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Education Without Limits: 'enablED' – A VR Solution for The Physically Disabled

Problem Statement

The limited access to quality education for physically disabled individuals is a significant social logistics problem with profound implications. Social logistics, in this context, refer to the coordination and organization of resources, infrastructure, and services to ensure equitable and inclusive access to education.

Many schools and universities are not adequately equipped with ramps, elevators, accessible restrooms, and other essential amenities, making it difficult for physically disabled students to attend classes. This lack of physical infrastructure is a logistics challenge that must be addressed to provide equal access to education. Furthermore, social stigmas surrounding disability can exacerbate the problem. These stigmas often lead to discrimination, exclusion, and limited opportunities for disabled individuals.

Per Census 2011, in India out of the 121 Cr population, **2.68 Cr persons** are **'disabled'** which is **2.21%** of the total population.

- **20%** of the disabled persons have having **disability in movement**.
- **10%** of the **disabled children** (0-6 years) have **locomotory disability**.
- **22%** of the **age group 20-39 years** are having a **disability in movement**.
- Among the disabled in the **age group 40-59 years**, **23%** are having a **disability in movement**.
- In the case of disabled non–workers, among those with a **disability in movement**, **49.8%** are **dependents** and **19.7%** are **students**.
- Per **National Family Health Survey 5** (NFHS 5), out of every hundred individuals, four have a disability. **44.07% of these disabilities are locomotory** (Source: Pattnaik et.al, Prevalence, pattern and determinants of disabilities in India) [1]. The ages of **0-14** years had a **higher burden of locomotory disabilities**.

The adaptation of business logistics to the social context enhances resource distribution to educational institutions, ensuring accessible facilities and support. Collaboration among stakeholders like educational institutes, independent educators, physically disabled individuals, and their kin streamlines efforts. Proper inventory management prevents shortages of assistive tools. Anticipating regional needs and constant evaluation further improve the system. This approach promotes inclusivity, breaking down barriers, reducing stigmas, and providing equal educational access for disabled individuals, fostering a more equitable society.

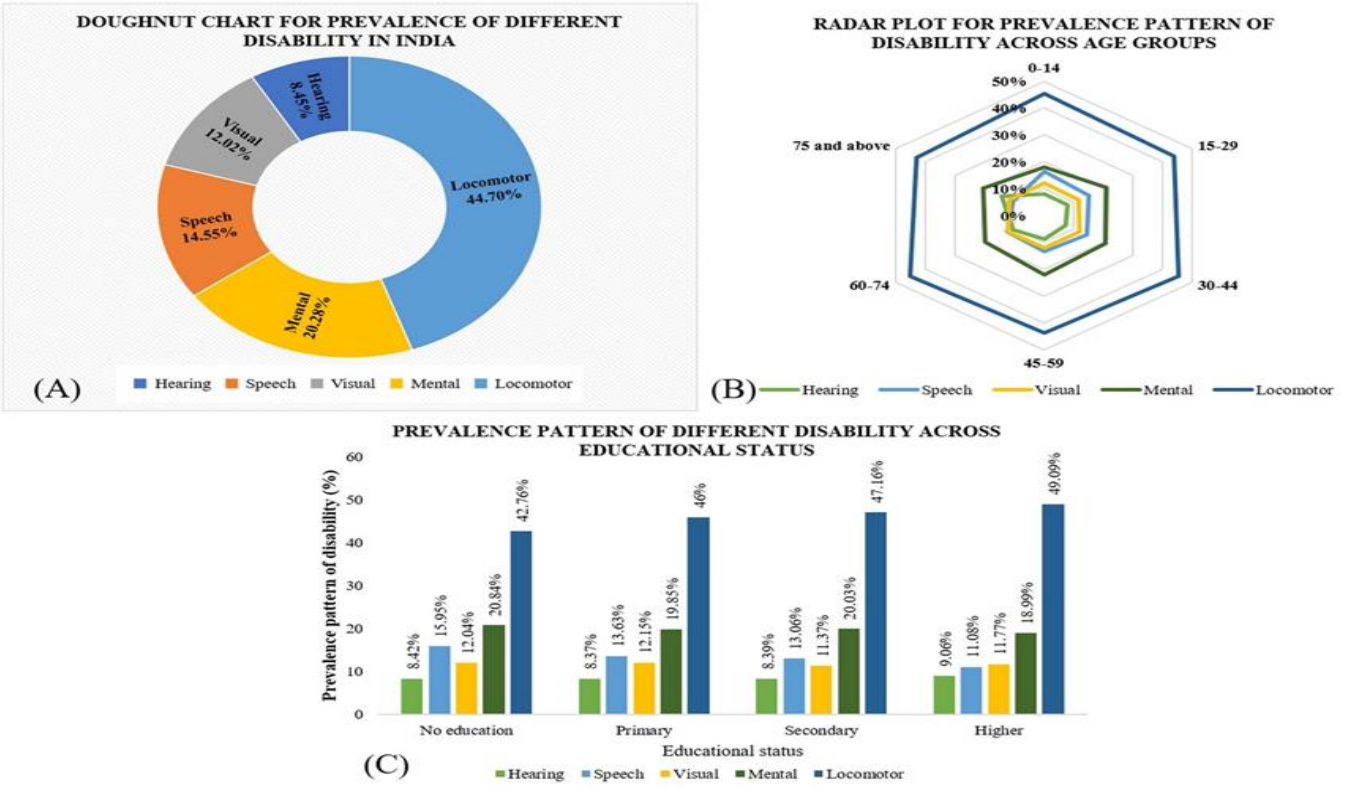


FIGURE 1
Prevalence of different disabilities across sociodemographic characteristics. (A) Doughnut chart for the prevalence of different disabilities across the population in India based on NFHS–5 (*N* = 1,15,557). (B) Radar plot showing the prevalence pattern of different disabilities across age groups in India based on NFHS–5 (*N* = 1,15,557). (C) The prevalence pattern of different disabilities across educational statuses in India based on NFHS–5 (*N* = 1,15,557).

Fig 2: Distribution of locomotor disability in India, NFHS-5

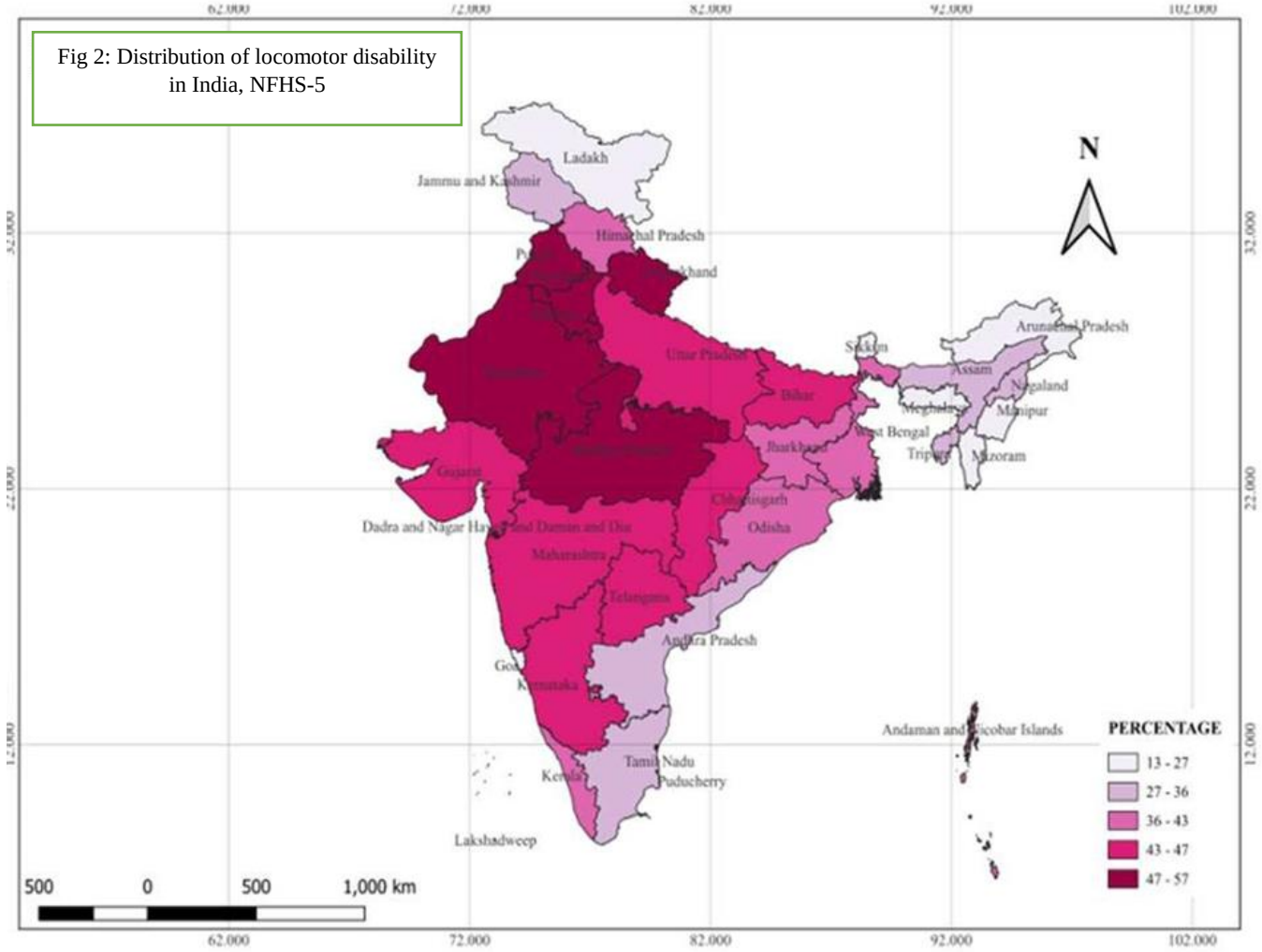


Figure 1,2: Source: Pattnaik et.al, Prevalence, pattern, and determinants of disabilities in India) [1].

Solution Development and Implementation Plan

The business model aims to begin as a B2B (Business-to-Business) model and later transition to a PPP (Public-Private Partnership) model to improve public availability while reducing costs.

➢ B2B Model:

1. **Market Research and Product Development:** Begin with thorough market research to understand the specific needs and preferences of physically disabled individuals in the context of education.

2. **VR Educational Platform Development:** Develop a comprehensive VR-based educational platform tailored to the needs of physically disabled individuals, providing access to a wide range of educational content and interactive experiences.

3. **B2B Sales and Marketing:** Target educational institutions, healthcare facilities, rehabilitation centres, and corporate training programs as potential B2B customers, with a sales and marketing strategy to demonstrate the benefits of VR-based education for physically disabled individuals.

4. **Subscription Model:** Offer B2B clients a subscription-based model for using the VR educational platform, with various pricing tiers based on the number of users and the level of access required.

5. **Training and Support:** Provide training and ongoing support to clients, ensuring they can effectively utilize the VR platform for the benefit of their physically disabled students or employees.

6. **Licensing Model:** Implement a licensing model for B2B clients that allows them to use your VR platform for their students or employees. Pricing can be based on factors such as the number of users, the level of access, and the duration of the license.

➢ PPP Model: Public and Private Partnership:

Seek partnerships with government agencies, NGOs, and philanthropic organizations interested in promoting accessible education for physically disabled individuals.

- **Cost Subsidization:** Work with public and private partners to subsidize the costs of VR headsets, software, and platform access for individuals with disabilities.

- **Community Outreach:** Work closely with local disability support organizations, educational institutions, and advocacy groups to promote the availability of VR-based education.

- **Funding and Grants:** Pursue government grants, funding opportunities, and corporate sponsorships to further reduce the financial burden on individuals and institutions.

- **Sustainability:** Develop a strategy to make the PPP model self-sustainable over time, including exploring corporate partnerships, donation drives, and additional educational services.

Proof of Research (How VR Has Been Useful in Education)

The Aumentaty project (Labhuman laboratory (http://www.labhuman.com) at the Polytechnic University of Valencia in Spain), and the BuildAR project, (HITLabNZ laboratory (http://www.hitlabnz.org) at the University of Canterbury in New Zealand) offered tools to develop instructional AR apps [2].

Both organizations want to integrate augmented reality (AR) in classrooms. to transform education by improving the motivation and engagement of teachers. Research programs like CONNECT (2005–2007), CREATE (2004), and ARiSE (2006–2008), sponsored by the European Union, attempt to incorporate informal learning in a learning environment [2][3].

Researchers have used Aurasma (http://www.aurasma.com) which is widely used as a tool in various learning strategies (Parton and Hancock, 2012; Connolly and Hoskins, 2014) [3].

The Science Center to Go project (http://www.sctg.eu) is another example of using AR to improve science education by manipulating and testing virtual objects.

Magicbook (Billinghurst, Kato, & Poupyrev, 2001) is one of the first AR applications to use textbooks. This type of book can be used just like a traditional textbook, but virtual content such as 3D objects, animations, or videos can be viewed using a computer webcam or mobile device [3][4].

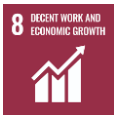
UN Sustainable Developmental Goals

The United Nations Sustainable Development Goals are a set of 17 global objectives designed to address a wide range of social, economic, and environmental challenges facing the world.

Our innovation, "enablED," which aims to create an immersive classroom experience for physically disabled individuals using virtual reality (VR), has the potential to contribute to several United Nations Sustainable Development Goals (SDGs). Here's how:

Good Health and Well-Being (SDG 3): While not directly related, improv access to education and skills development can indirectly contribute to better mental and emotional well-being for disabled individuals.

Quality Education (SDG 4): By providing physically disabled individuals with an immersive classroom experience, "enablED" can help ensure inclusive and equitable quality education for all.



Decent Work and Economic Growth (SDG 8): Through innovative solutions like "enablED," we can potentially empower disabled individuals with skills and knowledge, improving their employment prospects and contributing to economic growth.

Reduced Inequalities (SDG 10): Our VR solution can reduce inequalities by eliminating barriers that might prevent physically disabled from accessing traditional educational settings, creating a more inclusive society with equal access to educational opportunities.

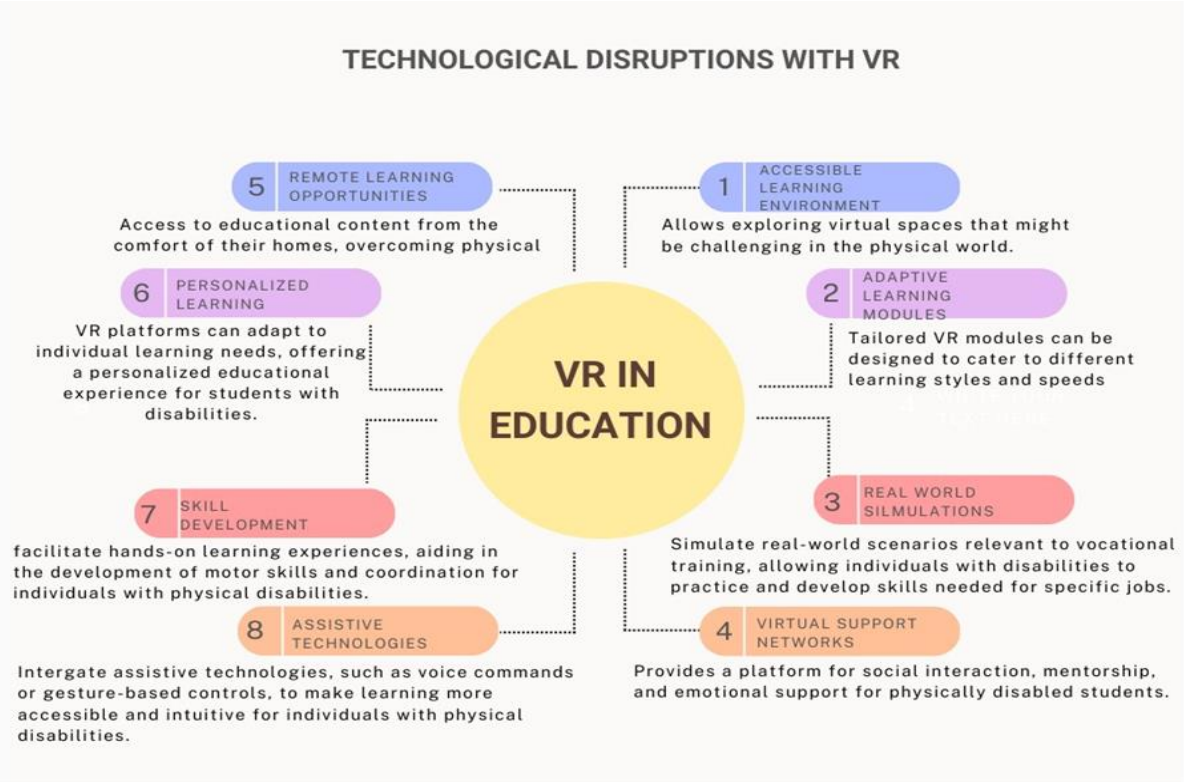
Partnerships for the Goals (SDG 17): Collaborating with relevant organizations, governments, and stakeholders to implement and scale "enablED" can promote partnerships for the achievement of sustainable development.

The Role of Technology

The latest wave of technology disruption in virtual reality (VR) is poised to revolutionize education for physically disabled individuals, ushering in an era of unparalleled inclusivity and personalized learning experiences. Advanced VR applications, specifically designed for the unique needs of students with physical disabilities, are emerging as transformative tools.

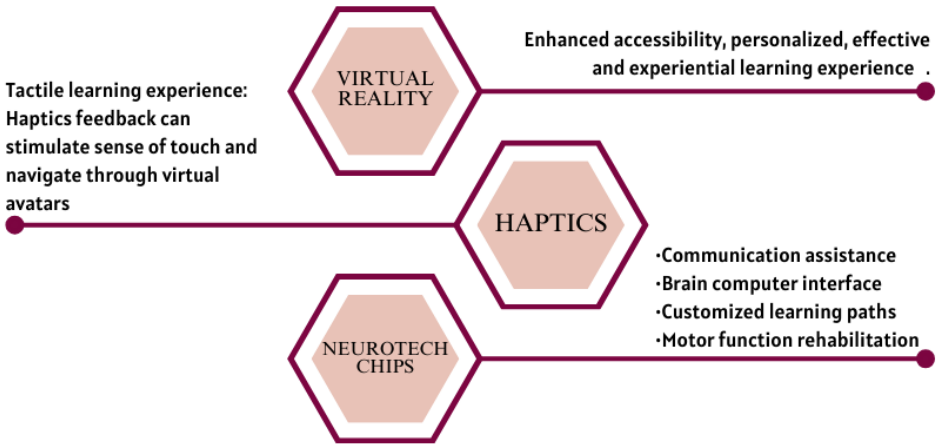
enablED is an innovative solution that connects people to a shared virtual platform using a VR headgear with built-in speakers and a microphone. In this virtual environment, users wearing the same headset can immerse themselves in a lifelike classroom setting with surround sound, creating an authentic learning experience. They will be able to see other users' virtual avatars as well. This invention is specifically created to remove geographic boundaries and provide physically challenged people the chance to attend and participate in a real classroom experience.

We intend to include haptic feedback and neurotechnology chips in enablED in addition to the VR headgear. Users will be able to communicate and manage their virtual avatars thanks to these improvements (discussed further), encouraging peer interaction and cooperation. Importantly, these characteristics will enable people with disabilities to get beyond physical restrictions and experience ultimately promoting accessibility and equality in education.



VR represents a significant advancement in education for disabled individuals, but its potential can be further harnessed through the integration of cutting-edge technologies like Haptics and Neurotech chips. These innovations have the power to transform education, not only for those with physical disabilities but also for individuals facing other challenges, by offering tactile feedback and enabling direct interaction with the nervous system.

FUTURE POSSIBILITIES



➢ Haptics

- Haptics, the technology involving touch and tactile feedback, holds great promise in enhancing the education of disabled people by providing a multisensory and interactive learning experience.
- It provides the experience of virtual touch and exploration which is a level above virtual reality. It can provide realistic simulations with virtual avatars. Virtual avatars controlled by haptic feedback can guide physically disabled students through virtual environments, helping them explore and interact with educational content or conduct virtual tours.
- Haptic devices can be programmed to represent sound in a tactile manner. Students can "feel" sound waves, pitch changes, and intensity variations, providing them with a unique multisensory understanding of sound.

➢ Neurotech Chips:

- Neurotech chips, or neurotechnology, involves interfacing with the nervous system or brain. They can empower students with severe physical disabilities, enabling them to control computers and devices through their thoughts, opening new pathways for communication and interaction.
- Neurotech chips can help individuals with speech or motor impairments by translating neural signals into text or speech.
- Neurotech chips can stimulate motor neurons and support motor function rehabilitation. This is particularly beneficial for individuals with physical disabilities who are working to regain or improve motor skills.

Reference

1) Pattnaik S, Murmu J, Agrawal R, Rehman T, Kanungo S and Pati S (2023) Prevalence, pattern and determinants of disabilities in India: Insights from NFHS-5 (2019-21). *Front. Public Health* 11:1036499. Doi 10.3389/fpubh.2023.1036499.

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3) Wu, F., Liu, Z., Wang, J., & Zhao, Y. (2015, March). Establishment virtual maintenance environment based on VIRTOOLS to effectively enhance the sense of immersion of teaching equipment. In Proceedings of the 2015 International Conference on Education Technology, Management and Humanities Science (ETMHS 2015). Atlantis Press. doi:10.2991/etmhs-15.2015.93.

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