

# Strategies for Developing Students' Empathy and Awareness for the Needs of People with Disabilities: Contributions to Design Education

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**Abstract.** The design of products for people with disabilities requires the understanding of a wide range of factors related to users' health, functional abilities, needs, expectations and preferences. Such multifactorial perspective is often perceived as beyond the reach by the students of both graphic and product design, as it comprises knowledge from different areas such as are not usually part of design curriculum as health, rehabilitation, computer science and biomedical engineering. Here, we report on strategies for developing design students' empathy and awareness for the needs and expectations of people with disabilities. By means of a combination of theoretical and practical approaches, a course on Inclusive Design was developed as part of the regular curriculum of the Bachelor Programme in Design at Sao Paulo State University (UNESP, Bauru campus, Brazil), with the collaborative participation of members of SORRI BAURU Rehabilitation Center. The final projects developed by the students were based on the demands presented by SORRI BAURU's rehabilitation team, and results reveal that the theoretical-practical approach based on interdisciplinarity was shown to provide the design students a learning experience that, ultimately, supports the quality decision-making in the design process. This paper describes the pedagogical approach, theoretical contents and practical activities developed during the Inclusive Design course. The challenges, benefits, results, and contributions of this experience from the perspective of the design education are also discussed.

**Keywords.** Inclusive Design, Assistive Technologies, Design Education, Interdisciplinarity.

## 1. Introduction

In Product Design education, students have been challenged to design solutions to real problems associated with modern life. This triggers the need for integrating knowledge and abilities from different areas in a highly dynamic context. Of these, accessibility and social inclusion of people with disabilities have received increasing interest. Global information shows that around 1 billion people experience disability in the world [1]. In

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a Brazilian context, data from the Census [2] indicate that around 24% of the population experience some type of disability. Recent laws aimed to guarantee equal rights and the social participation of people with disabilities [3] have prompted the need for discussions to identify the means needed to reach these objectives. In this context, projectual areas such as Design, Architecture and Engineering have been challenged to integrate knowledge of areas such as Health, Rehabilitation and Technology.

Inclusive design represents a tool for this integration. According to Coleman, Lebbon, Clarkson and Keates [4], Inclusive Design is not a new genre of design, but an area that helps to develop projects targeting the user needs, regardless of their age or abilities, thus, including portions of the population that otherwise are excluded.

The challenge is to integrate those concepts in the design education in an effective way to develop awareness of users' special needs. The study of Goodman-Deane et al. [5] describes theoretical methods that can be used with this proposal, such as user-centered design methods or even methods developed for inclusive design.

Another practical approach is empathy modeling. With this approach, the designer assumes the position of the user and becomes better equipped to understand the difficulties and feelings during use. According to Altaya and Demirkana [6], this can be done through observations, interviews, review of scientific literature about users' needs and experiencing the user's condition. A combination of these strategies may be the best scenario for the development of projects targeting people with disabilities. In this paper, we discuss the challenges, benefits and results of an interdisciplinary approach to rehabilitation and assistive technology for people with disabilities in product design education.

## **2. Material and Methods**

### *2.1. Inclusive Design Course at São Paulo State University*

The Inclusive Design course is a regular part of the curriculum of the Bachelor Programme in Design at Sao Paulo State University (UNESP, Bauru campus, Brazil), which includes collaboration with members of the SORRI BAURU Rehabilitation Center. This course is also offered to Architecture, Urbanism and Visual Arts students.

The course is composed of theoretical classes exploring concepts and applications of Inclusive Design, contents referring to the mobility and execution of activities of daily living by subjects with disabilities and presentation of the concept and applications of Assistive and rehabilitation technologies. In addition to the theoretical classes, the students have practical activities and lectures given by professionals from the SORRI BAURU Rehabilitation Center. All these activities aim to sensitize students to the needs of users with physical, cognitive, sensorial and multiple disabilities. Students are thereby able to reflect around design aspects that go beyond the usability of the products they will develop.

### *2.2. Simulated tasks in Inclusive Design*

The experience of practices that simulate disabilities is important in order to develop empathy and to understand the difficulties experienced by people with special needs. According to Altaya and Demirkana [6], one of the ways to enable this immersion is through Role Playing. Bernardi and Kowaltowski [7] also recommend that Role Playing

is combined with other pedagogical practices, such as user's interviews and theoretical classes about inclusive design.

In the Inclusive Design course at UNESP, Role Playing has been implemented as a tool to provide students with experiences in simulated activities of functional difficulties, such as moving around with wheelchairs and crutches, full blindness or low vision simulation browsing the computer through a screen reader and simulated aging. This can for example be achieved by reading a book with glasses that blur vision and gloves that decrease manual dexterity.

### *2.3. Final Project and Assessment Questionnaire*

During the course, the students had to develop a prototype of a product to be used in the rehabilitation programs at SORRI. The process is initiated as the SORRI team presents a list of needs with a brief description of ideal use, the target user of the product and possible applications. The students were divided into groups to work on a single product.

At the end of the course, the students answered a questionnaire about the discipline. The questionnaire comprised questions about the student's previous knowledge related to topics such as disability and Assistive Technology and their knowledge at the end of the discipline. The questionnaire also counted with open questions where the students could write their opinions.

## **3. Results**

### *3.1. Final Projects*

The student group projects were developed as therapeutic tools in the rehabilitation program. The rehabilitation resources were initially integrated into the Occupational Therapy routines, but it ended up being used by physical therapists, psychologists and phono-audiologists. The main applications and therapeutic objectives of the UNESP students' projects for the SORRI patients are listed below:

- Broaden the perception of body schema and laterality;
- Stimulate mainly tactile sensory abilities;
- Improve fine motor coordination and visual motor integration;
- Stimulate the knowledge of shapes and colors;
- Favour spatial organization;
- Increase threshold and length of stay in activities;
- Stimulate the comprehension of rules and the beginning, middle and end of tasks;
- Stimulate social interaction and inclusion;
- Benefit independence and autonomy in daily tasks;
- Increase the participation in daily life activities, in particular changing clothes;
- Benefit attention and focus on activity and increase of the sensory threshold for distracting external stimuli.
- Improve performance in different learning phases at school.

The body scheme puzzle with textures (see Figure 1) was proposed to support therapeutic strategies for developing the perception of body scheme and laterality. It has

been used with children of 3-6 years of age with delay in neuropsychomotor development and sensory alterations, in the Sensory-Motor Integration Unit at SORRI. The professionals reported good acceptance by the users, indicating that this tool is a positive resource to incorporate in the rehabilitation strategy. Figure 2 shows the body scheme perception targeted by the project, with special emphasis on the perception and acceptance of differences and diversity in the society and the use of assistive devices such as wheelchairs, crutches and glasses.



**Figure 1.** Body scheme puzzle with textures.



**Figure 2.** Body scheme puzzle with assistive devices.

Aiming to stimulate the perception of proportionality, colours, light and shape, the students' project presented in Figure 3 has been used by the transdisciplinary team comprising occupational therapists, psychologists and phono-audiologists. Children from 4 to 9 years old were the target users in the sensory-motor integration and fine motor ability approaches, showing good acceptance for individual and group work.

The project Graphic Alphabet Builder (Figure 4) has been used by the interdisciplinary team of the Autism Program at SORRI. By using different colours and textures, the tool proposes the learning of the shape of different letters by simple and common shapes (sticks and semicircles). SORRI professionals reported positive outcomes in terms of good acceptance, easy comprehension and interest in supporting school activities using this tool.

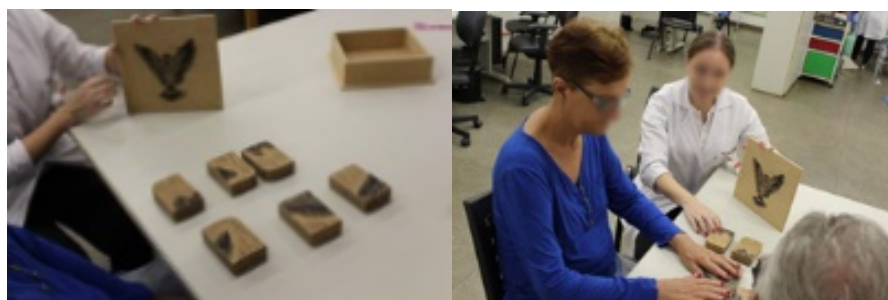


**Figure 3.** Interactive board.



**Figure 4.** Graphic Alphabet Builder.

The Xylography Puzzle (Figure 5) has been used in individual interventions with adults and elderly patients with cognitive impairments and problems with fine motor abilities with the upper limbs. The tool has yielded good results and the professionals stated that the big size and cubic shape of the pieces allow users with low upper-limb function to effectively perform the task.



**Figure 5.** Xylography Puzzle.

The project presented in Figure 6 aimed to develop fine motor abilities with upper limbs and pinch grip using an interactive story-telling approach. It has been used with children of 4-6 years of age with delay in the neuropsychomotor development and sensory alterations, in the Unit of Sensory-Motor Integration at SORRI. The feedback from the professionals is positive as it uses a ludic approach to stimulate essential components for the patients' functional performance.



Figure 6. Interactive story-telling.

### 3.2. Students' Perceptions About the Course

The Inclusive Design course run in 2017 included 34 students, most of them were doing their bachelor's in design, but there were also students of Architecture and Visual Arts (see Figure 7).

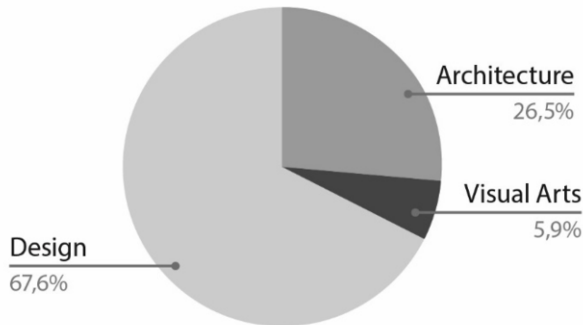
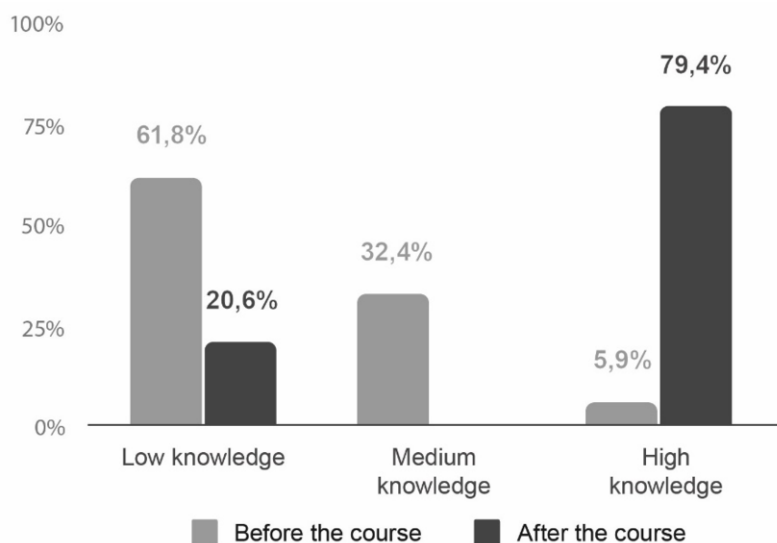


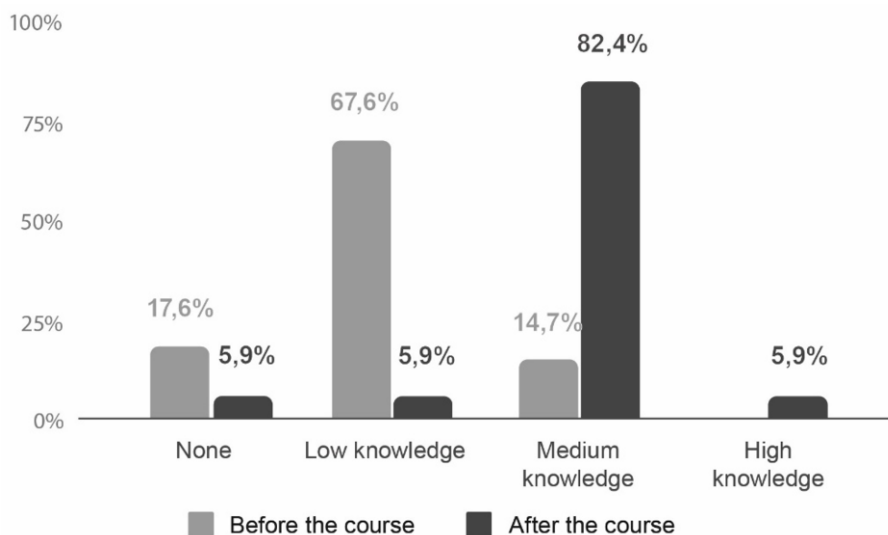
Figure 7. Percentage of students attending the 2017 Inclusive Design Course.

Regarding the level of knowledge about Inclusive Design prior to the course, 61.8% of the students reported having little knowledge and only 5.9% said they had much knowledge about Inclusive Design. At the end of the course, 79.4% of the students reported having much knowledge about Inclusive Design, and only 20.6% reported having little knowledge about this subject (see Figure 8).



**Figure 8.** Level of knowledge about Inclusive Design.

When it comes to Assistive Technology, 17.6% of the students reported no previous knowledge about assistive technology and 67.6% assessed their previous knowledge about assistive technology as low. After the course, both values dropped to 5.9%, while 82.4% and 5.9% assessed their knowledge in Assistive Technology as medium or high, respectively (see Figure 9).



**Figure 9.** Level of knowledge about Assistive Technology.

The Inclusive Design methodology presented in one of the classes was very useful for the students to develop the final project. When answering the question "How much did Inclusive Design methodology contribute to the final project?", 91.2% of the students responded that it contributed a lot to the execution.

When it comes to the student' satisfaction with their final project, none of the students was unsatisfied with their own project. However, 55.9% were fully satisfied and 44.1% were moderately satisfied with the project (see Figure 10).

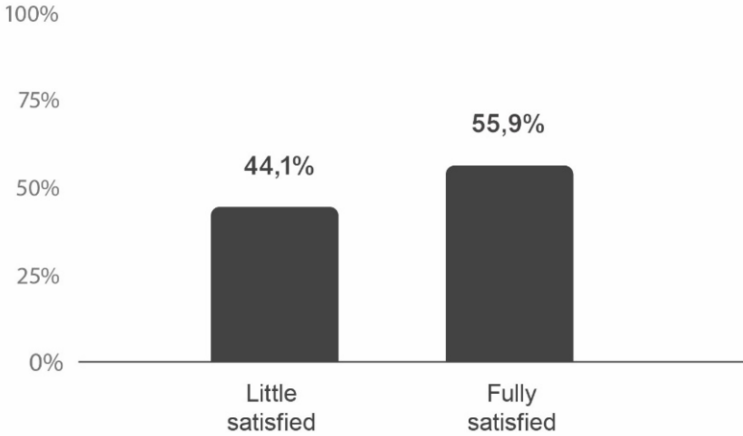


Figure 10. Student' satisfaction level with their final project.

At the end of the course, 23.5% of the students reported that they felt totally confident to work on inclusive design projects, while 70.6% considered themselves somewhat confident. None of the students considered themselves totally inconfident to use inclusive design concepts (see Figure 11).

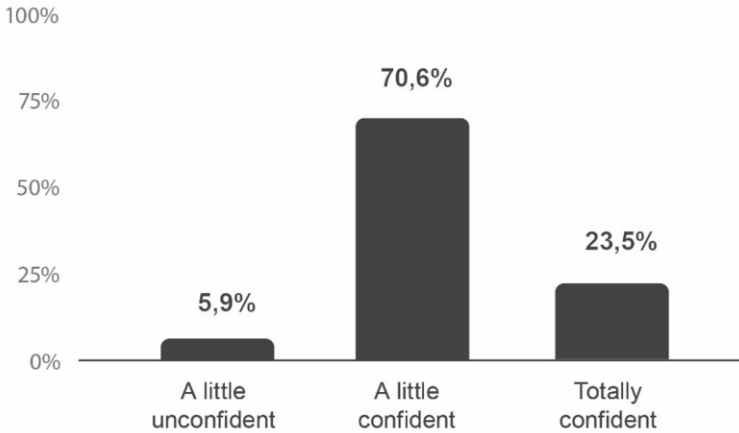


Figure 11. Students' confidence to work with Inclusive Design.

Of the general observations about the course, the most common issues that emerged in the open questions were the need for more interactions with the users, in this case, SORRI' patients, and more topics related to accessibility and inclusive design for graphics and digital media.



#### 4. Discussion

Pedagogical strategies for developing empathy in design students have been reported herein. In situations when the design process is focused on the development of technologies to be used by people with disabilities, it is important that the design team is sensitive and aware of the challenges experienced by those who experienced reduced function in daily activities. The Role-Playing technique represents a simple and interesting practice that provides a learning experience where designers better understand user's needs and, consequently, design successful solutions that best meet users' needs and expectations. The benefits of using the Role-Playing technique to develop empathy have been reported [6][7].

The initiative of introducing in the design education the challenge of developing solutions in the areas of rehabilitation and assistive technologies demanded from the academics the need of promoting practices of feeling and understanding the difficulties and challenges that people with disabilities experience in daily life. Such initiative is connected to the research and innovation developed by the authors, therefore meeting the need of integrating the three main pillars of the university: research, education and community work. Examples of some of our research and innovation on design and assistive technologies include wheelchair mobility [8][9][10], universal control for smart home appliances [11], adapted sports [12], text entry adaptation strategies [13] and optimization of scan-path on scanning keyboards [14], mobility aids for the elderly [15] and, more recently, teaching strategies on collaborative design and prototyping of Assistive Technologies [16].

The teaching strategies of developing empathy and the challenge of designing solutions for real demands from SORRI Rehabilitation Center has shown to be positive for students' engagement with the course. Also, the students' responses at the end of the course show that most of them reported a positive level of satisfaction and an important gain of knowledge on inclusive design after the course, and that the methodology implemented in the course had a positive contribution for their project development as well as for their confidence to work with inclusive design. Complementing these findings, the reports from the SORRI rehabilitation team revealed that the students were able to detect the most relevant requirements for the project and user's needs, leading to a very precise design briefing and, as a result, in prototypes that were successfully implemented in the rehabilitation routines.

The work reported here provides a feasible proposal of framework for a course on Inclusive Design based on interdisciplinary and interinstitutional collaboration. By combining theoretical content with practical experiences of raising awareness and developing empathy and students involved in design solutions for demands from SORRI rehabilitation center, it was observed a positive result in terms of pedagogical outcomes and project development and application in real contexts. However, availability of materials and equipment are still aspects to be improved. The use of rapid prototyping and 3D scanning technologies may significantly contribute to both educational and project development outcomes. Future experiences should focus on implementing such technologies in the educational approach.

It should also be noted that although empathy is an important first step to better understand the situation of users, empathy can also lead to a divide or power distance between the designer and the user where the designer is somewhat elevated above the user. Empathy must thus be practiced in an inclusive sense using inclusive language, actions and interactions characterized by the notion of "us" rather than "we" and "them".

## 5. Conclusion

This paper reported on the results and benefits of the implementation of an Inclusive Design course framework based mainly on practical experiences and students engaged in designing solutions for people with disabilities in a rehabilitation context. Practices of experiencing situations of functional difficulties (Role Playing technique) have shown to be a promising approach to develop students' awareness and empathy for the needs of people with disabilities. The collaboration with SORRI Rehabilitation Center and the active participation of SORRI professionals was decisive for promoting the students a unique experience that, ultimately, resulted in the positive educational and project development outcomes.

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