Brilliance and Resilience: A New Perspective to the Challenges, Practices and Needs of University Students with Visual Impairments in India

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Abstract. People with visual impairments in India have low literacy rates and only a few pursue higher education at the country's top universities. We present an insight into the educational experiences of these few university students with visual impairment based on the Frame of Interdependence. We found that educational challenges arise when interdependence fails due to restricted or misfitted assistance from social relations and ableist social interactions. Analysis of practices to overcome these challenges from the lens of Resilience Theory revealed that students develop a sense of self-confidence through successful academic experiences, internalise external stressors into intrinsic motivation, and find ways to navigate inaccessibility with the available social resources. In addition, students express the need to increase the integration of assistive technologies in education and facilitate social integration. Finally, we discuss the implications of these findings for equitable and inclusive education practices.

Keywords: Visual Impairment, Education, Assistive Technologies, Global South, Interdependence, Resilience, Interview Study

1 Introduction

Nearly a quarter of a million children with visual impairments live in India, where visual impairment (VI) is one of the most feared health problems [1]. Children born with a visual impairment who lose sight at a young age face emotional, social, and economic challenges over a lifetime [2]. The implementation and utilisation of public health programs and overall socioeconomic development have decreased the

prevalence of childhood visual impairment in India [3]. On the one hand, it is imperative to reduce vision loss in children by managing preventable and treatable visual impairment. At the same time, it is important to support children with visual impairments to become independent, integrated and contributing individuals to their society.

Education is the single greatest tool for achieving social justice and equality. But the literacy rate for students with visual impairments (SVIs) in India is significantly lower than the overall literacy rate of the country [4]. Despite having one of the most progressive policy frameworks in the Global South towards the education of people with disabilities, there remain considerable gaps in implementation. Issues still need to be addressed in providing science and math education, teacher support and training, braille book access, assistive technologies, tactile displays, and training for screen readers. Attitudinal barriers and an apathetic approach to curriculum adaptation for SVIs also create a challenging environment to succeed [5,6].

Some universities have implemented policies to support the enrolment of SVIs and provide accommodations to support learning. However, the specific number of SVIs in higher education is hard to find as enrolment is relatively low. A few students overcome significant challenges to attain higher education in competitive subjects from the country's top universities. Previous work has provided a good understanding of the barriers to the education of SVIs. However, it is unclear how social interdependencies play a role in the education of SVIs and how challenges are overcome. Likely, the combination of intrinsic motivation, problem-solving skills, a supportive social network, and the availability of assistive technologies influences overcoming challenges. Understanding the challenges and how SVIs are overcoming them is instrumental for designers and HCI practitioners to create products and services that facilitate more students to *make it*. Therefore, in this paper, we contribute a thematic analysis of the educational challenges of university students from India through the lens of the Interdependence Framework for Assistive Technology [7] and the strategies students use to overcome challenges with reference to the Resilience Theory [8]. We also identify and interpret the most pressing needs of students considering the above findings.

2 Related Work

2.1 Education of Students with Visual Impairments

In diverse and complex societies, experiences with disabilities intersect with sociocultural issues of class, gender and traditional beliefs [9]. The general understanding of disability exacerbates stigmatisation, and gender differences marginalise females with disabilities [10]. A significant proportion of people with disabilities with low income also have limited access to healthcare, education, and stable employment [11]. In India, for instance, less than 0.5% of the total number of students in university education are disabled [12], 9.65% of disabled people in India receive higher education [13] out of which 32.13% are visually impaired [14]. The Constitution of India cites the Right to Education as a fundamental right for free and

compulsory education for all children aged six to fourteen years [15]. The National Education Policy (NEP) 2020 mandates that 'children with disabilities will be enabled to fully participate in the regular schooling process from the foundational stage to higher education' [16]. There are schemes to provide accessible content, teaching aids, transport allowance and teacher training. Still, a lack of support for training teachers in integrated schools [17], limited guidance and bureaucratic delays create challenges in obtaining the allocated funds to procure assistive technologies [18,19].

Similar barriers in other countries have made teaching SVIs a neglected area. Borah and Sorathia [20], Sahasrabudhe and Palvia [21], Lamichhane [22] and Dey et al. [23] illustrates SVIs in India and Nepal's limited access to educational tools and report the consequences of limited assistive technology, for instance, being unable to take up math or science in higher education [5]. Wong and Cohen [24] describe the disconnection in the knowledge of assistive technology and ICT skills among teachers in Singapore. In their book Ableism in Academia, Brown and Leigh [27] theorise contemporary academia's ableist context, challenges and practices in the UK, while Baker et al. [25] explained reflections and barriers for visually impaired programmers from Europe and North America through surveys and follow-up interviews. They reported that barriers permeate all parts of SVI's education, from accessing material and doing homework, which increases isolation and decreases motivation.

As we can see, the education of blind students globally has many barriers and challenges. However, the community in SVIs is not behind in technology adoption and use. Due to the shortage of tactile content, students turn to audiobooks to access educational materials and freely share content with peers [26]. Pal and Lakshmanan [27] presented a rich narrative picture based on the voices of visually impaired employees in India and their increased use of assistive technologies at the workplace. India et al. [28] have shown that visually impaired students in an inclusive setting actively participate in play through tangible interfaces to understand basic math concepts and computational thinking without explicit instructions. It shows that students and teachers are keen to learn, provided there are ways to make education accessible, such as using games aligned with the educational curriculum [29]. An improved understanding of the challenges SVIs in higher education face in India, their voices, and leveraging the enhanced frameworks to understand ableism and inclusion will provide valuable insight for disability innovation [30,31] and pathways towards a more accessible and inclusive society.

2.2   Disability and HCI

Mankoff et al. [32] brought learnings from disability studies to the domain of HCI. They argued that 'by exploring individual, cultural, societal and theoretical foundations of assistance, one can expand the view of Assistive Technology (AT) and its place in the complex world of disability'. From there on, particularly the social and biopsychosocial (BPS) model of disability has been used to understand and design for the diverse needs of users with disabilities, such as designing self-tracking devices for patients with chronic illness [33]. Applying the BPS models in the context of HCI resonates with Interdependence Framework for AT devices suggested by Bennett et al.

[7]. The authors emphasise that an individual's relationship with the environment is mediated by ATs and relationships with people who collectively work to create access. It challenges the traditional ability-centric understanding and highlights the importance of considering the interactions between the user's impairment, technology, and the environment in which it is used. For example, through autoethnography, Jain et al. [34] explains in-situ coping strategies and how they go beyond technology. The authors, who themselves are disabled, realised that proactive customisations by social network, collaboration, and participation must go hand in hand to solve the in-situ need. Gadiraju et al. [35], through observations and interviews, brought in teachers' expectations of technology and found that introducing an element of play, including parents, and increasing collaborative skills can enhance education. Shinohara et al. [36] also reports that the inaccessibility of research tools adds time and effort but increases social and collaborative relationships.

However, despite being a practical framework for HCI and approximately one-third of the work published in HCI about accessibility relates to visual impairment [37], the use of the Interdependence Framework as a lens to understand the educational experiences of people with visual impairments, mainly where technology use is limited is at a nascent stage. Therefore, our study analyses the educational experiences and challenges of SVIs in India through the lens of the Interdependence Frame.

2.3   Resilience and Visual Impairment

Adverse events due to visual impairment life can be understood as a perturbation to which the person must adapt. This trait of Resilience has been previously used to analyse the coping process among visually impaired individuals. Resilience explains how a system recovers from adversity, sustains itself, and thrives. Ungar and Theron [8] describe resilience as the 'process of multiple biological, psychological, social and ecological systems interacting in ways that help individuals regain, sustain or improve their mental wellbeing when challenged by one or more risk factors'.

People can cope with visual impairment through self-awareness and adaptation, facing circumstances, and through positive reinforcement processes [38]. Pathways to resilience are also formed by independence, allowing people with visual impairments to understand their self-identity, create social connections, and engage in recreational activities [39]. For people with visual impairments in low-income contexts, mobile interactions with technologies are mediated through existing social infrastructure support that influences the use and experience of technology and, therefore, the perception of self [40]. It is also evident that to holistically support individuals with disabilities in India, cross-cutting health issues, caste, religion, gender, and hierarchy must be considered alongside fostering resilience [11]. Our study uses theories of Resilience [41,42] to identify the promotive, protective factors and processes that help overcome the difficulties faced in the education of SVIs in India.

3   Methods

The study aimed to learn about the challenges faced by students who made it to top universities in India, understand how they overcame the challenges in the journey, and identify the most pressing unmet needs. Data collection took place through a focus group discussion with SVIs who were at the time studying at some of the best universities in Delhi. A focus group was suitable for this research question because it could discuss the topic in-depth. Furthermore, education and its challenges are relatable to every participant in the group, and there may be many overlapping experiences. The group discussion will bring forward prevalent challenges and differences, leading to sharing practices and strategies to address some issues. The Research Ethics Committee from UCL (UCL REC 18925/001) and Institute Ethics Committee from IIT Delhi (IEC P-086) provided the ethical clearance to conduct this study.

3.1   Participants

Table 1. Participants for the study

Participant	Age	Current Educational Degree	Visual Impairment	Background
P1	20	Bachelors in computer science	Congenital Blindness	Urban
P2	20	Bachelors in computer science	Congenital Blindness	Rural
P3	32	PhD in Political Science	Congenital Blindness	Urban
P4	27	MSc in Economics	Congenital Blindness	Rural
P5	28	PhD in English Literature	Congenital Visual Impairment (Light perception)	Rural
P6	21	Bachelor's in Political Science	Congenital Visual Impairment (Light perception)	Urban
P7	20	Bachelors in economics	Congenital Blindness	Urban

Seven university students with visual impairments participated in the study (**Error! Reference source not found.**). All the participants have been visually impaired since birth. The mean age of the participants was 24 (SD=4.93). The recruitment took place using convenience sampling through personal communication with three participants in direct contact with the first author. They were requested to identify more volunteers for the study, which resulted in four more participants being a part of the study. Remuneration in the form of food and travel expenses was provided to the participants.

We balanced the group composition to include participants from urban and rural backgrounds. Three participants (P2, P4 and P5) were from rural backgrounds where awareness and understanding of disability are low, social stigmatisation against people with visual impairment is high, and schools are not adequately equipped with the required AT [5]. Their recalled experiences of not having access to appropriate braille books in inclusive schools and being dependent on listening to teachers and friends. The remaining four participants (P1, P3, P6 and P7) were from an urban background and had studied at a special school for the blind. They had access to a bespoke education ecosystem where learning materials were available in braille, and special educators taught subjects like math and science. Despite a better education environment, there were still challenges at a social level and in integrating into an inclusive university.

The group represented a community of exceptionally educated young, congenitally visually impaired students of India who went through competitive exams to get admitted to one of the top institutions in the country. These exams included the Joint Entrance Exam for Engineers (JEE), JNU PhD Entrance Exam and Joint Admission Test for Masters (JAM). Everyone was comfortable in using digital technologies and social media and worked with laptops and smartphones daily.

3.2   The Procedure of the Focus Group Discussion

The focus group discussion was conducted in person in a well-ventilated room. It started with an icebreaker that warmed the participants to share their thoughts and ideas with the group. The focus group guide to conducting the data collection enquired about their motivations to pursue education, the difficulties they faced in the educational context, the general challenges in society and how they were overcome. The discussion also discussed the ideal vision in 25 years that the participants would like for future SVIs in India. The final questions of the discussion enquired about the most pressing unmet needs of the participants at present. The entire discussion happened in English and Hindi according to the participant's preference. The conversation was audio recorded, translated into English as needed and transcribed for analysis.

The discussion lasted for just over two hours, during which participants showed energy and engagement, leading to a natural flow of the conversation. Participants shared anecdotes, observations, and thoughts about their educational experiences, their perception of their societal attitudes, how they overcame challenges, and their expectations for the future.

3.3   Analysis of the Focus Group Discussion

Transcripts were analysed through a thematic analysis process through a hybrid reflexive approach [43]. Bennet et al. [7], with their Frame of Interdependence, proposed that the frame allows us to see how people and things are connected to create access. We used the frame to identify where things are disconnected and create inaccessibility. Therefore, the transcripts were coded by two researchers to find instances when the tenet of interdependence fails due to failing social relations, lack of assistance, ableist hierarchies and notions towards the achievements of the participants.

These codes were clustered and combined to identify themes for challenges. Previous research has cited difficulties accessing suitable content and inadequate teaching practices [5,11,17,20,22]. Our findings highlight interactions between people and the environment that are restricted, misfitting or motivated by ableist notions. Therefore, with the frame of interdependence, we provide a new perspective on ecosystem problems beyond the more commonly reported financial, instructional, and technological barriers.

It is important to note that more is presented in literature about difficulties in educational experiences than factors that show how the difficulties are overcome. Therefore, from the data, we identified practices illustrating how the participants overcame the difficulties. Two researchers again coded practices from the data and used the principles of the Resilience Theory [8,41] to interpret how students overcame challenges. Based on this data reflection, we contribute the themes of self-confidence, internalising extrinsic stressors and navigation with social resources to overcome difficulties.

For the speculative inquiry about the ideal future and critical reflection on the most pressing need, the seven participants one-by-one shared their vision and then the most pressing needs and challenges in the context of education. During the discussion, statements from each participant were enriched by comments, discussions, and anecdotes from other group participants. The discussions were noted on sticky notes. The notes were analysed through an affinity mapping exercise with the participants on the spot. Through this process, the group co-identified two significant themes – integrating assistive technologies and integrating disabled people in society.

4 Challenges

Participants in this research study were academically exceptional but shared several challenges in the educational context to achieve their accolades. Challenges arise when interdependence is broken, and this happens in two thematic ways:

4.1 Restricted and Misfitting Assistance in Learning

This thematic group entails scenarios where SVIs are keen to attain education, but social relations could be more cooperative, and technologies are unavailable to create the required access. The participants narrated many incidences in which they struggled to get essential attention because SVIs are considered an *extra burden*. Due to this perception, the needs of SVIs are entirely neglected, especially in an inclusive setting. For example, when P4 took what is often referred to as PCMB (Physics, Chemistry, Mathematics, and Biology) and made it into the 11th Std class, which is the first of two senior secondary education years in India, they faced discrimination:

> "When I was in school, I took PCMB. I somehow managed 11th, but the schoolteachers were in a psychologically damaged mindset. Their first reaction towards me was, it's a government school, [and] they have the result as a liability or accountability, so from the principal to all the teachers, they

> were like the result will be bad only. Out of 20, this one will fail. He [P4] has come to this school, but our 5% result is gone, so out of that 95%, let us see how many students we can pass." – P4.

This resulted in actions such as:

> "They [teachers] will come to the class, teach, and go without caring that I am there. There was a shortage of reading material there as well. I used to record their lecture, listen to them repeatedly." – P4.

This outright denial shows how the social environment may not take the necessary steps to create a relationship with SVI. It is not restricted to the school environment but is also prevalent in university education. Considering the mandates from a policy perspective, this social attitude creates a tokenistic approach toward people with disabilities. Rather than providing a more active environment with the support of assistive technologies, the social ecology in educational contexts is static and, to an extent, unwilling to support SVI's education. P6 explains this with an example:

> "You see, there are a lot of [SVI] students enrolled in XXX University, and there has been an awareness [of disability] in the university for a long time. Once, it happened to me when our political lecture was going on, and I requested my professor to record his lecture, to which he refused directly, saying, 'No, you can't record my lecture'. Then I had to write an email to the principal and meet her. Further, she made my professor understand that we have such students, so you must conduct yourself needfully. Forcefully, I must work on such things, and then get the required returns." – P6.

This attitude also creeps to the top, where policies and directives get established. Misinformed perceptions about the capabilities of SVIs and the lack of awareness of assistive technologies limit opportunities for learning by creating barriers citing a lack of AT. It is likely because the voices of people with visual impairments in decision-making panels are also tokenistic. P5 shared his experience at a high-level meeting with government officials:

> "I was invited to a high-level meeting with government secretaries, as a case was in the XXX Court, and they had to give feedback on what should be done to improve accessibility. They had a draft with them in which it was written that PPTs could not be provided, and another clause mentioned those sign language interpreters couldn't be provided." – P5.

To this attitude, P5 responded:

> "I mean, how can you [secretaries] conclude in advance that such things can't be provided? It would help if you tried it first." - P5.

The negative perceptions about the capabilities of SVIs limit curriculum that disallows them to pursue specific subjects. For example, the omission of math from the curriculum of students with visual impairments in educational boards creates barriers for those who understand math and wish to pursue it in future. P1 explained this:

> "One major problem is that after Std. 7th, the school will not let you study Math. Schools say that you will have to study the same math you studied in classes 5th, 6th, 7th, 8th, 9th, and 10th. So, because of this, it is hard to get Math in std. 11th & 12th." – P1.

Some narratives in the discussion appreciated attempts made by social relations in the educational context to bridge the access gap. Unfortunately, due to a lack of awareness of fit-for-purpose solutions and a casual approach to implementation, the bridge often does not fit. Social relations attempt to assist in education, but due to various reasons, the support needs to be aligned and complete. Such misfitting relations can happen when the mediative AT is inappropriate due to unawareness of dedicated AT solutions or their non-availability. It can also occur when the social environment attempts to create workarounds to communicate but at the cost of increased workload and poor management. For example, P4 shares:

> "Professors wanted to help. They wanted to provide accessible material and work harder but had no ideas or knowledge. There were few things that they used to do at their personal level such as Latex typing and rather than sending us a scanned image and would be willing to type the equations and make the ppt."– P4.

This shows that there needs to be more awareness in general about best practices for inclusive education. Previous research also suggests that few learning resources and training are available for tutors in an integrated learning environment [44]. We found that institutions have created some form of accessible learning methods, which were in response to the demands of previous SVIs. However, even if tutors are cooperative, additional effort takes time to create accessible content that can be restrictive for the students. A lack of awareness about the importance of inclusion and weak enforcement of accessibility in education is also evident through these procrastinated and reactive attitudes to create an accessible solution for SVIs.

> "The coding/programming course I was talking about had teaching assistants. So, whatever teachers have written on the blackboard, they have typed and given to me, but after the 1st lecture, they would give it to me after 15 days or a month later." – P2.

4.2   Ableist Social Interactions

From a social perspective, building relations with peers can often be challenging due to the need for more awareness and sensitisation about visual impairment. Lack of communication can cause stigma about disability and leads to the formation of *social bubbles.* P7 shared his discovery of this social phenomenon while in conversation with one of his sighted friends.

> "I was talking to a sighted friend, and she made a very good point that many people, even in my university, are in their bubble. Someone in the 'normalcy bubble' wants to stay in that bubble. They may ask you [SVI] out of curiosity but don't want to leave their comfort zone. They don't want to go out of the way and understand our angle and things related to it." – P7.

People in these bubbles assert caution and hesitance when speaking to SVIs. P3 reflected that if people with visual impairments are part of society, then communication should be accessible and natural, be it about disability or anything else. However, suppose a person with visual impairment is not part of society. In that case, communication will be confounded with presumptions that may cause fear of sounding

offensive. Such presumptions emerge when society fails to consider a person with a disability a part of society. Fear of speaking about disability by stepping out from the bubble of normalcy is created by the fact that a disabled person is perceived as not normal or as unfortunate and in need of charity.

> "Most people consider us as an object of charity, people who need help, as if we are victims and we only need help and people owe a sympathy perception, but this is something we don't want now." – P1.

Directly talking to people with visual impairments about their disability appears to be discomforting, and people generally prefer to be in a bubble of misperceptions. It highlights deeply engrained attitudes that lead to ability-based hierarchies in which people with visual impairments must prove their capabilities more than others. Often SVIs are not considered productive or contributing group members and cannot be treated equally. Such notions often lead to social situations in which people with visual impairments are alienated despite being part of a group.

> "Imagine there is a group of four friends. Amongst them, there is one friend's birthday is sighted. For his birthday, everyone will contribute except the VI one; no one will ask the visually impaired person." – P2.

On the contrary, in scenarios where the person does well in life, for example, lands a competitive job or clears a difficult public exam, society considers a person with a visual impairment to be a person with superpowers and gets subjected to inspiration porn [45].

> "Recently, I visited my village where a lot of people say sir, you must have a super-intelligent mind'. I reply I have the same level of brain as you, it's just that I try to utilise it." – P4.

The examples show that the contributions from SVIs are not recognised due to the traditional ableist notions of disability. Hard work and persistence are misinterpreted to be superpowers. A general lack of participation and visibility of SVIs in education leads to these ableist notions. In conclusion, the participation of people with disabilities is promoted through inclusive policies, but the emergent social relations are not equitable. Assistance through these relations happens reactively and can be tokenistic, casual or procrastinated.

5 Overcoming Challenges

While speaking of the above challenges, participants also narrated how they overcame them. These practices reflected an understanding of themselves and the underpinning reasons for the motivation for education. The following three themes illustrate the personal and social factors that foster students' resilience in an educational environment.

5.1 Developing Self-Confidence

Self-confidence is an individual's attribute concerned with the belief that a judgement is accurate. It is also considered an individual's ability to be sure about their abilities.

For resilience, belief in one's abilities is crucial [41]. Positive educational experiences created a sense of self-confidence that motivated the participants to push ahead through limitations and difficulties. With increased self-confidence, SVIs develop a resilient mindset and a strong acceptance of their visual impairment. For instance, P5 had extremely few resources during his schooling, but positive experiences in learning created excitement to learn more.

> "When I was in school in rural XXX, I did not have books. I requested other people to narrate, yet I saw that I was performing much better than others by listening. I saw that despite my difficulties, I am doing good. I started enjoying this and wanted to take this further and try different things. It's becoming my personal journey by pushing through my limitations." – P5.

Social ecology plays a crucial role in building a positive sense of self and confidence in one's actions, for instance, bridging the access divide was enough for P5 to see his capabilities and build his confidence. Repeated positive experiences build autonomy, allowing students to experiment, try and explore to identify and navigate resources that sustain and improve well-being. Students demand more from the social environment to provide resources in the form of ATs and social support, which P7 explained:

> "I want to be successful and stand out from the crowd. Technology is there, I have a laptop and mobile phone in my hand, of course, limitations are there, but technology is there. I must focus, and developing my skills can't be limited. For that, I do a lot of experiments. I fail, but that's okay. This was one of the main reasons to pursue Liberals Arts and Sciences." – P7.

A positive mindset about self also helps build personal coping strategies to adapt to adverse situations. As explained in Section 4.1, restricted and misfitted interdependencies create adversities. Due to a positive self-identity and confidence in one's ability, SVIs identify workarounds in such scenarios and continue to excel. For instance, P4 developed his method to understand mathematical derivations that had missing steps due to inaccessible class notes.

> "We all are surviving because of being outstanding. We must get out of the box. For a sighted student, all the resources are available but for us reading material isn't there, you can't seek help from a book and the internet is not accessible. So, I used to read the logic step by step and imagine ways the sequences used to be formed to fill in the gaps in notes and then I used to check if it matched the result. But can every student [SVI] do this?" – P4.

As highlighted above, a strong personal belief is critical to overcoming adversities. The previous examples also showed that positive self-identity is necessary to build this resilience developed through successful experiences and increased autonomy to identify and create the resources needed to support well-being.

5.2   Internalising Extrinsic Stressors to Intrinsic Motivation

It was interesting to note that some participants had transformed extrinsic factors and events into intrinsic motivation. Reflecting on these behaviours from the theory of self-determination proposed by Deci and Rayn [42], social factors have created an intrinsic desire to achieve to give a response either to social injustices or become valued in the

eyes of society. For example, P3 faced many social situations that motivated him to show people they were wrong in thinking about him and his mother.

> "As I was VI by birth, the first VI in my family, my mother faced societal taunts. So, when I was 3–4 years old, I often wondered why these people were saying such things to my mother. No one used to speak to me; instead, they talked with someone who used to accompany me. This was a strange societal problem as well. So, I wanted to become independent and have my own identity that people talk to me." - P3

Some stories revealed the years of discrimination and suppression that the participants faced due to their visual impairments. Responding appropriately to the stigma motivated the participants to attain a good education from a reputable place and acquire high-paying jobs. In this way, they believed society would respect them and their capabilities rather than doubt their abilities and potential for life. For example, for P4, his perceived image in the community he came from was important to him, and increasing his social value within this community motivated him:

> "I come from a rural background where educated people are highly valued. If, along with education, you get a permanent job, people *literally* worship you, so that's the kind of value you get there. So, for me that was a huge motivation to get a better education and get back to my region where I can get valued there." – P4

P6 was motivated by a more personal factor – his grandfather's job in the government service. The esteem and privilege that his grandfather's employment bestowed had motivated him to gain similar employment that would enable him to contribute to society's development, and in turn, he would be viewed as a contributing member of society.

> "Someone close told me that if I get educated, I will be a big man, so the words 'to be a big man' attracted me. My grandfather had a government job and was highly respected because of that. He was a big man. So, I wanted to be a big man." – P6

The above examples describe the internalization of social factors to create the intrinsic motivation to be educated. Social relations also facilitate access to missing information which we describe ahead in greater detail.

5.3   Navigating with Social Resources

In recent years, Resilience Theory has been used extensively to study social ecology's effect on an individual's ability to cope with adversities [8]. Many of the narratives described before highlight the role of empathetic teachers, peers, and friends to support and provide the access required for education. We use the term empathetic because these activities are not generally standardised and are invented by social relations in bespoke ways to create access. These include teachers who understand the needs of students and are willing to put in the required efforts to help them understand the subjects. It requires additional time from their end, increased workload, and creative effort to develop interfaces that are accessible to the students and help them learn about a concept. For example, for P6, learning Math was a challenge until a new teacher

worked closely with him and changed his perspective and self-confidence toward learning.

> "A new teacher had come; she didn't know how to teach well. I was very weak in Math. You can say that I used to fail in Math. But then we had another new teacher. He worked on me a lot and pushed me to the point that I could pass my Std.10th. Otherwise, I had no hope of passing." – P6.

P2 and P7 shared that teachers who provide special attention to students are highly appreciated. They can make learning more enjoyable and improve their educational experience.

> "There used to be one teacher who supported me in English, Math, Science. I couldn't see much; there were no books. I was partially sighted, so we used to sit under the bright sun, and the teacher used to write big letters on the board from either a sketch pen or write big letters on the copy and teach Math. He used to teach me separately." – P5.

However, special attention can only reach some. It also means that education depends on the motivation and intelligence of the special educator. A good teacher can build confidence and capabilities; however, a bad teacher can severely damage the SVI's personal resilience and problem-solving ability. Teachers may also be unable to find ways to teach students with visual impairments at the same level as their sighted peers. In such scenarios, students tend towards friends and family members.

We identified many situations in which friends and family helped with reading, writing, and explaining a topic. Beyond access to education, these practices promote social inclusion and the formation of new relations and begin to include SVIs as part of the group. For example, when the teacher of P1 could not provide access in a needed way, he turned to friends, which increased his social integration within the university.

> "My professor used to write code on boards rather than laptops. This used to be his problem. Many times, I told him to explain whatever he wrote, but he used to say it was my habit and used to say that he would do it next time, but he never did. So, I reached out to my friends and studied with them." – P1.

This highlights how SVIs and their community organise themselves to create pathways to access education. Better AT to promote and support such social relations can also improve inclusion and learning experiences. However, the ATs must promote the right attitudes towards people with visual impairments because existing perceptions may still be constrained within the ableist hierarchical structure. SVIs in social scenarios can still be perceived as an object of ill-health, as a student who is less productive, not equal, and in need of help.

6   Unmet Needs

Having understood the challenges SVIs face in education and how they overcome them, this section focuses on needs that still need to be met.

6.1 Integration of Assistive Technologies

Participants agreed that educational resources need to be improved for independent education, and access to graphs and diagrams is a significant issue. Specifically, the lack of accessibility to graphical data was highlighted, creating challenges for students to pursue math and science subjects to survive the challenges posed by the subject. Not being able to understand the subject due to a lack of resources is damaging as they may not understand and deliver to their fullest expectations.

> "If diagrams are unavailable and friends are not always available to help, how will a student survive at a university level? It will be very problematic. If one is interested in the field and cannot learn 100% in the field or give his 100%, then he will get demotivated." – P7.

Two participants strongly advocated that all visual media must be made accessible for students with visual impairments to understand the subject through tactile graphics or automated means to provide text-based descriptions of the graphics. This raises the need for a tactile display interface that is visualised by one of the participants in the following comment:

> "At the initial stages in school, during 9th and 10th, the tactile diagrams are available, but what after that? In college, there are not a finite number of problems. Making diagrams for everything is not possible. So, in this case, there needs to be a device, like a braille display, something that we connect to the laptop or smartphone and just like the braille text, we can see the diagram." – P1.

Enquiring further about tactile displays, it was surprising to note that none of the participants had purchased a tactile display. Two participants were given a refreshable braille display from the university, while one borrowed a display from a friend. The remaining participants have just seen such devices or never felt the need to buy one. Despite the need for tactile interactions expressed in academic literature and the amount of research and development in this field, people still are unsatisfied with the available products or at least need to perceive a sufficient benefit to purchasing. Another participant mentioned that finding a good scribe who can understand the answers and translate them to write in exams is a significant burden and can be eliminated by introducing computers as a medium for exams. Deliberating on this thought, the group discussed that it is possible only if computers are introduced in early education and with software solutions that require minimum human intervention. Accessing academic books through audio and appearing in exams through computers can solve many challenges that SVIs face.

> "If we make computers accessible and available at an early school level, where the subjects are also confined, that will give more students a better education who may also take up technical fields. They will demand more and will create the need for better and more accessible materials." – P7.

Previous research has also pointed to increasing access to tactile media and introducing computer interfaces at an early school level. Doing so will provide SVIs with an opportunity for independent learning, increasing personal resilience and improving autonomy and problem-solving ability.

6.2   Integration in Society

Fostering personal resilience covers half of the factors necessary for a better educational experience. Two participants from the group (P4 and P2) strongly felt that the most pressing challenge is the lack of awareness and negative societal attitudes towards people with disabilities. The group regarded this issue as the root of the other challenges, as can be seen in the comment from P4:

> "My biggest challenge is the lack of awareness of teaching and non-teaching staff. They don't know how to help or treat." – P4.

Participants shared that all educational institutions should treat an SVI like a regular student, not a special student with special needs. Participants agree that ATs discussed earlier will make people's lives easier and more productive. However, how society changes to include and value people with visual impairments at par with sighted people was still concerning.

> "New technologies will keep coming, but how far the mindset of people will change, we don't know." – P2.

The group felt that attitudinal changes in society go much slower than technological advances. The availability of technology would surely facilitate the change in levels of accessibility. Still, it will create a gap between places where technological accessibility is available and where it does not exist.

> "Attitude change is obviously at a very slow pace. Because of this, there would be a huge gap, which would be the most negative side because some institutes like private institutes will provide, and some will not." – P7.

Discussing this point further, P3 shared that the empowerment of people with technology will make them more independent and successful. As dependence on society decreases, society's negative attitude can be easily ignored or improved through better participation of SVIs. Hence, technological advances must also aim to change societal perceptions and attitudes toward disability. Society creates greater barriers for people because of its procrastinated, burdensome attitude toward accessibility and inclusion. The bubble of normalcy is so comfortable that people are happy to stay in the shadows of misinformation, away from reality and need for proper accessibility, equitable opportunities, and relevant support so that the motivation that drives SVIs is facilitated. Participants share this attitudinal concern concerning their social integration.

> "Because of technology, we will get empowered. The technological shift will be there, but change will be at our level only. The attitudinal level changes at a slower pace. With AT, disabled people can do everything independently but won't have self-satisfaction with society. They will be educated and have everything but still will not get valued. Suppose you are doing a good job and still you face delays for your marriage." – P2

7   Discussion

This paper attempts to understand the challenges, practices, and needs of SVIs who make it to competitive universities in India based on the Framework of Interdependence

and the Resilience Theory. We found that educational challenges arise when the tenants of interdependence break and the social environment around an SVI fails to take the necessary steps towards access. A lack of awareness about assistive technologies solidifies the ableist bubble of normalcy. Further, it hinders the development of social relations, while a lack of communication causes misperceptions about the capabilities of SVIs.

We also found that overcoming challenges requires self-confidence fostered by academic success. Many participants had also developed a method to internalise extrinsic social stressors into intrinsic motivation to succeed in education and navigate the challenges of inaccessibility with whatever is available in their ecology. Finally, we found that in terms of technology, there is still a dire need to increase the availability of tactile media and computers in education, with which students can learn independently and build their autonomy and command over the subjects of their choice. It is also important to note the need to facilitate social integration in the ecosystem to abolish ableist hierarchies and establish equitable interactions and collaborations.

7.1 Rethinking Education to Facilitate Independence and Interdependence

Existing education policies and practices can be critiqued to promote ableism and tokenism. It focuses on adapting SVIs to the education system, citing differences in abilities and accepting that visual impairment is a problem that requires special adjustments to be fixed. For example, it motivated the curricular adaptations that limit choices for students, and its implementation without appropriate teacher training limits the support SVIs get in schools. The policy allows students to use screen reading software to appear for exams and use computers in schooling; however, schools or the board have no mandate to provide software or hardware support [18,19]. The lack of access to AT creates dependencies, and with inappropriate support, surviving the educational environment becomes challenging.

Therefore, on the one hand, the education system needs to empower students with AT to develop autonomy over their experience and develop more command by having the opportunity to learn independently. At the same time, the system needs to be empowered to identify ways that facilitate better and deeper relations with their social ecosystem. Empowerment through assistive technology in employment [27] and peer effects in learning [26] have been discussed before. Our findings extend these works by showing the impact of makeshift AT by interdependent actors in the educational ecosystem that creates access to information. Previous research also highlights the challenges in learning math at high schools [20,22,23]. Still, participants opted for math in our study. Our findings highlight how some exceptional students can internalise the challenge and develop bespoke methods to visualise and access mathematic information. We also found teachers overcoming the disconnection in AT knowledge and using ICT skills [24] but with the perception of an extra burden.

Therefore, there is more that needs to be done beyond access to affordable AT [46], better teaching practices [47], and putting people with diverse abilities together in an integrated classroom [16]. The ability-based design framework [48] proposes designing

systems focusing on users' abilities. The Frame of Interdependence allows us to see these social relations, relations with AT, and the contributions of people with disabilities [7]. The Disability Interactions framework brings in the value of co-design and co-creation that acknowledges participation and power balances [49]. These frameworks and co-designing educational tools that increase independence and foster interdependence will be necessary for inclusive education. We aim to explore solutions at the intersection of these frameworks in future work.

7.2   From Assistive Education to Inclusive Education

Previous research has shown that due to a lack of tactile tools [20], accessible information [21,23,26,27] and appropriate teaching practices [22], students find it difficult to pursue education. Our research highlights that assistive education was realised through makeshift tech by teachers in the educational ecosystem (such as Latex files) and through peers that collaborate to create access to information. In practice, these actions were considered an extra or a special effort to support a few capable and outstanding students; not every SVI can have that entitlement. Therefore, education as a human right needs to move away from the disability-centric bespoke approaches that have been reported to cause an invisible burden to the person with a visual impairment and their social environment [50] to widely available inclusive practices that every student can engage using their respective abilities.

Project Torino is an excellent example of an AT that can provide an equal collaborative learning experience not determined by the visual impairment [29,51]. Its implementation has shown that students with diverse abilities actively participate in play through tangible interfaces to understand basic computational thinking concepts without explicit instructions [28]. Another tool called Tip-Toy uses tangible blocks with QR codes that allow students with diverse visual abilities to learn basic computing [52]. Play-based approaches have been used to co-design inclusive games that promote engagement between disabled and non-disabled players. The games used multisensory feedback and a tactile crafting process that engaged children in an engaged and collaborative behaviour [53]. However, despite the improved learning experience provided by tangible interfaces, their practical implementation in contexts where technology use has not been a traditional way of teaching requires developing ways for manageable adoption. In such cases, more mature technologies such as Alexa are paving the way to facilitate inclusion [54].

7.3   Limitations of the Study

While we contribute a qualitative rich insight into the challenges, practices and needs of SVIs in India that compliments research from around the world, the study has some limitations. Although the participants have diverse backgrounds and provide a good representation of challenges, the small sample size of seven participants needs to be improved in how SVIs create creative ways to overcome challenges. Second, all the study participants were male because very few people with visual impairments in top universities, and the number of female students is even less. From our sampling, finding

more participants in the given was not feasible. However, this study is part of a longer ongoing research within which we hope to further develop our understanding through different genders, stakeholders of the educational system and cities. Third, using the frame of Interdependence and Resilience Theory to understand challenges and ways of overcoming them is just one of the many ways this data can be reflected. Furthermore, these are evolving conceptual frameworks; hence, we can identify richer and more detailed insights in future work as the frameworks evolve.

8   Conclusion

In this paper, we report findings from a focus group study that explored the educational experiences of university students with visual impairments in India. To improve educational experiences, significant steps are required. A lack of understanding about inclusion and a casual approach creates restricted or misfitted assistance and ableist social interactions. Students overcome these challenges through self-confidence, intrinsic motivation, and honing the ability to navigate accessibility through available social resources. We emphasise the need to empower SVIs through the necessary AT to support independent learning, foster social interdependence, and for the education system and practices to move from assisted education to inclusive education.

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