Experiences of college teachers with visual disability using AT and AI based solutions in India: Benefits, Issues, Challenges and Prospects

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Abstract. The study explores various issues related to usage of Assistive Technologies and Artificial Intelligence based solutions by college teachers with visual disabilities for teaching and academic purposes. Existing academic work indicate that these technologies have supported and transformed the lives of people with disabilities and particularly people with visual disabilities but also posed several challenges and limitations. This research examines real time issues encountered by the college professors with visual disabilities using such technologies and suggest measures for implications for future development of such technologies. This study goes beyond describing, analyzing and theorizing the benefits and limitations of Assistive technologies and Artificial Intelligence based solutions for college teachers with visual disabilities and attempt to address larger issues of accessibility, inclusiveness, consideration of local context for such technologies and aim to improve the agency of such users. For this purpose, a qualitative study has been undertaken to explore the experiences, concerns and suggestions regarding the research issue. I have used semi-structured interviews as tools to analyze the impact of these technologies. This study sits at the intersection of technological innovations and disability studies.

Keywords: Assistive technologies, People with visual disability, Artificial Intelligence

1. INTRODUCTION

Due to ongoing COVID-19 pandemic online teaching and learning has become ubiquitous when all the schools and colleges have been either shut or functioning partially [1]. In this scenario the college teachers with visual disabilities have resorted to online teaching platforms and using various Assistive technologies (AT) and Artificial Intelligence (AI) based solution for teaching and academic purposes. The objective of this study is to examine the advantages, limitations and future scope of these solutions and improve the agency of college teachers with visual disabilities about such solutions.

The context of this study emerges from the crucial role AT and AI solutions has played to make the life easier for people with disabilities and particularly for people with visual disabilities. According to WHO data, the estimated number of persons with visual disability in India is about 62 million, of which eight million are blind [2]. But AI solutions can play an important role in improving the life of visually disabled people and it is already playing as written by many scholars and experts. The kind of advances these solutions have provided for people with disabilities include robotic arm, AI supported...
prosthetic limbs and decision support tools for people with disabilities. Now people with visual disabilities can use text-to-speech translations that describe emojis and pictures seen on social media. These people can also have digital eyes in the form of smart glasses and vision-free communication. There are so many apps and wearables based on AI and machine learning that help the people with visual disability to recognize world through narration. Some of these include – Seeing AI, NavCog, Horus, MyEye, Aira, AiServe, Drishti, and so on. This study explores the opportunities, challenges, limitations and prospects of assistive technologies and AI based solutions from college teachers’ perspective who are using them for teaching and academic purposes. What I suggest through my research here is that the developers of these solutions need to be more inclusive in approach while constructing software and technology for them at least at the stage testing and evaluation so that the real issues could be addressed in the Indian context.

Before going further, it is important to discuss the essence of AT and AI. Any assistive technology provide access to information and other environmental barriers to readers who can’t read printed texts or having visual disabilities [3]. AT can be described as any equipment, or system, which could be used in the original form or could be modified and customized with the aim of enhancing the functional capabilities of individuals with disabilities. It includes computers with speech output, screen-magnification, or braille readout; electronic magnifiers; and other devices [4].

While according to researchers AI “refers to programs, algorithms, systems and machines that demonstrate intelligence” [5], is “manifested by machines that exhibit aspects of human intelligence” [6], and involves machines mimicking “intelligent human behavior” [7]. Since this study also falls into disability studies domain, it is important to engage with the discourse of disability.

There are several debates about defining the concept of disability, but I support disability scholar Susan Windle’s argument that you can’t define impairment or disability in biomedical terms only as it is resulted by the interaction of both biological and social [8]. And that’s the reason I am using social model of disability offered by various disability activists and scholars where impairment is defined as “lacking part of or all of a limb, or having a defective limb, organ or mechanism of the body” [9]. According to Mike Oliver “impairment is, in fact, nothing less than a description of the physical body. Disability, by contrast is the disadvantage or restriction of activity caused by a contemporary social organization which takes no or little account of people who have physical impairments and thus excludes them from participation in the mainstream of social activities” [9]. And this is the reason I am using the term people with visual disability because I don’t want to address the individual first and then their disability. Another reason for using this term is that here I am also supporting the popular slogan of disability movement by James I Charlton “Nothing about us without us” which calls for a more inclusive framework [10]. In the document Fundamental Principles of Disability, UPIAS (Union of Physically Impaired Against Segregation) defined disability not as an impairment of the body or brain, but as a “relationship between people with impairment and a discriminatory society” [11]. So according to the social model society disables individuals by the constructs which it places around us. Apart from that the non-inclusiveness of society leads to disability of individuals.

This gives rise to the following questions for the study:

- How assistive technologies and AI based solutions are helping college teachers for teaching and academic purpose?
- What are the limitations and challenges associated with the use of such technologies?
- What implications for future research on such technologies do these findings have?

To better understand the context of this study it is important to go through some of the important earlier research related to the study.

2. REVIEW OF LITERATURE

These technologies have been so helpful, but they have their own limitations this is what has been expressed by disability scholars Peter Smith and Laura Smith in their opinion paper where they have used their own narrative accounts in the form of diaries as two disabled people to reflect upon how AI solutions and assistive technologies have become part of their daily life through extensive support but they also highlight the moments of frustration while using them. In this paper they also suggest some measures to improve the development of AI solutions for future [12]. But this study lacks to address
the larger issues related to people with visual disabilities like accessibility, inclusiveness and considering local context which are the main objectives of my study.

There are many other studies indicating the challenges and limitations faced by people with visual disabilities while using web [13]. Lazar, Allen, Kleinman and Malarkey in their study “What Frustrates Screen Reader Users on the Web: A Study of 100 Blind Users” draws attention to the causes leading to moments of frustrations for people with visual disability. The major ones are conflict between screen reader and application, poorly designed/unlabeled forms, no alt text for pictures and 3-way tie between misleading links, inaccessible PDF, and a screen reader crash [13]. Such kind of problems with screen readers have been highlighted by College teachers with visual disability also during the interviews conducted for this study.

Development of several assistive technologies for people with visual disabilities tend to self-reliance and promote usability which ultimately leads to improved quality of life but at the same time it poses several difficulties. There are researches which have highlighted the need for technological advancements, accessibility-inclusive interface paradigm, and collaboration between medical specialists, computer professionals, usability experts, and domain users to realize the potential of ICT-based interventions for people with visual disabilities and providing more inclusive solutions [14]. These research findings have drawn our attention to the issues and challenges for people with visual disabilities with the aim to highlight the benefits and limitations of existing techniques and technologies. This is also one of the objectives of this research paper.

There have been various research works primarily catering to the issues of mobility, navigation, object identification and access to information on printed artefacts [15]. In past few decades, we have witnessed the influx of low vision reading devices having their own advantages as well as limitations [16]. Even the researchers and technology experts have realized that AT and AI based solutions can be explored to increase the quality of life for individuals with visual disabilities by increasing educational and employment opportunities, enhancing social networks, and facilitating independence [3]. Guo et al. identify how AI may “impact particular disability constituencies if care is not taken in their design, development, and testing” [17]. My argument here is that this study aims to address many such issues highlighted by earlier research along with the aim of improving the agency of college teachers with visual disabilities. In next section I am going to discuss about the kind of methodology I am using to conduct this study.

3. METHODOLOGY
To conduct this study, I have chosen qualitative approach as it seeks to answer ‘how’ and ‘why’ rather than ‘what’ or ‘how often’ questions [18]. I have employed semi-structured in-depth interview method to get to know about the real issues. As Kvale rightly argues that through interviews individuals get the opportunity to interact and know about others’ lived experiences, feelings, family, social life and work life [19]. This research method rightly fulfills the objective of the research which aims at knowing the real issues and challenges of using assistive technologies and AI based solutions by college teachers with visual disabilities. It also provides them the opportunity to share their views in extensive manner. I have interviewed college teachers with visual disabilities from 25 colleges across the country from various disciplines. The interviews have been conducted face-to-face and through telephone.

4. FINDINGS
I have summarized the data and findings of the interviews into different relevant themes. The themes have emerged after reviewing the findings and data. My focus has been on ‘why’ and ‘how’ and that’s why I have focused more on the issues rather than the statistics. All the emerged themes are interrelated and some of them are overlapping also.

4.1 Benefits
Most of the participants highlighted that AT and AI based solutions have revolutionized their life. They believe that it has empowered them in many ways. They can now take online classes through various platforms like Google Meet, Zoom and Microsoft teams from their homes. They can now communicate directly with the students for their assignments on WhatsApp and even get office orders
These technological solutions have promoted reading and writing independently without any human assistance. One of the participants during the interview said, “Now I can read anytime and anywhere which is a real pleasure. Earlier I had to rely either on human assistance or recordings for it”. Speech enabled devices and screen reading machines and software applications have played a crucial role in it [21]. Almost all the professors are using AI technology, such as speech technology on either mobile phones or computers [22]. Navigation is an important function of such applications. Technology has come a long way particularly for individuals with disabilities. One of the participants teaching Sanskrit in a college in Delhi said, “I am proud to say that I have supervised five PhD scholars and I have myself evaluated their thesis without any assistance. Also, now I can easily read traditional literature like Ramayana and Mahabharata on my own for references”. But not to forget that these AT and AI based solutions have presented some real time challenges for its users which I am going to discuss in the next section.

4.2 Popular AT and AI solutions

There are various AT and AI based solutions being used by the participants of the study. Throughout the interviews the popular AT and AI solutions cited by the respondents included TalkBack on android platform, Envision app and glasses, EyeVision software, Job Access With Speech (JAWS) screen reader, Orbit Reader, Narrator Screen reading app and Voice Dream Reader. To know about the most popular AT and AI solutions among college teacher with visual disabilities refer to figure no 1. Using these speech synthesis systems of screen reading technologies the participants can read e-books using a mobile application. They actually use speech in natural languages to read the soft copies of documents for the readers with visual disabilities [23]. Some of these apps are for object recognition system for visually impaired people [24]. For some of the solutions the voice commands assist the visually impaired. These systems use AI through voice commands to help individuals with disabilities. Some other AI based solutions recognize the photographs or use camera to identify objects and send the audio commands to the individuals with visual disabilities [25].

4.3 Challenges during usage

One of the major issues that came up during the interviews was that the speech recognition system doesn’t work efficiently many times. Some participants noted that the screen reader technology seems more compatible with computers rather than smartphones. Sometimes controlling the speed of screen reader becomes an issue and if you miss anything, you must start all over again. Language is another issue with these technologies. One of the participants noted, “When a message is received on phone in English it works absolutely fine but when any message comes in Hindi or any vernacular language, it either doesn’t read it properly or skips it completely”. One of the participants noted that screen reading technologies are still not very compatible with the languages like Sanskrit. Some of them drew attention to the point that all the inputs particularly images and handwritten texts are sometimes not read properly and compel for crosschecking by human assistance which becomes a very time-consuming process. Apart from that less availability of important printed material in the e-form is a big problem, particularly at a time when the libraries have been shut for so long during the lockdown.
4.4 Accessibility issues

Throughout the interviews most common issue cited by all the participants was accessibility. These AT and AI based solution are inaccessible in many ways and there are multiple reasons behind that. Like many websites are not VH friendly and particularly the government websites. This is another area where government and administration’s intervention needed to be sought. One of the participants teaching at a college in Delhi shared about an incident at a government department established for the welfare of people with disabilities where he went to deliver a lecture and found that they were using a software Video Connect which was not at all accessible for individuals with visual disabilities and many such people couldn’t join it as it wasn’t accessible for them. Sensitization towards such issues is very important.

Apart from that every participant raised the issue of latest technologies being so expensive and hence inaccessible for most of its users. One of the respondents teaching at a premier institute said, “I have been quite privileged for being in this job for quite some time and having decent income to afford some of the latest assistive technologies like image and object narrators, iPhone and wearable but not everyone can”. Even some of the original software application like JAWS are so expensive to buy for everyone and many such users are bound to use pirated software solutions which don’t guarantee accurate solutions and corrupt devices many times.

4.5 Need for awareness and training

Technology is changing rapidly and lack of awareness about the new technological innovations have been pointed out by some of the participants which somehow leads to inaccessibility. They are still not aware about many new innovations. They think that awareness and training programs can be crucial. But most of the training is happening at informal level through self-learning among their own groups. One of the college teachers from Delhi said, “Training programs for awareness about new technologies need to be introduced as a part of upgrading skill at the higher education level. Universities need to take it up as one of the projects and curriculum to be designed and customized as per the group be it teachers or students with visual disabilities”. Though a few interviewees have attended some workshops for this purpose, but they too think that there is a need for constant updating.

4.6 Accuracy

Another important point highlighted by most of the interviewees was regarding the dilemma of accuracy of output provided by the system or software, particularly in case of image/object narration, text in Hindi or vernacular languages and captcha. One of the participants teaching Sanskrit to the students in a premier institute in Delhi said, “Though these assistive technologies, life has become so easy but in case of languages like Sanskrit and Hindi Vyakarana where mistakes are not accepted even in pronunciations these technologies still need to improve a lot”. The AT and AI based solutions for image/object narration are sometimes not very reliable when the image clarity is not that good, narration might be very confusing, or it might not work at all. Captcha related issues is another accuracy problem that has been reiterated by most of the participants. Visual captcha is inaccessible without AT and Audio captcha don’t work well [26].

4.7 Consider local context

Any technology can provide its real benefits to the users only when it is presented with the right context. The participants during the interview emphasized on the need to consider the Indian context while designing technology for India users with visual disabilities. The western based AT and AI solutions are always not very beneficial in a diverse country like India. Here people communicate in various languages and they have different needs and issues which can’t be catered with one type of solution. In our county many areas are still lacking internet connectivity. Many people don’t have smart devices which could support the latest technological solutions. So, the providers of AT and AI solutions need to ponder about these issues. Though some of the respondents shared that they are using some Indianized solutions, but their quality needs to be improved to great extent.
4.8 **Inclusiveness required**

The data gathered also suggested that to overcome the above-mentioned issues there is need to involve the individuals with visual disability right from the process of designing AT and AI based solutions rather than waiting for testing or evaluation stage. Most of the respondent argued that the user centric designs are always better when they are designed with the help of their involvement. If this happens, the errors can be reduced to great extent and these solutions would become more inclusive [12].

5. **CONCLUSION AND SUGGESTIONS FOR AT AND AI SOLUTIONS IN FUTURE**

Most of the respondents think that AI based solutions have long way to go particularly for individuals with visual disabilities. It can intervene in many ways in current technological scenario as per the suggestions provided by the interviewees. Some of them are, improving the speed of screen reading technologies particularly in the context of Hindi and vernacular languages thus saving lots of time. It can make possible things at just one click. One of the interviewees said, “When you are taking an online class and a new student joins in between, then I have to follow the entire navigation process guided by the speech system to admit that student. It is sometime very disturbing and lots of time is lost due it. I think AI can make these processes easier for us”. Another interesting suggestion is about assisting the teachers with visual disabilities through robots particularly in the classrooms which can assist them for teaching and other related activities. Other researchers have also emphasized that robots in education sector can play a crucial role as assistants, though some of them have contrasting views but there is no denial to the fact that an inclusive approach and appropriated technology from robotics might be a boon for this sector as well. There could be further research in this area to address many issues noted by this research.

This study highlights many issues related to the usage of AT and AI based solutions for college teachers with visual disabilities and provide some valuable suggestions which could have further implications for the providers of these solutions and even for researchers. The most important argument it puts forward is that such technological solutions need to be inclusive for all kinds of groups including people with visual disabilities to reap its benefits for all and to the maximum. And above all, this study, to some extent, attempts to provide agency to the users of such technological solutions. Despite all the benefits, some of the respondents also emphasized that technology should be assistive, but a lot of dependency is not good. It should be used judiciously for the welfare. One of the participants during the interview cite, “Technology is something that one should not be so dependent that it starts controlling your life. Technology is a mean to end but some people rely on it so much that it becomes an end for them”. This is something which can be researched further to examine that to what extent technology should be supportive and assistive but not controlling. What could be the impact of too much dependency upon technological solutions, is something which can be of interest to other researchers.

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