due to time constraints, the study was limited to Lahore

According to the study conducted in 10 Recognized Universities in Lahore, only 19.7% of the assistive technology is available and accessible for students with visual impairment, also 14% of students do not have basic training in using recording and audiobooks and 20% of students who do not have basic training in using screen reader software. The results also show that most students enrolled in subjects such as Urdu literature, English literature, political sciences, history, education, psychology, special education, international relations, Islamic studies, economics, business administration, etc. there was not a single student who had taken subjects such as Bio, Chemistry, Physics, Mathematics or Natural Sciences due to accessibility hurdles. In addition, the students stated that they have to ask a peer to note the lectures inside the classroom in their higher education institutions because the teacher who is there puts information on the whiteboard as if they are not getting it. When they have to take help from their peers in this way, they feel frustrated and hesitate to disturb them (Hussain, Hameed & Ashraf, 2022).

In all the studies done before this, accessibility has been described overall, such as the accessibility of their environment, educational accessibility, and other accessibility issues. However, this study specifically highlights the status of availability of assistive technology (AT) in Punjab, Pakistan. and challenges related to the accessibility of visual content (non-textual material) in both print and electronic media.

LITERATURE REVIEW

A message/information or content transmitted from one individual to another through any channel, can be in the form of text, numeric data, or visuals. In this paper, visual content refers to content presented in visual form to convey information. In an educational context, visual content is around us in a wide range Such as drawings, paintings, collages, mosaics, diagrams, charts, maps, graphs/graphical media, Statistics, pictures, photographs, symbols, videos, printed or text books, magazines, newspapers, machine made prints photos, films, electronic pictures, projected images such as slides overhead transparencies are commonly used. Visual content has the property that it draws the attention of many audiences at a time. Secondly, it provides comprehensive information, that's why it is used in most subjects (Pettersson, 1989).

Visual impairment restricts the direct source of information that is taken in through vision (Icssr & Bhardwaj, 2020). Considering the ability of the student to use the visual sense for learning that occurs after correction, they are divided into two categories, blindness and low vision. Blind refers to a student who does not use vision for learning but has some visual imagery or light or dark perception. Blind students use tactile and Auditory senses as their primary learning channels, while Students with low vision may also find it difficult to complete the visual task. Still, they can use their visual sense to learn through assistive technology and teaching techniques. (Kirk et al., 2015).

Because of these differences, their approach to accomplishing the learning task differs ((Icssr & Bhardwaj, 2020). Students with visual impairment find it difficult to access visual content in the mode they prefer and at the time they find it, sometimes they don't even understand what is written on the notice board and inside the diagrams and on the whiteboard (Ahmad, Parveen, & Arif, 2024).

Accessibility refers to providing services in an accessible format for students with disabilities, i.e., by transforming information into text, Braille, or speech in whatever format which is usable for them. In Pakistan, student with visual impairment do not get their information in the desired form, thus they are mostly isolated from the information society (Ahmed, & Naveed, 2021).

Accessibility is providing sources in a physically and electronically accessible format that is reachable and usable for students with visual impairment (Kumwenda, 2020).

According to studies, the top priority or top source of information for the accessibility of print media for a student with visual impairment is their family and friends. Besides, the accessibility of print media for students with low vision is through magnifying glasses. Students stated that they have never read a newspaper or a magazine in Braille format that has been converted from print to Braille format. The internet has improved accessibility for students, especially for their information accessibility. Now, students can read articles through the internet instead of waiting for someone to read the articles for them, hence, the internet plays a vital role for students. The Internet enables students to access information independently, which was impossible before (Kumwenda, 2020).

Now there are also tools and devices available for accessibility, which we also call assistive devices, which are used to improve the functional capabilities of students with visual impairment. Assistive Technology (AT) is a device, software, or product that can be customized, modified, according to the needs of the students with special needs. AT for SWVI, including technologies like screen readers, real-time displays, speech recognition software, magnifying glasses, bold line paper, are commonly used. Also, some devices include adaptive keyboards, augmentative communication devices, braille embossers (also known as braille printer), which convert computer-generated text into braille paper, and closed circuit television, which enlarges a printed page and displays the image on a display. Refreshable braille displays provide tactile output of information to students with VI that is being taken from the computer. Instead of

conventional braille displays or braille devices, the characters on the refreshable braille display can be erased when the student reads the information, refreshed, and then a new line appears. The scanner converts the image on the printed page into a computer file and then optical character recognition software (OCR) converts it into a computer file that can be edited. Screen magnification software magnifies the screen to increase the viewing capability of students with low vision, and screen readers that read text, punctuation, etc. on the screen (Kirk et al., 2015).

In addition, students install software such as JAWS and NVDA in their Windows to access visual content, and optical braille recognition software (OBR) also supports students by scanning and analyzing the braille dot pattern in a document or braille page and presenting text on the screen. However, student visual impairment presents difficulties in the accessibility of visual content because a technology that works best for one group of visually impaired individuals is not necessarily the same for another group of blind individuals with total blindness (Ashraf, (2019).

Technical accessibility issues present as additional barriers to student with visual impairment. According to studies, most students with VI face difficulty accessing website information. Common reasons are:

- Inaccessible graphic user interface: Screen reader has some functional limitations in reading text. Screen readers (e.g OCR software) not being able to read graphics, and unable to read text on website due to many reasons like poorly designed form, page not properly laid out (like newspaper),
- screen reader crash while using.
- PDF which is made up by scanning images and collect in one file as PDF. If the file is an image file, there is no guarantee that the screen reader will read the text. For example, a jpeg file looks normal text to sighted individuals, but if it is an inaccessible graphic file, unable to read for a student with visual impairment.
- braille embossers can only convert computer-generated text into braille. It cannot convert visual content such as graphics into braille.
- pictures without alt text,
- speech recognition software that enable the student to enter data through voice commands, but the speech recognition software must also have an understanding of the student's language and grammar, which is often not the case and leads to a time-consuming and inaccurate result. (Kumwenda, 2020).

These all cause frustration among individuals with visual impairment. Other studies also noted issues related to visual content accessibility like 1. that lack of technical training and skills or digital literacy among student and teacher, 2. high cost of assistive technology, and the absence of inaccessible formats concluding that providing accommodation according to need of student with visual impairment is still a challenge. It is necessary to provide them with alternative text or provide audios or convert the content into Braille so that the accessibility for them can be improved (Kumwenda, 2020).

Accessibility Challenges in Pakistan

UNCRPD 2006 ensures that all nations will provide students and diversity with inclusive education without discrimination. All the states agreed that they would create such accommodation and modification to environment and educational content that SWVI able to not only impart new learning, knowledge and skill but they would become also share their knowledge with their peers without any difficulty. In Pakistan, the UNCRPD was ratified in 2008 and the Federal Ministry of Education started working on it in 2011. In developed countries with the help of information and communication technology, study material and subjects have been made accessible but Pakistan is still at the initial stage

in this regard. But Unfortunately Students still face accessibility challenges at the higher education level In Pakistan such as:

1. Students are not able to take notes of the lectures in the classroom because most of the teachers use white board and SWVI are not able to read what is written on the white board. The students stated that they have to ask a peer to note the lectures inside the classroom in their higher education institution because the teacher who is there puts them on white mode as if they are not getting it and when they have to take help from their peers in this way, they feel frustrated and hesitate to disturb them.
2. The classroom handouts are not in accessible format. Mostly students with visual impairment have to take support from their university peers or friends to prepare their assignments and to read such visual content.
3. The related accessibility tools or devices i.e. assistive technology is not available **i**n the campus. Due to the lack of availability, the students are not able to access their related study material on the internet.

Students with visual impairment have to take support from their university peers or friends to prepare their assignments and to read such visual content (Hussain, Hameed, & Ashraf, 2022).

Subject Related Challenges: In Pakistan, there is no strong relationship between the institutions to effectively implement the policies and also there is no coordination between the HEC Ministry of Education and the universities. According to the study conducted in 10 Recognized Universities in Lahore, only 19.7 percent of the assistive technology is available and accessible for students with visual impairment, 14 percent of students who do not have basic training in using recording and audio books and 20 percent of students who do not have basic training in using screen reader software. The results also show that the majority of student enrollments are in subjects such as Urdu literature, English literature, political sciences, history, education, psychology, special education, international relations, Islamic studies, economics, business administration, etc. Due to accessibility hurdles, there was not a single student who had taken subjects such as Biochemistry, Physics, Mathematics or Natural Sciences. Due to inaccessible study materials and attitudinal barriers, most students limit themselves to arts and theoretical subjects and not enter the field of science and technology (Hussain, Hameed, & Ashraf, 2022).

According to Rule, Stefanich, Boody, & Peiffer (2011), Students with visual impairment have the same cognitive abilities as sighted peers, but they face accessibility challenges in subjects such as science, technology, engineering, mathematics (stem) fields. Because of this, their representation in these subject is absent or limited exposure to Post secondary STEM programs. **Reasons includes**: 1. Student with visual impairment cannot fully participate in Subjects like Bio, Physics, earth sciences, math etc because in these subjects, visual content such as graphs, charts, drawing, images, and other illustrations are widely used to further explain the content which pose a challenge for SWVI 2. and also for teacher who are unfamiliar or untrained dealing with diversity. 3. Furthermore student experience low expectations from the teacher and parent, 4. the lack of text description with visual content, 5. isolation of the student from his peers, 6. outdated science resources are extra challenge for SWVI which ultimately lead to them dropping a class, changing their major, or getting a lower grade, lack of confidence in abilities.

Due to information and communication technology, there are many options for creating study materials that can enhance their accessibility such as e-books is accessible through screen readers and scanning software and websites accessibility are enabled through format standardization in mainstream institutions. They can work with their sighted peers in the same way. In addition, the software technologies that exist help edit and create information in the science class. They have changed the perception and expectation of

the teacher and administration for the student with visual impairment. Students can also study subjects such as mathematics and statistics "using different combination of software bundles" i.e., statistical software with a screen reader. Students can also improve mathematics with I- Math software also in their higher studies. To enhance student accessibility, university campuses should have learning resource centers that include accessibility tools or assistive technology so that students can read and write the subject without any difficulty (Hussain, Hameed, & Ashraf, 2022).

According to Rule, Stefanich, Boody, & Peiffer (2011) For accessibility to these subjects require alternative methods such as enlarge text or providing audio-converted text or textile representation of graphics or providing hands-on science experiences. There should be independent learning centers in which students can be given choice to choose their activities according to their own will and interest and according to their pace so that they will feel self-empowered and their self-esteem will increase and they will feel motivated. Most of the students do not develop their interest in these type of discipline due to accessibility issues and if ever the interest develops and the student has confidence in his abilities, he is discouraged or not allowed to pursue this field.

RESEARCH METHODOLOGY

Research Design: This study was conducted using a **qualitative research design** and open-ended interviews were incorporated as a research design.

Population of the Study: University students with visual impairment were the population of the study. The open-ended interview was used as the instrument of the study.

Instrument Development: The instrument consisted of two parts: part 1 dealt with demographic information (name, gender, qualification, VI status) and part 2 consisted of a ten-research questions and a few probing questions. Face to face and online interviews were conducted.

Participant and Sampling Technique: The sample of the study was ten university students with visual impairment. The convenient sampling technique was used by the researchers for the sampling. Ten interviews were conducted and used for data analysis and findings. The participants were aged between 20 and 35 years. In which six participants were females and the remaining four were male and three of them had acquired blindness and the rest had congenital blindness. Also, three were Students who have low vision and use some vision to acquire visual content and the rest were with total blindness (Students who have light and dark perception also included). The language medium of the respondents is Urdu.

Data Collection : In-depth interviews were used for the data collected of study. During in-depth interviews, researchers and participants have the freedom to explore additional points and change the direction of the process when necessary. Most interviews took from 30 to 60 minutes to complete.

Data Analysis: After collecting data, the researchers analyzed the qualitative data using thematic analysis techniques used in qualitative research. The researcher analyzed the data almost three times using thematic analysis techniques. The researcher drew out some codes and merge the codes in themes. Every code represented an individual aspect or challenge encountered by participants. The systematic coding procedure made it easier to categorize related concepts, leading to a thorough comprehension of the many aspects of the obstacles to obtaining visual content.

After collecting data following codes and Themes are drew out:

Themes	Codes
Inappropriate Teaching Methodology & Lack of Awareness	• Lack of adaptations, Inadequate explanations, Lack of attention to visually impaired students' needs Lack of tactile representation for understanding diagrams, Inaccessible reading materials, lack of awareness among instructors and sighted peers, Unclear audio descriptions from some teachers, Teacher's lack of interest and failure to implement shared ideas
Technical and Financial Barriers	• Reliance on audio cues, facing clarity issues in videos, Videos without subtitles, Screen Reader Limitations to read images, tables and graphs, potential inaccuracies of Apps, Internet dependency, Inaccessible aids such as magnifying glass for low vision, Inaccessible aids,OCR processing issues,incompatible software, high costs of specialized tools.
Subject-Related Challenges	• Lack of awareness in drawing and painting courses, Computer science, mathematics, and statistics pose significant challenges due to heavy reliance on visual representations like diagrams, graphs, and equations, Lack of accessibility in software for data analysis. dealing with numbers and graphs is the biggest challenge, Arabic and Urdu is challenging due to the absence of a good Urdu, Arabic screen reader, difficulties in subjects like finance, marketing, accounting, statistics, economics, math
Educational & Social Impact	• Relying on skilled teachers and sighted peer for clear explanations, Marks given without completing work due to lack of assistance, Deduction of marks due to exam questions from unaddressed video content, almost failed due to inaccessible material, Fear of missing visual content impacting self-confidence,Feeling one step behind peers impacting progress and achievement, Causing deprivation and challenges in learning,

Figure 1

FINDINGS

As a result of data analysis, the following **major themes** emerged. 1. Inappropriate Teaching Methodology 2. Subject Related Challenges 3. Educational and social impact 4. Technical and Financial Barriers.

Inappropriate Teaching Methodology

In most of the interviews, the students say that the attitude of the teachers towards disability is sometimes positive and sometimes negative. According to them, whenever they approached the teacher to meet their

needs, some teachers responded positively and some ignored them, in addition to their inappropriate teaching methodology Which causes a lot of challenges, especially in higher education. The main cause of which is the lack of awareness among the instructors, they do not give appropriate explanations, they write on the whiteboard, they use gestures and do not give verbal explanations, they use graphics in their presentations that are not readable by their software and technologies. Also, pictures without description are difficult to understand. Tactile representation in science projects and Maps etc., is very limited, which makes it difficult to understand concepts.

Subject-Related Challenges

Subject related issues students have to face because what they have is limited access to maths and computations in addition to the graphs, charts, diagrams that are there in their classrooms but they do not have tactile representation due to which their accessibility is not possible. So that they don't have the issue of accessibility later, they use such arts subjects which have very few graph charts and diagrams, in addition they have not chosen such subjects like Urdu and Arabic in arts for higher studies because Text to speech softwares (TTS) and OCR can read only English content accurately but not Urdu and Arabic content. According to students with low vision, there is very limited accessibility to enlarge text and magnifying glasses provided by the institute. Due to limited resources, it is difficult to provide assistive technology to every student in public universities therefore, public universities do not provide magnifying glasses. Because of financial issues, the students also find it difficult to purchase their aids. There are many students who did not know that there are technologies for maths and diagrams and charts, which is big issue. Also, students who knew that there were technologies that could read visual content stated that they did not have laptops for these technologies to install the technology software.

Educational and social impact

Most of the interviewees said that due to the limited or non-accessibility of visual content, it affects their educational performance and their independence in society. In reading content, Student always feel fear that there is no content left or not, which also affects their self-confidence and keeps them one step behind their peers. Their social image is also affected in the classroom and they feel excluded from their fellows. All interviewee said that challenges happens in subjects like science, math technology, that contain vision content like graphs diagrams. Non availability of subject specialists and resources, the students do not choose the STEM field as their major, besides, the students do not have the awareness of assistive technology. Students do not know how to use assistive technology and face financial and technical issues. Student stated that their independence and self-confidence in the class are affected because whenever they do not have access to visual content, they approach their classmates to explain what is written within the content. In this way, the student who is inferior to other students becomes sympathetic. Students who are living with the fear that they are left with no topic that uses visual content and their self-confidence is also affected due to this wear and tear, they have to repeatedly approach their classmates to record the distribution content which is a different kind of Student Without Impairment for that Identical Individual. It creates a burden and they feel that they are burdening the other individual which affects their inclusivity.

Technical and Financial Barriers

Today there are many assistive technology and tools available for students and special needs especially for student experience within Pakistan but due to financial issues and technical issues within Pakistan and due to lack of awareness and students do not know how to use technologies, most of the students face many issues. This is to say that they use screen readers to access their visual content but screen readers

can only read text and they cannot read text that is in scanned form and apart from that they use audio recordings. Most of these two methods are used, including screen readings and audio recordings. Now for audio recordings, when they approach their classmates, most of the classmates are helpful, but they also have to complete their assignments and there is also a workload on them, so they are not able to respond on time. It takes time to prepare for the study material and to understand the material due to which their educational achievement and grades may drop. Besides there are some students who know the OCR software that can read the picture but according to them, the OCR does not read such pictures that are not accurately formatted like tables. Mostly they don't get it properly or the students find it difficult to read it. Moreover the videos that are there are without subtitles and the text without description.

CONCLUSION

This study aims to identify status of provision of accessibility of visual content to students with visual impairment who are at university level. Also this paper highlights challenges which is faced by students. After review the literature and analysis of responses which is collected through detailed interview it is shown that student with VI in Pakistan face many challenges in accessing visual content due to lack of awareness among students and educators of assistive technology, lack of resources in institutions specially public sector, lack of implementations on policies that support equitable and accessible educational material. Untrained teachers in an inclusive setup or higher education who have a background in general education. Technical challenges like software inability to read graphics or content that is not formatted accurately. In Pakistan Provision of assistive technology to students or options for gaining information is also limited and where the technology is given to students there is a lack of program or courses to provide training to students and teachers on how to use it effectively.

Due to all of these reasons student with VI show less interest in science, technology, engineering, mathematics (stem) fields due to presence of visual content such as graphs, charts, drawing etc. And if they show interest in such fields they are discouraged by providing inaccessible material leads to a high rate of drop out, changing of major etc.

RECOMMENDATIONS

Teacher training programs should be created in which teachers are trained on technologies that are available for special needs students, and financial support programs should be given that are necessary for the accessibility of tools to students with visual impairment. In addition, accessibility features that are present in digital platforms should be integrated, such as speech software for reading Urdu. There should be an option and there should be a mentorship program. Availability of resources in institutions, especially for low vision magnifying glasses, and technologies for individuals with blindness, in which JAWS programs are installed and they have an idea how to use what they have, all these things are necessary and their implementation is very important in Pakistan so that what they have can increase their contribution to educational progress.

Apart from this, awareness should be provided on how teachers can collaborate with students and those students with vision impairment should also be invited to these meetings to ask and address their challenges. In addition, workshops should be created to provide information to teachers about each updated capability, and inclusive policies should be created that address the challenges at each institution level.

REFERENCES

Aslan, C., & Yalçın, G. (2023). Views of students with visual impairment on distance education during the covid-19 pandemic. *European Journal of Open, Distance & E-Learning*, *25*(1).

Article 24 - Education - (Country information) | European Blind Union. (n.d.). https://www.euroblind.org/convention/article-24

Ahmad, T., Parveen, Z., & Arif, A. (2024). *Experiences of Students with Visual Impairment at University level: a Participatory Action Research*. Journal of Social Sciences & Humanities.

Ahmed, M. R., & Naveed, M. A. (2021). Information accessibility for visually impaired students. *Pakistan Journal of Information Management and Libraries*, *22*, 16-36.

Ashraf, K. (2019). Experiences of people with visual impairment in education and the role of assistive technology (Master's thesis, OsloMet-Oslo Metropolitan University).

Hussain, F., Hameed, A., & Ashraf, T. (2022). Accessibility hurdles in inclusive education of the visually challenged students at university level in Pakistan. *Pakistan Social Sciences Review*, *6*(2), 458-467.

ICSSR, D. A. S. P., & Bhardwaj, D. *Learning Styles of visually impaired and sighted adolescents.*

Kirk, S. A., Gallagher, J. J., Coleman, M. R., & Anastasiow, N. J. (2015). *Educating exceptional children* (p. 396).

Kirk, S. A., Gallagher, J. J., Coleman, M. R., & Anastasiow, N. J. (2015). *Educating exceptional children* (p. 560). Stamford, CT: Cengage Learning.

Kumwenda, S. (2020). *An analysis of print media information and its accessibility to people with visual impairments* (Doctoral dissertation, University of South Africa).

Panda, S., & Kaur, D. N. (2024). Quality Education for Visually Impaired: Achieving Sustainable Development Goal 04 through Web Accessibility Measures.

Pettersson, R. (1989). *Visuals for information: Research and practice*. Educational Technology.

Rule, A. C., Stefanich, G. P., Boody, R. M., & Peiffer, B. (2011). Impact of adaptive materials on teachers and their students with visual impairments in secondary science and mathematics classes. *International Journal of Science Education*, *33*(6), 865-887.

Supporting Higher Education for Persons with Visual Impairment | The Nippon Foundation. (2024, September 27). The Nippon Foundation.

https://en.nipponfoundation.or.jp/what/projects/security/inclusive_society/higher_education

Sukati, V. N. (2024). Access to basic education: A literature review of challenges facing children living with visual impairment in Sub-Saharan Africa. *British Journal of Visual Impairment*, https://doi.org/10.1177/02646196241235284

TFS HealthScience. (2024, October 17). Empowering the visually impaired - TFS HealthScience | Contract Research Organization | Global Resourcing Provider | CRO. TFS HealthScience | Contract Research Organization | Global Resourcing Provider | CRO. https://tfscro.com/resources/empowering-the-visually-impairement