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Exploring the Challenges of Digital Literacy among Students with Visual Impairment Studying at Higher Education Level

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ABSTRACT

Education is the beacon for every human around the globe. Students with visual impairment are also supposed to be part of the quality learning process. This is a great expedition for students with visual impairment to study at graduate or post-graduate levels in the recent wake of digital literacy. Meeting the academic needs of students with visual impairment in this era of the digital world requires a sufficient level of technological resources along with mastery to use them. This study aims to explore the challenges faced by students with visual impairment in digital literacy studying at the graduate and post-graduate levels. A total number of 85 students with a visual impairment from graduate-level (N=50), post-graduate level, and above (35=50) were taken as a sample of this study. A questionnaire was developed as a tool of this study based on three main components. Statistical data were analyzed with IBM version22. Both the descriptive and inferential statistical analysis techniques were used to analyze the data. Frequencies and percentages of the responses along with the Mann-Whitney test were performed to analyze the data. The findings of the research showed that owning a basic level of digital literacy skills and a lack of advanced digital devices/resources causes challenges in academics for visually impaired students. It is recommended strongly that students with visual impairment must be provided with adequate and latest assistive technological facilities to enhance their digital skills and combat the challenges of digital literacy.

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1. Introduction

In this era of overarching adoption of technology, one must have the capability to search, apply and generate ideas with great responsibility and ethics, using information and communication technology tools and technologies combined with the internet. This emergent human aspect is known as digital literacy. It has become an essential part of everyone's life to survive and succeed in the digital world. The notion of education with digital resources has powered education in the 21st century. Individuals need a variety of abilities and expertise to acclimatize with the technological era (Reddy, Sharma, & Chaudhary, 2020). This Digital Revolution (Peña-López, 2009) has made it mandatory to acquire knowledge of digital tools, mobile devices, computer-aided manufacturing tools, communication tools, and smart learning cities.

Visual loss is the deficiency of vision that restricts the students to move easily, interact socially, and study normally. This deduces the functional abilities of visually impaired students

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to the maximum extent. The consequences of visual impairment put the students with visual impairment on dependency and inclemency in their lives (Lourens, 2021).In modern times, digital literacy has emerged as much supportive and innovative approach for students with visual impairment (Reddy et al., 2020). Likewise sighted persons, the use of digital literacy enhances, sustains, and expedites the probabilities for individuals with visual impairment to excel in academics (IDEA, 1990). Promising the survival of visually impaired students in the smart world through digital literacy skills enhances the access to independent living of visually challenged students. It empowers them to perform tasks they would have not been able to perform otherwise. Coping with the requirements of a new era of digital literacy is not so easy for students with visual limitations besides their age and grade level (Agesa, 2014). The lack of awareness on using digital technology for performing complex tasks and unequal facility of internet due to electricity failure and other reasons have increased this challenge for students with visual impairment at a massive level. The shifting of teaching activities from face-to-face to online systems in the recent pandemic scenario has increased this challenge for students with visual impairment many times greater than the rest of the student body (Lee, Fanguy, Bligh, & Lu, 2022).

This sudden change of shifting teaching-learning process to online and blended system in public sector institutions has enforced the researchers to study this changing scenario (Núñez-Canal, de Obesso, & Pérez-Rivero, 2022) with reference to students with visual impairment studying at the graduate and postgraduate level in the province Punjab. It will direct us towards the better resolution of challenges visually impaired students are facing presently in meeting the demands of digital literacy.

This study has focused on the challenges of digital literacy faced by visually impaired students during their learning process at the higher education level. The objectives of the study were to find out the use of various assistive technological devices by visually impaired students, explore the challenges faced by visually impaired students in getting aligned with the hassles of digital literacy at graduate and post-graduate levels and to compare the difference in challenges of digital literacy faced by the students with low vision and blindness. The questions of the study were to explore,

- What type of digital resources visually impaired students are using to perform academic tasks?
- What type of digital literacy skills do visually impaired students possess?
- What are the different types of challenges visually impaired students are facing in getting aligned with the digital devices for their academics?
- Is there any difference between the challenges of digital literacy faced by the students with low vision and blind ness?

This article will be beneficial for all visually impaired students by highlighting the challenges they are facing in digital literacy. Additionally, this study will be useful for students with visual impairment to know the importance of digital literacy for their education. It will provide a base for further research in discovering the future challenges of digital literacy in the learning of visually impaired students in Pakistan. It will aware the concerned authorities on the provision of resources required to enhance the opportunities of digital literacy for visually impaired students at the higher education level. This study is limited only to the students with visual impairment studying at the graduate and post-graduate levels in the province of Punjab, Pakistan.

2. Literature Review

The word *literacy* denotes the achievement of simple and practical skills that bring profound enhancement and revolution of human beings thinking abilities. The term digital literacy has reached its peak after the technological revolution in the 21st century. This term has led to the invention of new literacies and made workplace performance more complex due to the requirement of technological skills (Cisotto & Pupolin, 2018).The meanings of digital literacy change as per the advancement in technological devices and resources. In 1960 the nature of ICT technology was quite different as compared to the 21st century. SZ, Saleem, and Batcha (2014) defined digital literacy as the ability to analyze information by using digital technology. Digital literacy is not just computer literacy rather it is the ability to use digital

technologies for the communication of information via digital platforms. According to Guri-Rosenblit and Gros (2011) digital literacy is a complex concept, including technological, cognitive, and meta-cognitive skills, civic engagement, and moral obligations.

The ICT has given a new direction for literacy, broader the learning opportunities, enhance the participation and opportunities for life-long learning. The use of digital devices to acquire literacy has shifted education into a new paradigm (Reddy, Sharma, & Chaudhary, 2021), making it more creative, interactive improvement in students' and teachers' efficacy (Ahmad, Hashmi, Shehzadi, & Nawaz, 2021; Chu, Reynolds, Tavares, Notari, & Lee, 2021). This shift from traditional learning style to virtual learning has changed the role of both the teacher and learner.

Besides the fact that rapid computer technology provides new options for a person with visual impairment, this new paradigm of digital literacy put such students in a great challenge. Now, the visually challenged learner has to rely on complex and expensive technological devices to learn. For some students, who can afford, these advances make a life for the visually impaired feasible and provide opportunities to them to access information, can communicate smartly by using digital literacy. Technology applications such as speech synthesis, electronic messaging, screen readers, captioned televisions, alternative keyboards, augmentative communication devices, electronic books, a global positioning system (GPS), color & face identification devices, talking watches/thermometer/weight machines, electronic canes with various electronic mobility options and audio recorders are salient to assist a person with visual impairment. The use of these devices is no doubt a greater challenge for the people who cannot see or who are blind. A person is blind when vision has deteriorated to the point that, to function capably and efficiently, the individual uses alternative and nonvisual techniques to accomplish daily activities (Omvig, 2009).

The United Nations defines assistive technology as "technology adapted or specially designed to improve the functioning of people with disabilities" (Borg, Larsson, & Östergren, 2011; Shehzadi, 2018). Hardware, such as screen magnifiers and alternative keyboards, as well as software, such as optical character recognition, onscreen keyboards, voice recognitions, mechanical, electronic, and microprocessor-based equipment; non-mechanical and non-electronic aids; and specialized instructional materials, services, and strategies that people with disabilities use to: (a) assist learning, (b) make the environment more accessible, (c) compete in the workplace, (d) enhance independence, or (e) improve quality of life. The American Foundation for the Blind (2006) grouped assistive technologies into seven categories, which include positioning and seating, mobility, augmentative and alternative communication, computer access, adaptive toys and games, adaptive environments, and instructional aids. In contrast, Reed and Lahm (2005) classified assistive technologies for visually impaired persons into thirteen categories based on the task for which each is useful: (a) computer access, (b) motor aspects of writing, (c) composing written material, (d) communication, (e) reading, (f) learning/studying, (g) math, (h) recreation and leisure, (i) electric aids for daily living, (j) mobility, (k) vision, (l) hearing, and (m) vocational.

Assistive digital technology plays an important role in the lives of people with visual impairment at higher education levels as it enhances information access and allows user to accomplish their tasks in a more refined manner independently. WHO has identified digital technology as one of the six global priorities aimed to enhance the accessibility to educational technologies to provide quality education (Ferreira-Meyers & Pitikoe, 2021; Kashif, Shehzadi, & Arshad, 2020). The use of assistive technology has made education flexible for students with visual impairment at higher education level. The concept of assistive/adaptive technology and its role in the access of information for people with visual impairment in the digital environment at higher education level has been studied. It is explored that there are thousands of computer-based assistive aids and devices available today for the visually impaired. The literature has shown that the area of adaptive technology is growing rapidly and making various assistive software applications available for visually impaired, which differ in range and functionality from simple to highly specialized, to meet the user's needs like screen reading software JAWS (Job Access With Speech), OMNI 1000 which provides the ability to scan information from a book, newspaper or magazine and have it read aloud by the screen reader, OMNI 3000. Nevertheless, the situation is quite different in Pakistan due to the overall

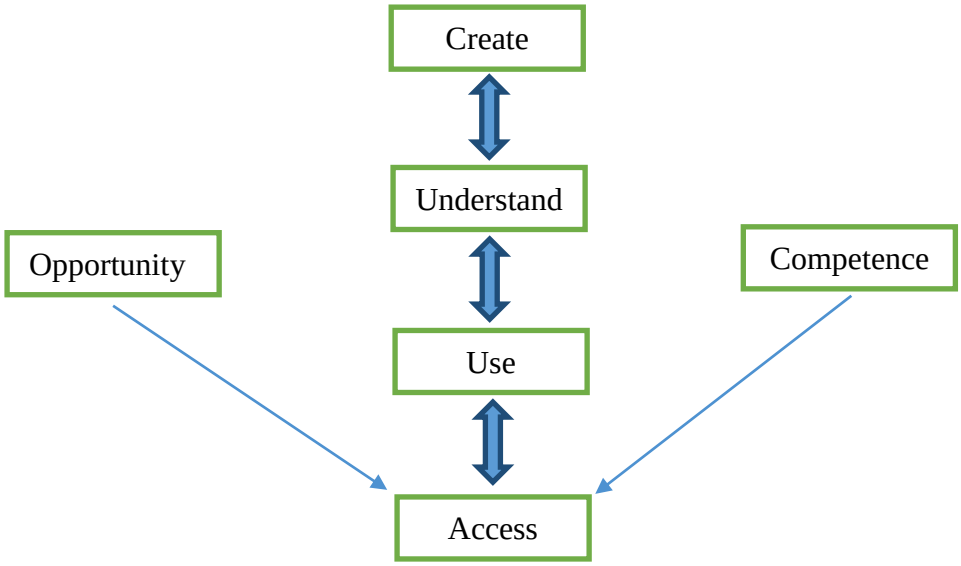
lack of availability and access to digital devices and allied resources for persons with visual impairment.

This situation has brought many complex challenges for visually impaired students in acquiring digital literacy skills (Almukainzi, Almuhareb, Aldwisan, & Alquaydhib, 2020). These challenges create hurdles in the learning process at the higher education level. The utilization of digital technology to access the learning opportunities at the higher education level requires good command of digital devices. Students with visual impairment require the latest assistive devices for independent and productive work (Tejedor, Cervi, Pérez-Escoda, & Jumbo, 2020). However, challenges to access assistive technology create barriers in digital literacy for visually impaired students. Kisanga, Wambura, and Mwalongo (2018) have observed the provision of assistive technology tools, e-learning user interfaces, as major challenges of visually impaired students. In the light of the above discussion, it is desirable to conduct the study on the challenges, visually impaired students are facing in the domain of digital literacy within our local context (Tohara, 2021).

3. Conceptual Framework

The theoretical framework of the study is conceptualized based on a literature review related to digital literacy. The theory elaborated that digital literacy requires abilities to *Use, understand, and create by the technology users. Whereas* ***Use*** represents the technical fluency or sophisticated abilities for accessing and using knowledge resources, such as search engines and online databases, and emerging technologies. ***Understand*** is that critical piece, it's the set of skills that help us comprehend, contextualize, and critically evaluate digital media. ***Create*** is the ability to produce content and effectively communicate through a variety of digital media tools. Creation with digital media is more than knowing how to use a word processor or write an email.

Figure 1: Theoretical Framework



4. Research Methodology and Procedure

The type of research was quantitative, conducted through a self-reported survey.

4.1 Targeted Population

The population of the study included students with visual impairment, studying at graduate and postgraduate levels at various institutions of Punjab.

4.2 Sample of the Study

A total number of 85 students with visual impairment (N=50 graduate level, N=35 postgraduate level and above) studying at various institutions (colleges and universities) of Punjab were taken as a sample of the study. Majority of the respondents 68.2% were blind, whereas 31.8% were a low vision. 54.1% of the respondents were studying in inclusive settings whereas 45.9% were studying in segregated settings. 87% of the respondents were

male, 23% of the respondents were female students. The age range of the students were from 18 to 27 years.

4.3 Tool of the Study

The tool of the study was a self-made questionnaire, consisted of total 31 Likert-type items. All of the items were close-ended.

4.4 Data Analysis

The data was analyzed through the statistical procedure (SPSS). Mean along with slandered deviation and ANOVA was administered to find the accurate results.

4.5 Ethical Consideration

In this study, The Researchers tried to maintain the level of ethics and honesty. It has been decided not to highlight the names of the respondent. The informed permission was taken from every individual respondent to comply with the high level of confidentiality, rights to self-willpower, morality, and privacy. Subjects were free to decide because they were informed before the study. As a very high ethical value, honesty was contemplated while conducting this study. Researchers tried well to avoid any dishonesty.

5. Data Analysis

The analysis is given in following tables.

Table 1: Item 1: I can use digital technology for my studies

No	To some extent	Neutral	Greater extent	Yes
4	10	1	25	45
4.7	11.8	1.2	29.4	52.9

Table 2: Item 2: My teachers guide me in using technology during my academic activities

No	To some extent	Greater extent	Yes	Total
27	10	21	27	85
31.8	11.8	24.7	31.8	100

Table 3: Item 3: I can access and read textual material through search engines

No	To some extent	Neutral	Greater extent	Yes	Total
5	7	1	16	56	85
5.9	8.2	1.2	18.8	65.9	100

Table 4: Item 4: I can access notes provided to me by the teachers via digital resources

No	To some extent	Neutral	Greater extent	Yes	Total
31	13	2	13	26	85
36.5	15.3	2.4	15.3	30.6	100

Table 5: Item 5: I can download the material easily from email

No	to some extent	Neutral	Greater extent	Yes	Total
8	6	2	11	58	85
9.4	7.1	2.4	12.9	68.2	100

Table 6: Item 6: I can use the OCR technique to read the content

No	To some extent	Neutral	Greater extent	Yes	Total
23	7	1	10	43	85
27.1	8.2	1.2	11.8	50.6	100

Table 7: Item 7: I can comprehend the material provided by teachers in audio or soft form

No	To some extent	Neutral	Greater extent	Yes	Total
2	3	1	14	65	85
2.4	3.5	1.2	16.5	76.5	100

Table 8: Item 8: My teachers encourage me to use digital resources for literacy purpose

No	To some extent	Greater extent	Yes	Total
7	10	21	47	85
8.2	11.8	24.7	55.3	100

Table 9: Item 9: It is affordable for me to purchase an android cell phone

No	To some extent	Greater extent	Yes	Total
8	6	8	63	85
9.4	7.1	9.4	74.1	100

Table 10: Item 10: It is affordable for me to buy the latest computer

No	To some extent	Greater extent	Yes	Total
22	8	16	39	85
25.9	9.4	18.8	45.9	100

Table 11: Item 11: I can use social media to contact my class fellows

No	To some extent	Greater extent	Yes	Total
3	5	14	63	85
3.5	5.9	16.5	74.1	100

Table 12: Item 12: Internet facility is available at my school for learning

No	To some extent	Greater extent	Yes	Total
22	5	7	51	85
25.9	5.9	8.2	60	100

Table 13: Item 13: Uninterrupted Internet connection is there at my home

Missing	No	to some extent	Greater extent	Yes	Total
1	12	3	3	65	84
1.2	14.1	3.5	3.5	76.5	98.8

Table 14: Item 14: I can use a computer to design my assignments

No	to some extent	Greater extent	Yes	Total
5	6	16	58	85
5.9	7.1	18.8	68.2	100

Table 15: Item 15: I can use a cell phone for networking

No	to some extent	Greater extent	Yes	Total
1	2	6	76	85
1.2	2.4	7.1	89.4	100

Table 16: Item 16: I can use a screen magnifier to view the text

No	to some extent	Greater extent	Yes	Total
62	5	2	16	85
72.9	5.9	2.4	18.8	100

Table 17: Item 17: I can use a talking calculator for calculation during my studies

No	to some extent	Greater extent	Yes	Total
14	4	9	58	85
16.5	4.7	10.6	68.3	100

Table 18: Item 18: My digital literacy skills make the educational environment accessible for me

No	to some extent	Neutral	Greater extent	Yes	Total
4	7	5	21	48	85
4.7	8.2	5.9	24.7	56.5	100

Table 19: Item 19: I can access new information through the latest technology in trend

No	to some extent	Greater extent	Yes	Total
52	8	18	7	85
61.2	9.4	21.2	8.2	100

Table 20: Item 20: The electronic sound indicators available in my institutes

No	to some extent	Yes	Total
73	2	10	85
85.9	2.4	11.8	100

Table 21: I can use Google meet to attend online classes

No	to some extent	Greater extent	Yes	Total
25	6	5	49	85
29.4	7.1	5.9	57.6	100

Table 22: I can use Zoom independently for my academic activities

No	to some extent	Neutral	Greater extent	Yes	Total
15	7	1	8	54	85
17.6	8.2	1.2	9.4	63.5	100

Table 23: I can connect my android cell phone to use social media

No	to some extent	Neutral	Greater extent	Yes	Total
1	3	4	7	70	85
1.2	3.5	4.7	8.2	82.4	100

Table 24: I can buy internet facility easily

No	to some extent	Neutral	Greater extent	Yes	Total
11	3	4	8	59	85
12.9	3.5	4.7	9.4	69.4	100

Table 25: I can connect on Facebook to attend live streaming sessions

No	to some extent	Neutral	Greater extent	Yes	Total
15	6	3	10	51	85
17.6	7.1	3.5	11.8	60	100

Table 26: I possess essential skills to use digital sources for academics

No	to some extent	Greater extent	Yes	Total
5	7	17	56	85
5.9	8.2	20	65.9	100

Table 27: My teachers possess essential digital literacy skills to impart knowledge to us

No	to some extent	Neutral	Greater extent	Yes	Total
68	5	1	9	2	85
80	5.9	1.2	10.6	2.4	100

Table 28: The latest digital resources are available in my institute for my better learning

No	to some extent	Neutral	Greater extent	Yes	Total
39	12	1	5	28	85
45.9	14.1	1.2	5.9	32.9	100

Table 29: I can use digital resources for complex academic tasks

No	to some extent	Neutral	Greater extent	Yes	Total
58	5	4	4	14	85
68.2	5.9	4.7	4.7	16.5	100

Table 30: I can afford the latest digital technological devices

No	to some extent	Neutral	Greater extent	Yes	Total
32	6	1	30	16	85
37.6	7.1	1.2	35.3	18.8	100

Table 31: The Mann-Whitney test was performed to see the difference between digital literacy skills of Low vision and blind students.

Disability of the respondent	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Sig. (2-tailed)
Low vision	28	36.85	995.00	617.00	.144
Blind	57	45.18	2575.00		
Total	85				

The above table shows that there is no difference between the mean rank of the digital literacy skills of low vision and blind students, however, this difference is not statistically significant (Mann-Whitney U =617.00, sig =.144).

6. Findings

While seeking the answer to the first and second question of the study, the mean and frequency of the responses were calculated against each item. The findings show that majority of the students with visual impairment are acquainted with digital devices and can use the computer for typing their academic assignments. 76.5% of the respondents said that they can use the internet, can email their teachers and friends. 65.9% of them responded that they can access and read textual material through search engines. 68.2% of the respondents said that they can download the material easily from email. 50.6% responded that they can use the OCR technique to read the content. 76.5% responded that they can comprehend the material provided by teachers in audio or soft form.

A good number of respondents 45.9% expressed that the latest computer lab resource room is not available in their institute. A vast majority of the students 74.1% expressed that they use social media to stay connected with their class fellows. 60.0% of the respondents responded that an internet facility is available at their learning school. 68.2% responded that they can use a computer. 89.4% responded that they can use their cell phone for social media and online activities. 72.9% responded that they cannot use an electronic magnifier to view the text. 58.2% of the respondents responded that they cannot pay financial charges through digital devices. 56.5% responded that their educational environment is supported by them because of digital literacy.37.6% responded that they can afford digital technology devices.

Majority of the respondent 61.2% responded that they can access new information through the latest technology in trend. 85.9% of the visually impaired students responded that electronic sound indicators are not available in their institutes. 57.7% said that they can use Google meet to attend online classes whereas 63.5% replied yes that they can use Zoom independently. According to 82.2% of respondents, they can connect their android cell phones to online sources to perform academic activities. 63.5% responded that they can buy internet facilities easily. Majority of the respondent 69.4% responded that they can connect on Facebook to attend live streaming sessions. 65.9% answered that visually impaired persons possess essential skills to use digital sources for academics**.**

Major challenges expressed by the visually impaired students in digital literacy according were lack of availability of uninterrupted internet facilities, non-availability of electronic sound indicators, use of digital devices to perform complex tasks, affordability of charges of advanced digital devices, lack of availability of specially designed computers for visually impaired, rare use of advanced technology by the teachers.

7. Conclusion

Visually impaired students are using various digital resources for their academic purpose including the use of search engines, emails, optical character recognition (OCR), electronic magnifier, and talking calculator. For input, the Braille notetaker keyboard and for output refreshable Braille display are utilized with Braille as an interface to a computer. A

standard laptop/tablet is used by the student on which input comes from voice recognition software, touch, or keyboard typing. Furthermore, text to speech software is most likely output for Blind students but low vision can benefit from screen magnification software in class as well. Students with visual impairment at college levels use screen readers on their computers and cell phone (Stone, Kay, & Reynolds, 2019). The study has highlighted that visually impaired students possess essential digital literacy skills to perform basic academic tasks. This becomes their strength in their education and learning (Suhendri, Maryanah, Ediyanto, & Norimune, 2020).

International studies have shown that Zoom Text (Ai Squared), non-visual desktop access (NVDA), and Voiceover (Apple) are the most common screen readers used by visually impaired students at the higher education level. But the findings of this study have shown a rare use of this software by our students at the higher education level. Therefore, students with visual impairment require in their class an accessible accommodation to a tablet, laptop, and various computing devices. Students with visual impairment use digital learning aids including a mobile device (Web AIM 2015). However, in this study, a reasonable number of students with visual impairment accepted that they are not supported to use these advanced digital resources for their academic learning. According to the student, they are not facilitated with the latest computer lab in their learning premises. This is the need of the time if the students with visual impairment are provided with a standardized computer lab in their institute for their better learning (Gadiraju, Doyle, & Kane, 2021). No statistical difference has been found between the challenges of digital literacy faced by the students with low vision and blindness. It is because, in the majority of the institutions, both low vision and blind students are provided with more or less similar learning opportunities, hence their skills are similar besides the difference in visual loss.

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