

INCLUSIVE SOCIAL DESIGN IN PRODUCT DESIGN EDUCATION DEVELOPING THERAPEUTIC SOLUTIONS FOR SPASTICITY IN THE MEXICAN PUBLIC HEALTH CONTEXT

Griselda Esthela OYERVIDES-RAMÍREZ and Juan Carlos MÁRQUEZ CAÑIZARES
Tecnológico de Monterrey, México

ABSTRACT

This proposal describes the design process and results obtained through an academic and social collaboration between Product Design students from a Mexican University and the Physical Medicine and Rehabilitation Unit of the Mexican Social Security Institute (IMSS). The project focused on developing products for patients with upper limb spasticity, a condition requiring constant therapy, which is often demotivating and involves limited accessibility to affordable equipment. The implemented methodology is an example of inclusive design and diversity in educational practice, as it compelled designers to look beyond technical specifications. Extensive ethnographic research and constant validation were carried out with various stakeholders: patients (adults and youth), family members/carers (who often provided information due to patients' language complications), therapists, and psychologists. This empathetic approach revealed that the main obstacles to recovery were the lack of motivation and psychological needs (anxiety/depression), in addition to the lack of tools for home therapy. The resulting solutions (such as ARMS, MindFit, Fonbu, Mino, MelodiX, and Kinisi) integrated elements of gamification and cognitive stimulation with occupational therapy to encourage constancy and social interaction. This work demonstrates how user diversity (physiological, psychological, and social) becomes the driver for innovation in design education, equipping future designers to address public health problems with empathy and more holistic solutions.

Keywords: Inclusive design, higher education, physical motor rehabilitation, User-Centred Design, innovative education

1 INTRODUCTION

Product design education stands at a critical intersection, where technical excellence alone is no longer sufficient to address the complex problems, designers face as professionals. There is currently a pressing need to cultivate critical, creative, and strategic thinking to engage with complex social, technological, and environmental transformations [1]. The call to explore diversity and social inclusion compels us to look beyond university settings and to confront systemic disparities in access to healthcare services. This article examines an academic initiative developed in Mexico, in which design education shifts towards 'Inclusive Social Design', focusing on the creation of therapeutic solutions for patients with spasticity within the complex ecosystem of the Mexican public healthcare system.

1.1 The Challenge of Spasticity in a Context of Inequality

The project addresses spasticity, a motor disorder characterised by muscle stiffness, rigidity and pain, resulting in significant limitations in patients' mobility and autonomy. It is a common sequela of neurological conditions such as cerebral palsy, stroke, multiple sclerosis and traumatic brain injury. Globally, it is estimated that over 12 million people live with spasticity associated with cerebral palsy and stroke alone [2], [3]. However, in developing countries such as Mexico, the challenge is exacerbated by socio-economic barriers that limit timely diagnosis, continuous treatment and access to rehabilitation services.

Mexico's public healthcare system is primarily represented by the Instituto Mexicano del Seguro Social (IMSS), which provides treatment, rehabilitation and therapy services to patients with physical disabilities through facilities such as Clinic No. 1, the Physical Medicine and Rehabilitation Unit. This

unit faces significant patient overcrowding, which limits the frequency of in-person rehabilitation sessions [4], [5]. Consequently, shifts responsibility for ongoing care, monitoring and therapeutic continuity to patients and their families.

1.2 Educational approach of design

The pedagogical approach underpinning this project prioritises empathy, ethics and ethnographic research, enabling students to design solutions that not only enhance fine and gross motor skills but also consider the psychological factors and socio-economic contexts shaping patients' everyday experiences. From a design perspective, spasticity presents a high degree of complexity, as each patient exhibits different levels of mobility and strength. Impairments most commonly affect the upper limbs the hand, wrist, elbow and shoulder compromising performance in activities of daily living (ADLs) [6], such as eating, dressing and personal hygiene. The management of spasticity requires a multidisciplinary approach [7].

Field research conducted by the students revealed that many of the devices currently used in rehabilitation could be described as 'DIY' (Do It Yourself), consisting of improvised objects such as containers, recycled plastic lids or even children's toys. This precariousness not only affects the effectiveness of treatment but also impacts patients' morale; therapists report that adults frequently complain that the materials resemble 'nursery objects', which diminishes their motivation to engage actively in their recovery.

This reality points to an urgent need: the design of low-cost rehabilitation devices suitable for home use and adaptable to the anatomical and functional diversity of a population that often cannot afford specialised medical equipment for personal use [8], [5]. Moreover, the high cost and limited availability of specialised assistive technologies further exacerbate disparities, particularly for low-income households [9], [5], [10]. From a rights-based perspective, access to rehabilitation services and appropriate assistive devices constitutes a fundamental component of independent living and full participation in society [11]. It is precisely at this intersection of systemic constraint, social inequality and therapeutic necessity that Inclusive Social Design can intervene meaningfully, contributing not only to improved motor function but also to enhanced dignity, autonomy and quality of life [12].

'Social Design' is not merely a category of product development but a philosophy of practice that prioritises human wellbeing and equity over commercial gain [13], [14], [15]. Within design education, the integration of this perspective enables students to recognise their responsibility as agents of social change rather than solely as service providers to industry [16].

2 METHODOLOGIES

The projects were developed by fifteen students coursing the sixth semester of the bachelor's in design from Tecnológico de Monterrey during 2024. The implemented methodology is an example of Social Design for inclusion in educational practice, as it compelled designers to look beyond technical specifications. Extensive ethnographic research and constant validation were carried out with various stakeholders: patients (adults and youth), family members/carers (who often provided information due to patients' language complications), therapists, and psychologists [17], [18]. Students approached 'field research' not as a theoretical exercise, but as an immersion into the reality of public hospitals where time and resources are scarce. These learnings were documented in each student's field journal, wherein all activities undertaken were systematically recorded, together with their individual reflections. Within this environment, user diversity manifests across multiple dimensions, including age, gender, degree of motor impairment, and socio-economic and family context. The Social Design for inclusion process can be divided into four major stages.

Ethnographic and Field Research: Students conducted visits to IMSS facilities to interview physicians, therapists and patients, gaining first-hand understanding of mobility limitations and the challenges associated with maintaining existing equipment.

Identification of Specific Needs: It was identified that a lack of motivation, time and external assistance prevents patients from carrying out their exercises at home.

Iterative Prototyping and Validation: Alpha and Beta prototypes were developed, validated by medical experts and directly tested by patients to refine ergonomics, durability and ease of use.

Life Cycle and Business Analysis: Assessment of the feasibility of local production as a strategy to reduce costs.

3 RESULTS

The results of this study demonstrate a clear relationship between the insights obtained through ethnographic research and the design decisions implemented across the five projects. Table 1 analyses the key characteristics of the projects developed in collaboration with the IMSS, highlighting their therapeutic approach, user, value proposition and design innovation within the public healthcare context.

Table 1. Key characteristics of Inclusive Social Design Projects

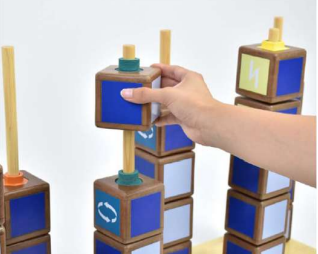
Feature	MINO	KINISI	FONBU	ARMS	MINDFIT
Therapeutic Approach	Fine motor skills and manual dexterity	Autonomy and muscle strength	Holistic neurological rehabilitation	Occupational therapy for severe spasticity	Physical-cognitive rehabilitation and well-being
User	Adults with neurological sequelae in their hands	Patients in intermediate stages of recovery	Patients with barriers to accessing the clinic	Patients with high limited mobility	Elderly people
Value proposition	Multifunctionality, portability, and accessibility for home therapy	Regaining a sense of independence	Makes it easy to perform complete therapy at home	System adaptable to varying degrees of spasticity	Connection between mental health, habits, and physical exercise
Design Innovation	Simplify fine motor skills exercises in a single multifunctional and compact object	Design based on natural (kinetic) movement with adjustable resistance	Self-directed therapy system, no therapist required	Adaptability to different degrees of spasticity	Holistic approach, combining physical and cognitive stimulation

One of the most significant findings was the low level of motivation and adherence to therapy, particularly due to repetitive and discouraging rehabilitation routines. In response, several projects incorporated gamification and interactive elements to foster engagement and continuity. For instance, MINDFIT integrates cognitive challenges and habit-forming dynamics, while ARMS and FONBU introduce playful interactions that transform therapeutic exercises into more engaging experiences.

A second key insight relates to the psychological barriers associated with spasticity, including anxiety, depression, and loss of autonomy. These factors were not initially evident as primary design drivers but emerged strongly through stakeholder interviews. Consequently, projects such as KINISI and MINDFIT adopted a more holistic design approach, integrating cognitive stimulation and emotional engagement alongside physical rehabilitation, thus addressing both mental well-being and motor recovery. The research also highlighted the high variability in motor impairment, as spasticity manifests differently across patients in terms of strength, range of motion, and coordination. In response, students prioritised adaptability and flexibility, developing systems with adjustable resistance, modular configurations, or scalable interactions. This is particularly evident in ARMS and KINISI, which allow the therapy to be tailored to different levels of ability and stages of recovery. Another critical finding was the limited access to rehabilitation services, caused by economic constraints, transportation difficulties, and the saturation of public healthcare facilities. This insight directly informed the development of portable, home-based solutions such as FONBU and MINO, which enable patients to continue therapy independently outside clinical environments.

Additionally, the need to support fine motor skill development for activities of daily living led to the creation of targeted solutions such as MINO, which focuses on hand dexterity through a compact and multifunctional design, adopting a more dignified and user-appropriate design language, enhancing user acceptance across several projects. This analysis demonstrates that design education, when addressing public health, must generate an ecosystem of products rather than a single universal solution. Table 2 shows the five products.

Table 2. Inclusive Social Design Projects

	Design iteration and user validation	Final prototype
MINO		
KINISI		
FONBU		
ARMS		
MINDFIT		

Regarding the educational value, the key processes that shaped the students' learning trajectories are compared below, illustrating how they navigated the tension between the technical rigour of the solution and the sensitivity required to enhance patient motivation in occupational therapy.

MINO & ARMS: Students experienced a 'reality shock' upon witnessing the saturation of the public healthcare system. Their research focused on trauma ergonomics, learning to translate complex medical diagnoses into concrete design requirements.

FONBU: The research approach adopted a socio-logistical perspective. Students identified that the primary barrier was not solely physical impairment, but also distance and transportation costs. This shifted their learning towards service design and tele-rehabilitation strategies.

KINISI & MINDFIT: Students learned to integrate mental health considerations into the design brief, recognising that patient motivation is as critical as the mechanical resistance and functional performance of the device itself.

4 DISCUSSION AND CONCLUSIONS

The methodology applied in these projects followed an iterative prototyping cycle grounded in clinical validation. The need to ergonomically validate each device with real patients compelled students to confront their assumptions about the ‘average user’. Clinical literature underscores that spasticity presents different degrees of impairment [2],[7]. In the context of Mexican public healthcare design, the ‘average user’ does not exist; rather, there is a diversity of bodies with complex medical histories that demand flexible solutions. Beyond motor limitations, spasticity is frequently accompanied by psychological factors such as depression and anxiety linked to loss of independence and reduced social participation [7], reinforcing the need for holistic, patient-centred design approaches aligned with global calls for integrated rehabilitation strategies [4].

The most significant educational achievement was the deconstruction of the ‘average user’. A single problem: patient spasticity generated five distinct pathways of learning and technical innovation.

Functional Diversity: Students recognised that spasticity manifests uniquely in every individual, as widely documented in neurological research [2]. Consequently, they developed modular and adjustable systems instead of rigid, standardised artefacts.

Socio-economic Diversity: Designing ‘for IMSS’ required consideration of product life cycle, maintenance and affordability. In a context where people with disabilities face structural barriers and limited access to assistive technologies [4],[8],[9], students learned that a solution beyond the patient’s financial reach ultimately constitutes a design failure.

Cognitive Inclusion: Particularly in the MINDFIT project, neurodiversity and ageing were integrated into the brief, positioning older adults as active users deserving of high-quality and dignified design, a stance consistent with rights-based frameworks advocating independent living and inclusive participation [11].

This article presents a disability-centred, real-world design education model developed through five full-scale student projects in direct collaboration with a public rehabilitation institution in Mexico. By focusing on spasticity within an overburdened public health system [4], [5], the initiative offers a replicable framework for integrating social responsibility into design curricula [18]. Unlike traditional studio-based or simulated projects, this approach situates students within contexts shaped by disability, socio-economic inequality and institutional constraints, requiring them to adapt and critically reassess standard design methodologies. The findings provide practical, field-tested strategies for embedding equality, diversity and inclusion (EDI) into design education [13], [14], [15].

Ultimately, the study argues that design education must evolve to embrace the complexity of human diversity. Anchoring learning in real societal challenges not only strengthens students’ technical and strategic capabilities but also fosters ethical awareness and civic responsibility [1]. By engaging directly with issues of access, dignity and systemic inequity, future designers develop a deeper understanding of their role as agents of social change, enriching both the design process and the broader pursuit of global equity.

ACKNOWLEDGEMENTS

The authors acknowledge the financial and technical support of Writing Lab from the Institute for the Future of Education of Tecnológico de Monterrey, in the production of this work, and the School of Architecture, Art and Design Research Group Advanced Design Processes for Sustainable Transformation of which they are members. Also, the support given by the IMSS personnel for the development of the projects.

REFERENCES

- [1] Aldoseri A., Al-Khalifa K. N. and Hamouda A. M. AI-powered innovation in digital transformation: Key pillars and industry impact. *Sustainability*, 2024, 16, 1790. DOI: 10.3390/su16051790.
- [2] Pandyan A. D., Gregoric M., Barnes M. P., Wood D., Van Wijck F., BurrIDGE J., Hermens H. and Johnson G. R. Spasticity: Clinical perceptions, neurological realities and meaningful measurement. *Disability and Rehabilitation*, 2005, 27(1–2), 2–6. DOI: 10.1080/09638280400014576.
- [3] World Health Organisation. *Improving access to medicines for neurological disorders*, 2023 (World Health Organisation, Geneva). ISBN 978-92-4-009737-7

- [4] World Health Organisation. *Rehabilitation 2030: A Call for Action*. Available: <https://www.who.int/publications> [Accessed on 2026, 1 February], (2017).
- [5] Instituto Nacional de Estadística y Geografía. Estadísticas a propósito del Día Internacional de las Personas con Discapacidad (3 de diciembre). Available: <https://www.inegi.org.mx> [Accessed on 2026, 4 February], (2021).
- [6] Edemekong P. F., Bomgaars D. L., Sukumaran S. and Schoo C. Activities of daily living. In: *Ryan's Occupational Therapy Assistant: Principles, Practice Issues, and Techniques*, Fifth Edition, 2023, pp. 513–532 (Routledge). DOI: 10.4324/9781003526346-41.
- [7] Sáinz-Pelayo M. P., Albu S., Murillo N. and Benito-Peñalva J. Espasticidad en la patología neurológica. Actualización sobre mecanismos fisiopatológicos, avances en el diagnóstico y tratamiento [Spasticity in neurological pathologies. An update on the pathophysiological mechanisms, advances in diagnosis and treatment]. *Revista de Neurología*, 2020, 70(12), 453–460. DOI: 10.33588/rn.7012.2019474.
- [8] Comisión Nacional de los Derechos Humanos. Informe especial sobre la situación de los derechos humanos de las personas con discapacidad en México, 2018 (CNDH, Mexico City).
- [9] World Health Organisation and World Bank. *World Report on Disability*, 2011 (World Health Organisation, Geneva).
- [10] Consejo Nacional para el Desarrollo y la Inclusión de las Personas con Discapacidad. Programa Nacional para el Desarrollo y la Inclusión de las Personas con Discapacidad 2014–2018, 2018 (Secretaría de Desarrollo Social, Mexico City).
- [11] United Nations. *Convention on the Rights of Persons with Disabilities: General Comment No. 5 (2017) on Living Independently and Being Included in the Community*. Available: <https://www.ohchr.org> [Accessed on 2026, 1 March], (2017).
- [12] Mallin S. S. V. and Carvalho H. G. de Assistive Technology and User-Centred Design: Emotion as Element for Innovation in *Procedia Manufacturing* 2015 (Vol. 3, pp. 5570–5578). Elsevier B.V. <https://doi.org/10.1016/j.promfg.2015.07.738>
- [13] Margolin V. *The Politics of the Artificial: Essays on Design and Design Studies*, 2002 (University of Chicago Press, Chicago).
- [14] Margolin V. and Margolin S. A “social model” of design: Issues of practice and research. *Design Issues*, 2002, 18(4), 24–30.
- [15] Manzini E. *Design, When Everybody Designs: An Introduction to Design for Social Innovation*, 2015 (MIT Press, Cambridge, MA).
- [16] Cipolla C. and Bartholo R. Empathy or inclusion: A dialogical approach to socially responsible design. *International Journal of Design*, 2014, 8(2), 87–100.
- [17] Martin B. and Hanington B. *Universal Methods of Design: 100 Ways to Research Complex Problems, Develop Innovative Ideas, and Design Effective Solutions*, 2012 (Rockport Publishers, Beverly, MA).
- [18] Oyervides-Ramírez G. E. and Marquez Cañizares J. C. Design for the elderly: An immersive human dignity experience for university students. In *26th International Conference on Engineering and Product Design Education (EPDE 2024)*, 2024. DOI: 10.35199/EPDE.2024.33.