

## INCLUSION AND ADAPTATION BEYOND DISABILITY: USING VIRTUAL REALITY TO FOSTER EMPATHY

Luis Pinto-Coelho<sup>1</sup>, Anna Laska-Leśniewicz<sup>2</sup>, Elisabeth T. Pereira<sup>3</sup>, Joanna Sztobryn-Giercuskiewicz<sup>4</sup>

<sup>1</sup> Polytechnic Institute of Porto, Porto, Portugal  
School of Engineering, Department of Physics

<sup>2</sup> Lodz University of Technology, Łódź, Poland  
Institute of Mechatronics and Information Systems

<sup>3</sup> University of Aveiro, Aveiro, Portugal

<sup>4</sup> University of Lodz, Łódź, Poland  
Institute of Sociology

### ABSTRACT

**Background:** Virtual reality (VR) has the potential to be a powerful tool in promoting empathy towards inclusion, particularly for individuals with impairments such as mobility difficulties, vision deficits, or autism but also about pregnancy, which can create temporary difficulties. By immersing users in simulated environments that replicate the experiences of those with different abilities, VR can create a sense of understanding and empathy for those who face challenges in their daily lives. For example, VR experiences can simulate the experience of navigating space as someone with a mobility impairment, providing a new perspective and appreciation for the difficulties that others face. Similarly, VR experiences can simulate the experience of vision impairment, pregnancy, or autism, providing a window into the challenges faced by those with these conditions and fostering empathy and understanding. **Material and Methods:** During the development of this study, field experts were consulted to ensure the robustness of the methods employed. Then, questionnaires were specifically developed to explore disabilities and challenges related to inclusion and were administered to a large population. Additionally, guided interviews were conducted with individuals who possess specific impairments to gather first-hand insights. **Results:** The results obtained from the questionnaires and interviews provide a comprehensive overview of the inclusion challenges that necessitate attention and resolution. By drawing on the expertise of both experts and individuals with lived experiences, a holistic landscape of inclusion challenges has been established. **Conclusions:** The VR emerges as a powerful tool for promoting inclusion and fostering understanding among individuals. Its capacity to create immersive experiences that facilitate empathy has the potential to reshape society into a more compassionate and empathetic one. By leveraging the unique capabilities of VR, we can bridge the gap between different perspectives, fostering greater understanding, acceptance, and inclusivity. Med Pr. 2023;74(3):171–85

**Key words:** pregnancy, autism, empathy, disabilities, virtual reality, society

Corresponding author: Luis Pinto-Coelho, Polytechnic Institute of Porto, School of Engineering, Department of Physics, Rua Dr. António Bernardino de Almeida 431, 4249-015 Porto, Portugal, e-mail: lfc@isep.ipp.pt  
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### INTRODUCTION

In today's diverse and interconnected world, the promotion of empathy and understanding is crucial for creating a society that values and embraces individuals of all abilities. While advancements have been made in fostering inclusivity, there is still much work to be done to bridge the empathy gap and cultivate a more compassionate and empathetic society. In recent years, virtual reality (VR) has emerged as a powerful tool with

the potential to revolutionize the way we approach empathy-building and inclusion.

Virtual reality technology immerses users in simulated environments that replicate the experiences of others, enabling them to gain firsthand insights into different perspectives and challenges. This technology has shown promise in promoting empathy towards individuals with temporary disabilities or impairments, including mobility difficulties, vision deficits, pregnancy, and autism. By providing immersive experiences that

simulate the realities faced by people with diverse abilities, VR has the capacity to evoke a sense of understanding and empathy among users [1].

One area where VR has proven to be particularly impactful is in simulating the experience of navigating spaces as someone with a mobility impairment [2]. By enabling users to virtually experience the physical and emotional challenges of manoeuvring in an environment that is not designed with their needs in mind, VR can foster a deeper appreciation for the difficulties encountered by individuals with mobility limitations. The VR can even surpass simulation based on suits that try to mimic challenging biomechanical conditions [3]. Similarly, VR experiences can simulate the visual impairments experienced by people with vision deficits, allowing users to gain insight into the daily obstacles faced by those with limited or no vision. For example, the use of VR and augmented reality (AR) to simulate visual impairments can be explored with the OpenVisSim software [4]. Reported results showed that the simulated impairments substantially impaired performance in both VR and AR, suggesting that mixed reality technologies have interesting potential as a means of simulating the functional effects of vision impairment in normally sighted individuals. Furthermore, VR can offer a unique perspective on the experiences of pregnancy, providing users with a deeper understanding of the physical and emotional changes that individuals go through during this transformative period. Additionally, VR simulations can replicate the sensory sensitivities and social challenges associated with autism, fostering empathy, and promoting acceptance of individuals on the autism spectrum [1,5].

Autism spectrum disorder (ASD) is a highly heterogeneous, neurodevelopmental disorder whose central symptoms are deficits in social skills, verbal communication disorders (including delayed speech development, and difficulties with verbalization), and stereotyped behaviors, interests, and activities [6]. These irregularities are holistic, therefore they can be observed in various conditions, regardless of the environment [7]. Autism spectrum disorders are currently diagnosed in 1 in 100 people, so they are relatively common diseases [8], and the results of epidemiological studies over the years show that the number of cases is constantly growing [9,10]. In Western countries, ASD is treated as a lifestyle disease [11]. Males are 3–4 times more likely to be diagnosed with ASD [12]. To ensure the robustness and validity of the research, this study engaged field experts who provided their expertise during

the development of the methodology. Meticulously crafted questionnaires were administered to a diverse population to explore the various disabilities and challenges related to inclusion. Furthermore, guided interviews were conducted with individuals who possess specific impairments, allowing for a more nuanced understanding of their lived experiences and insights [13].

The results obtained from the questionnaires and interviews offer a comprehensive overview of the inclusion challenges that demand attention and resolution. By drawing on the collective expertise of both field experts and individuals with lived experiences, a holistic landscape of inclusion challenges has been established. It is clear that VR emerges as a potent tool for promoting inclusion and fostering understanding among individuals. Its unique capacity to create immersive experiences that facilitate empathy has the potential to reshape society into a more compassionate and empathetic one [14].

By leveraging the unique capabilities of VR, we can bridge the gap between different perspectives, fostering greater understanding, acceptance, and inclusivity. This paper explores the transformative potential of VR in promoting empathy beyond disability and highlights the significance of VR as a catalyst for inclusion and adaptation. By delving into the immersive experiences facilitated by VR technology, we can envision a future where empathy becomes a driving force for positive change, breaking down barriers, and creating a society that celebrates diversity in all its forms [15].

In this manuscript, the objective is to present a wide spectrum of inclusion challenges and to suggest guidelines that allow building experiences to foster empathy or suggestions of assistive technologies. The findings presented in this manuscript were the basis for further elaboration of immersive exercises with the use of virtual reality. The VR experiences have been created as a part of the European cooperation of several scientific institutions within the Mixed Reality on Universal Design's Secret Service (Mr. UD) project [16].

### **The evolution of disability and the role of immersive experiences**

The concept of different disabilities and their interpretations have changed through time and according to models determined by the socio-political, cultural, and educational trends [17].

For Camacho-Zuniga et al. [17], in the traditional disability model, “the person with disabilities (PWD) is conceived as a problem subject who alters the model of ‘normality’ and requires intervention in the care,

religious, and health perspectives.” During the 20th century, the rehabilitative model focused on finding formulas to achieve the ideal of social normalization, as well as to encourage policy and decision-makers to search for political, social, family, and educational solutions to the integration of the PWD.

The Treaty of the International Convention on the Rights of PWD, in 2007, focused on education as a fundamental right centered on respect, dignity, and participation according to the condition of the human being [17,18]. Based on this, the concept of inclusion was highlighted by researchers, teachers, professors, and professionals who offer their services for intervention and improvement of the well-being situation of PWD [17] and inclusive education. So, this expresses the relevance of the participation of PWD in Higher Education Institutions (HEI) positively impacted inclusion [19], which is associated with reducing barriers to learning and participation, implementing accommodations, and creating collaborative learning communities [17] to improve the inclusion of PWD in different contexts.

Additionally, Camacho-Zuniga et al. [17], in their results concluded the importance of the application of the Universal Design for Learning (UDL) approach to obtain new considerations and proposals to materialize the meaning of inclusive education, as well as to define innovative models of collaborative work and development of competencies oriented to different fields. The UDL allows to reduce barriers to learning, increases student engagement, empowers students towards self-regulation, helps students to evidence outcomes, and helps provide proper access for minorities, and gifted students [20].

- Simulating client scenarios: VR can enable social work students to become fully immersed in a simulated realistic world to experience client scenarios, which can help them develop empathy for clients with health conditions [21].
- Monitoring emotional processes: VR can be used to monitor emotional processes in intergroup helping behaviors, which can help researchers better understand how emotional reactions change according to different signals [22].
- Collaborative problem solving: VR can be used to study how pairs' empathy skills and dispositional empathy associate with their counterpart's evaluations of social closeness to the pair and subjective workload in a collaborative problem-solving task completed both face-to-face and in VR [23]. They reinforce group connections and social interactions.

- Implicit and explicit emotional empathy: VR can be used to study implicit and explicit emotional empathy in response to positive and negative emotional stories in different VR settings. This allows to improve interpersonal communication and interaction, creating stronger social bonds [24].
- Dental education: VR can be used to simulate the viewpoint of a child during a dental visit, which can help dental students experience what a child experiences and increase their empathy for children and also for dental problems [25].

It is important to note that there are also some concerns about using empathy as the intended outcome of many studies on immersive VR experiences. Empathy has many significant flaws that may lead to unintended and negative outcomes, going against the original goal of employing these technologies for the betterment of society. Therefore, some researchers propose designing for rational compassion instead of empathy [26].

## MATERIAL AND METHODS

The primary objective of the present study is to delve into the perspectives of diverse groups of individuals with special needs within the context of HEIs. This investigation encompasses a wide range of aspects, including mobility difficulties, vision deficits, challenges experienced during pregnancy, autism spectrum disorder, and the daily obstacles faced by individuals with special needs. To comprehensively understand these perspectives, various tools were employed, including in-depth interviews with specialists, data collection from HEIs, administration of questionnaires, interviews conducted with individuals with special needs and their relatives, as well as gathering indirect information from associations and available sources. In the subsequent sub-sections, the authors will provide a detailed description of the specific aspects addressed by each of these tools, allowing for a comprehensive exploration of the unique insights gained from each approach.

- In-depth interviews with specialists: By engaging in detailed and focused interviews with experts in the field, valuable insights and expertise were obtained. These interviews, carefully planned, provided a deeper understanding of the challenges faced by individuals with special needs within HEIs, shedding light on potential barriers to their inclusion and identifying areas where improvements can be made.
- Data collection from HEIs: Gathering data directly from HEIs offered a comprehensive overview of

the existing support systems, accommodations, and policies in place for students with special needs. This data provides an empirical foundation for understanding the current state of inclusivity within HEIs and helps identify areas that require attention and enhancement.

- Questionnaires: By designing and administering questionnaires to relevant stakeholders within HEIs, including students, faculty, and support staff, a broader perspective was obtained. These questionnaires allowed for the systematic collection of information regarding the experiences, challenges, and needs of individuals with special needs, enabling quantitative analysis of the data and identification of common trends or patterns.
- Interviews with individuals with special needs and their relatives: By directly engaging with individuals with special needs and their close family members, a firsthand understanding of their experiences and perspectives was gained. These interviews provided a platform for personal narratives, enabling a deeper exploration of the challenges faced by individuals with special needs within HEIs and the potential solutions from their unique standpoint.
- Indirect information from associations and available sources: By drawing on the knowledge and insights from relevant associations and existing sources, a broader context was established. This involved gathering information from disability advocacy organizations, research papers, and reputable sources to complement and validate the findings obtained through other tools, enriching the overall understanding of the subject matter.

Through the implementation of these diverse tools, this study aims to provide a comprehensive and multifaceted analysis of the perspectives of individuals with special needs within HEIs.

In the next subsections, the authors provide details about the questionnaires and interviews that were used to assess needs, limitations, and challenges within the focus of the disability scope in the study. All participants answered an initial set of questions, not presented here, for the purpose of social and demographic characterization of the population.

### General Disability Questionnaire

The purpose of this questionnaire is to gather insights into the challenges that individuals with impairments may encounter in their daily lives. It also seeks

**Table 1.** The *General Disability Questionnaire* used in a survey of students, teachers and support staff from Higher Education Institutions (January–March 2023, Porto, Portugal)

Point	Answer
What type of disability do you have?	<input type="checkbox"/> Vision impairment <input type="checkbox"/> Mental or psychological problem <input type="checkbox"/> Physical or motor problem <input type="checkbox"/> Deaf or hard of hearing <input type="checkbox"/> Autism spectrum disorder
My disability has a negative impact on my activities	<input type="checkbox"/> Totally agree <input type="checkbox"/> Partially agree <input type="checkbox"/> Neither agree nor disagree <input type="checkbox"/> Partially disagree <input type="checkbox"/> Totally disagree
I could need help on...	<input type="checkbox"/> Accessing specific locations in a building <input type="checkbox"/> Develop curricular unit projects <input type="checkbox"/> Dialogue with my teachers <input type="checkbox"/> Engage in social activities with my peers <input type="checkbox"/> take care of my personal hygiene
I can put myself in the shoes of a person with disability and I am aware of their daily challenges	<input type="checkbox"/> Totally agree <input type="checkbox"/> Partially agree <input type="checkbox"/> Neither agree nor disagree <input type="checkbox"/> Partially disagree <input type="checkbox"/> Totally disagree
My activities could be helped by the use of VR/AR	<input type="checkbox"/> Always <input type="checkbox"/> Frequently <input type="checkbox"/> Occasionally <input type="checkbox"/> Rarely <input type="checkbox"/> Never
I am motivated to use VR/AR	<input type="checkbox"/> Totally agree <input type="checkbox"/> Partially agree <input type="checkbox"/> Neither agree nor disagree <input type="checkbox"/> Partially disagree <input type="checkbox"/> Totally disagree

AR – augmented reality; VR – virtual reality.

to investigate the potential benefits of VR and augmented reality (AR) technologies. The VR and AR have demonstrated potential in enhancing accessibility and inclusivity by providing immersive experiences that can simulate various environments, offer training opportunities, and facilitate communication. This questionnaire aims to gather information to advance our understanding of the unique obstacles faced by individuals with impairments and explore the potential of VR and AR in creating a more inclusive and accommodating future. The respondents that did not have any type of disability will skip questions 2 and 3, while those with a disability will skip question 4. This allows to inquire both perspectives while having a common understanding of their motivation for the use of immersive experiences. In Table 1 we can observe the questionnaire structure as well as the included questions. These were specifically developed by the authors for this study and are based



**Table 2.** Questions in 4 categories asked to the pregnant women from Poland and Estonia (October–December 2021, Łódź, Poland and Tartu, Estonia)

Category	Question
Daily life activities	<ul style="list-style-type: none"> <li>■ What daily tasks are harder to do or more complicated?</li> <li>■ What were some things that took time getting used to?</li> <li>■ Was there anything unexpected that came with being pregnant?</li> <li>■ Are there things you need to keep in mind while doing daily activities?</li> </ul>
Health	<ul style="list-style-type: none"> <li>■ Is there anything that you cannot eat now that you are pregnant?</li> <li>■ Has pregnancy impacted your health?</li> </ul>
Commuting	<ul style="list-style-type: none"> <li>■ How do you commute and has it changed since getting pregnant? Has pregnancy affected or hindered your ability to drive?</li> <li>■ Are there any new complications that have arisen in social situations? Do you or others behave differently?</li> </ul>
Work/school	<ul style="list-style-type: none"> <li>■ Have you experienced any new obstacles in your work/school environment?</li> <li>■ Is there anything your workplace or school could improve upon for pregnant women?</li> </ul>

on existing questionnaires, namely *WHO Disability Assessment Schedule* (WHODAS) [27].

### Pregnancy questionnaire

Pregnancy is not a disability; rather, it is a natural and temporary state of physical and hormonal changes. Nevertheless, pregnancy may require adjustments in daily routines, workplace accommodations, and health-care considerations. In this sense, it is crucial to support and accommodate pregnant women to ensure their well-being and promote a healthy pregnancy journey.

To address the pregnancy group, a set of interviews was prepared, divided into 5 stages: introduction, the part about daily life activities, health, commuting, and the part concerning work/school. The exemplary questions are presented in Table 2. Specialists (a gynecologist and 2 urogynecological physiotherapists) were also a key part of the survey as they work with this group of people daily and know what problems and challenges their patients have to face.

### *Autism Spectrum Disorder Questionnaire*

In the case of ASD, 3 in-depth interviews were conducted by a psychologist. The interviewees were students with a formal medical diagnosis of ASD. The aim was to deepen knowledge about the characteristics of the difficulties that these people may encounter in everyday life. The interviews were informal, but they were based on general dispositions that focused on such topics as everyday functioning, functioning at the university, social relations – with family, peers, etc., establishing social contacts, travel, and movement, sensory sensitivity orientation in space, dealing with difficult situations. Additionally, 2 interviews with parents of children on the autism spectrum presented different

**Table 3.** The *Autism Spectrum Disorder Questionnaire* about daily difficulties used in a survey of students suffering from Autism spectrum disorder from a Higher Education Institution and to parents of ASD children (January–March 2022, Łódź, Poland)

<i>Autism Spectrum Disorder Questionnaire</i>
1. What problems arise in everyday life (at home, in the supermarket, on the playground, on public transport)?
2. What difficulties does your child encounter with learning and “being at school”?
3. How do you relate to other people (family, classmates, teachers, strangers)?
4. What challenges do you face as a parent of a child with special needs?
5. What facilities do you find useful and necessary?

perspectives – the point of view of the closest environment of people diagnosed with ASD. The conversations covered several areas, such as home, school, public places, interpersonal relationships, and facilities for a group of people with this disability. Sample questions are presented in Table 3.

The interviews were analyzed using thematic analysis, and the most frequent challenges were selected.

Through the implementation of these diverse tools, this study aims to provide a comprehensive and multi-faceted analysis of the perspectives of individuals with special needs within HEIs. By exploring these various aspects, the study seeks to contribute to the advancement of inclusive practices, the identification of areas for improvement, and the promotion of a more accessible and supportive educational environment for individuals with special needs.

## RESULTS

After the application of the described methodology, the authors have analyzed the collected data from which we present the main results in the next subsections.

### General Disability Questionnaire

The current results of the *General Disability Questionnaire* come to confirm and extend previous conclusions, from a 2021 study [28,29], that was now applied to a larger population. We have inquired 112 individuals (68 males and 44 females) with an age range 18–25 years. All participants were from Portuguese HEIs. The aggregated results can be observed in the charts in Figure 1.

From the first question results, we can observe that hearing, vision, and mental impairments are the most prevalent, representing 78% of the total. Most students report that this is negatively impacting their performance, with 59% of the population agreeing or totally agreeing with this. Social activities and interpersonal interactions, especially with teachers, are the activities that are reportedly most affected and where additional help would be welcomed. This may indicate that, in addition to the direct impacts, the existence of some types of disability also has serious indirect impacts that cover various aspects of the individual's social life. The persons that didn't have any disability (and did not answer the previous questions) declared in the vast majority that they are not able to put themselves in the shoes of a person with a disability and that they don't know or understand the challenges of living with a disability. Most of the respondents report that VR and AR can be useful technology as assistive technology but also as a way of experiencing these conditions. Finally, most students declare a positive or very positive attitude toward the use of VR and AR.

### Pregnancy

The interviews conducted with pregnant women and experts in the field have provided further validation to the findings obtained through initial desk research. The pregnancy group consisted of 6 women ( $M \pm SD$  29.4 $\pm$ 3.74 years), 2 women during their second pregnancy and 4 being pregnant for the first time. The interviews were conducted using video conference call technology, with woman from different geographical locations in Europe.

While pregnancy is often regarded as a wonderful time in a woman's life, it is important to acknowledge that it can bring about minor disorders due to postural, hormonal, and metabolic changes. These alterations can lead to significant transformations in a pregnant woman's state. Moreover, daily challenges tend to evolve and manifest differently. The mentioned minor ailments, although not typically posing significant risks to the woman or fetus, include symptoms such as nausea, tiredness, more frequent urination, constipation, back pain, pelvic pain,

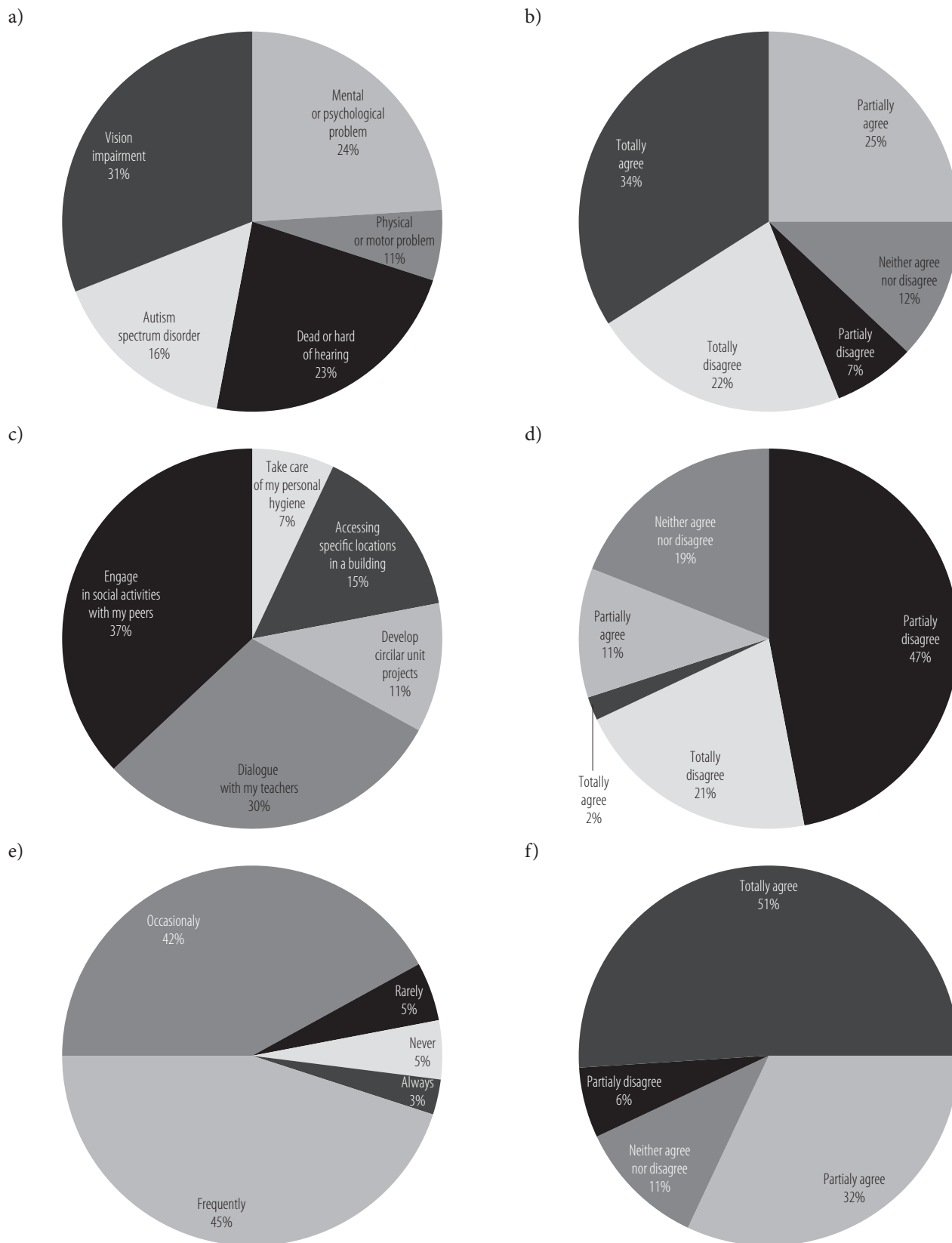
fluctuating emotions, touchiness, problems with concentration, and fluid retention in the body.

These minor ailments experienced by pregnant women can have various impacts on their work, commuting, and other daily tasks. Nausea and tiredness, e.g., may result in decreased energy levels and difficulty concentrating, affecting overall productivity and performance at work. During the commute, symptoms like nausea and fatigue can make traveling more challenging and uncomfortable for pregnant women, requiring additional considerations for their well-being. Frequent urination may cause inconvenience and disruptions during travel or while engaging in tasks that require continuous focus. Back pain and pelvic pain can affect mobility and limit the ability to engage in physically demanding activities, which can impact work performance and overall daily tasks. Fluctuating emotions and touchiness may affect interpersonal interactions and communication in work and social settings. Additionally, the physical discomfort caused by these ailments can make it more challenging for pregnant women to maintain a consistent level of productivity and engagement in various tasks throughout the day. It is important for employers, colleagues, and society to provide support, understanding, and reasonable accommodations to pregnant women to help them navigate these challenges and ensure their well-being during this transformative period.

### Autism spectrum disorder

For the autism spectrum disorder, we have interviewed 3 students (2 males and 1 female; age range 18–21 years) from Polish HEIs. The participants presented a highly diverse range of intellectual resources and communication styles, as well as variations in their specific disorders. Significant differences were identified, particularly in the realm of social communication. The interviews showed a full spectrum of features characterizing people with Asperger's syndrome – from verbosity and eloquence in statements (flowery speech, sophisticated vocabulary) to significant difficulties with speaking, finding the right word and the impression of mental slowdown. Each of the respondents spoke about a slightly different aspect of the difficulties and challenges they face on a daily basis. Problems mentioned by the students include:

- being out after dark, which is associated with a high sense of danger and uncertainty,
- annoying visual stimuli, such as negative reactions to specific colors (often bright colors) or patterns,
- stressful/irritating sensory stimuli, e.g. burning smell,



AR – augmented reality; VR – virtual reality.

**Figure 1.** Results for the *General Disability Questionnaire*: a) What type of disability do you have?; b) My disability has a negative impact on my activities; c) I could need help on...; d) I can put myself in the shoes of a person with disability and I am aware of their daily challenges; e) My activities could be helped by the use of VR/AR; f) I am motivated to use VR/AR

- difficulties with emotional functioning and maintaining balance, experiencing everything for no reason,
- emotional imbalance caused by auditory stimuli (e.g. the sound of a vacuum cleaner or dryer),
- feeling lost in the new, virtualized reality at the university and often a sense of loneliness,
- difficulties in functioning in a group,
- problems with spatial orientation, such as finding buildings, specific rooms at the university, or new places in urban space (using available mobile applications partially solves these problems).

Based on the interviews, it can be concluded that social relationships are important for people with ASD, despite the fact that problems in this area are one of the diagnostic criteria of this disorder.

In addition, the authors have conducted interviews with 2 parents of autistic children that provided further insights about this subject by proving a closed related perspective. The first interview with the parent of a 14-year-old boy (diagnosed with Asperger's syndrome in kindergarten) confirmed the positive effect of the therapy. Over the years, the boy's behavior changed, and he is able to function among his peers, interpersonal relationships are no longer as problematic for him as at the beginning of his education. Avoiding eye contact is the only behavior that can be noticed after a short contact with the boy. Interestingly, the 14-year-old from an early age is maniacally interested in selected topics (scooters, slides, roller coasters, snakes, predatory animals, fans, fireworks). If he is passionate about something, he literally "absorbs" knowledge about it, becoming an "expert" in this field. In discussions, he behaves like an adult, which is why it was sometimes difficult for him to find a common language. The boy finds himself best in repetitive, routine situations. Every disturbance in the routine makes him anxious and dissatisfied. The second interview with the mother of the 8-year-old showed a slightly different perspective. The boy does not do well around strangers. He feels very uncomfortable when touched. He doesn't shake hands. He is very sensitive to sounds, especially loud and abrupt ones, such as the school bell ringing. He is often overstimulated in public places and feels lost. In modern buildings with many glazed elements, people cannot stay freely. If there are railings on the first floor of the building, the boy has the impression that he will fall through them. In huge shopping centers, he is disturbed by excessive noise and crowds of people. Avoid glass elevators. In this case, the boy's parents must take special care of their son's environment so that he is able to function.

## DISCUSSION

Based on the questionnaires' answers and bibliographic research, an outline of the main inclusion challenges will now be presented. Inclusion difficulties are an underestimated problem and a major cross-cutting issue in society, affecting different ages or genders, from young children to the elderly. These often face stigmatizing practices, including labelling, stereotyping, setting apart, and discrimination against members with impairments. Their inclusion is only acceptable if it does not affect the pre-defined procedures or course of activities [30]. When focusing on a working-age population it is reported that workplace inclusion of employees, who have back pain or mental health problems, is difficult, particularly when their health problems are not clear and longstanding [31]. In fact, people with disabilities face low employment rates, a high dependency on benefits as well as increased poverty risk [32]. Concerning children, it is found that children with disabilities face challenges in gaining entry to play, feeling like legitimate participant, and having friends, which affects their inclusion in physical activity [33]. Moreover, there are specific studies on different countries and communities, demonstrating that we are facing a widespread problem. Overall, inclusion is a complex issue that requires a multi-faceted approach to address the various challenges they face.

### Mobility and vision

Persons with mobility and sight impairments face significant inclusion challenges that can limit their participation in various aspects of life. One of the main challenges is physical accessibility. Many public spaces, buildings, and transportation systems are not adequately designed to accommodate individuals with mobility impairments. Lack of ramps, elevators, accessible restrooms, and tactile cues can hinder their mobility and independence. Similarly, individuals with sight impairments often encounter barriers related to the built environment, such as inaccessible signage, poor lighting, or the absence of Braille or audio information. These physical barriers can isolate individuals, restrict their freedom of movement, and impede their ability to access essential services, employment opportunities, education, and social activities.

Another major challenge lies in communication and information accessibility. Persons with hearing or visual impairments may face difficulties in accessing information, understanding spoken or written content, or participating in conversations. Inadequate provision of sign



language interpretation, captioning, large-print materials, or assistive technologies like screen readers can create barriers to effective communication and limit their engagement in various settings, including workplaces, educational institutions, and social gatherings.

Socio-cultural attitudes and stereotypes further contribute to inclusion challenges. Misconceptions, biases, and discriminatory attitudes towards individuals with mobility and sight impairments can lead to social exclusion, stigmatization, and limited opportunities for meaningful engagement. Negative perceptions may hinder the development of inclusive policies, practices, and attitudes within communities, reinforcing societal barriers and perpetuating the marginalization of these individuals.

Additionally, economic barriers can hinder inclusion for persons with mobility and sight impairments. Limited access to employment opportunities, workplace accommodations, and financial resources can create barriers to economic independence and social participation. Lack of accessible transportation options, limited availability of assistive technologies, and high costs associated with specialized support services can further exacerbate the economic challenges faced by individuals with disabilities.

Individuals with mobility and sight impairments confront notable challenges when it comes to inclusion, which can restrict their involvement in various aspects of life. Among the primary hurdles is the issue of physical accessibility. Numerous public spaces, buildings, and transportation systems are inadequately designed to cater to individuals with mobility impairments. The absence of ramps, elevators, accessible restrooms, and tactile cues can hinder their mobility and independence. Similarly, those with sight impairments frequently encounter obstacles related to the built environment, such as inaccessible signage, poor lighting, or the absence of Braille or audio information. These physical barriers can lead to isolation, curtail their freedom of movement, and hinder their access to essential services, employment opportunities, education, and social activities.

Communication and information accessibility pose another significant challenge. Persons with hearing or visual impairments may encounter difficulties in accessing information, comprehending spoken or written content, or engaging in conversations. Inadequate provisions of sign language interpretation, captioning, large-print materials, or assistive technologies like screen readers can create barriers to effective communication and limit their participation in various settings,

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In addition to socio-cultural factors, economic barriers can hinder inclusion for persons with mobility and sight impairments. Limited access to employment opportunities, workplace accommodations, and financial resources can create obstacles to economic independence and social participation. The lack of accessible transportation options, limited availability of assistive technologies, and high costs associated with specialized support services can further exacerbate the economic challenges faced by individuals with disabilities. These financial constraints can prevent them from fully participating in society and accessing the resources they need to thrive.

Addressing these inclusion challenges requires a comprehensive approach that involves the collaboration of policymakers, designers, businesses, and society as a whole. By prioritizing and investing in accessible infrastructure, implementing inclusive communication strategies, promoting awareness and understanding, and ensuring equal economic opportunities, we can work towards creating a more inclusive and supportive environment for individuals with mobility and sight impairments. Such efforts will not only enhance their quality of life but also enrich the diversity and strength of our communities as a whole.

### **Pregnancy**

Pregnancy describes the period in which a fetus develops inside a woman's uterus and during this time many changes happen in the woman's body. Even the state of being pregnant seems to be something usual and present in public spaces, the awareness about the daily challenges of pregnant women is not very extended. In this context, there are several crucial inclusion challenges that must be addressed to ensure their well-being and full participation in society. One of the key challenges is related to workplace accommodations. Pregnant women often require specific adjustments in their work

environment to ensure their comfort and safety. This can include modifications to work schedules, the provision of ergonomic equipment, the availability of suitable facilities, and the flexibility to modify duties as needed. Additionally, discrimination and bias against pregnant women are prevalent challenges that hinder their inclusion. Negative attitudes, stereotypes, and biases can limit opportunities for pregnant women in various domains, including employment, healthcare, and social interactions. It is essential to combat such discrimination and foster a culture of inclusivity and acceptance.

Access to healthcare is another critical inclusion challenge for pregnant women. Ensuring that pregnant women have affordable and accessible healthcare services is vital for their overall well-being and the health of their unborn children. This includes providing comprehensive prenatal care, regular check-ups, and necessary medical interventions. Furthermore, maternity leave policies and parental support play a significant role in promoting inclusion. Pregnant women need adequate time off work to recover from childbirth and bond with their newborns. Offering flexible return-to-work options and providing supportive environments for balancing work and family responsibilities can contribute to their inclusion and well-being.

Social support and education are crucial for pregnant women, and the lack thereof can pose significant challenges to their inclusion. Access to supportive networks, community resources, and accurate information about pregnancy, childbirth, and parenting is essential. Addressing cultural and societal norms is another aspect of promoting inclusion for pregnant women. Challenging societal expectations around appearance, behavior, and work-related responsibilities can help create an inclusive environment that supports pregnant women without imposing unnecessary limitations or biases.

Addressing these inclusion challenges requires a comprehensive and multifaceted approach. It involves the development and implementation of supportive policies, raising awareness about the rights and needs of pregnant women, providing education and resources, and fostering a culture that values and supports their inclusion. By addressing these challenges head-on, we can work towards a society that ensures the well-being and full participation of pregnant women, promoting their rights and creating an inclusive environment for all.

When pregnancy occurs during university, pregnant students may encounter additional inclusion challenges that impact their academic journey and overall well-being. These challenges encompass various areas,

including the need for academic accommodations such as flexible attendance policies, extended deadlines, and modified schedules to support their pregnancy-related needs. Social support becomes crucial, as pregnant students may experience feelings of isolation or difference from their peers. Creating a supportive community through peer groups, counseling services, and student organizations can help address these challenges and foster a sense of belonging. The physical environment on campus should be made more accessible, ensuring pathways, elevators, and restroom facilities are accommodating for pregnant students. Access to comprehensive health and wellness services, including prenatal care and counseling support, is vital. Additionally, providing resources for parenting support, such as childcare facilities and lactation rooms, can assist pregnant students who become parents during their studies. Raising awareness about the challenges faced by pregnant students and providing education on available resources through orientation programs and workshops are essential steps in creating an inclusive environment within universities.

Finally, pregnant women face unique challenges when using public transportation. These challenges can include overcrowded conditions, lack of seating availability, long waits, and difficulty maneuvering through crowded spaces. Standing for long periods may be uncomfortable or even physically taxing for pregnant women, and the lack of designated seating can exacerbate their discomfort. In most countries, the inclusion of pregnant women is clearly visible in public transport in various means of transport. There are special seats for those people, and they have priority to sit there.

Despite pregnancy being a common occurrence, awareness about the daily challenges of pregnant women is not widespread. Key challenges include workplace accommodations, discrimination and bias, access to healthcare, maternity leave policies, social support, and education. Addressing these challenges requires a comprehensive and multifaceted approach, including supportive policies, awareness-raising, education, and fostering a culture of inclusivity.

### **Autism spectrum disorder**

The clinical picture of ASD is based on the coexistence of symptoms in 3 areas: language and speech development disorders, difficulties in social functioning, and limited stereotyping of behavior and interests [6]. However, due to the fact that the symptoms of social deficits and communication difficulties are difficult to separate

(e.g., a person with ASD may have relatively undisturbed language skills, and show other communication problems – e.g. lack of eye contact, which causes difficulties in creating relationships social), it is currently assumed that communication and social dysfunctions are one psychopathological dimension. The second is the stereotype of behaviors and interests, within which several types of symptoms are distinguished: extremely intense bizarre interests, attachment to atypical, unintentional patterns of behavior, motor mannerisms, and focus on parts of complex objects (ibid.). In people with ASD, repetitive sensory-motor activities and attachment to constancy (difficulty changing behavior patterns, rituals, unnatural attachment to objects) and extremely intense, limited interests were also observed [34].

The above-mentioned symptoms cause specific challenges for the social inclusion of people with ASD. Problems with verbal and non-verbal communication (e.g. stiff, formal speech, a problem with understanding metaphors, a “strange” sense of humor, poor or inappropriate facial expressions, stereotypical movements, not maintaining eye contact) cause difficulties in establishing closer relationships in the group and are a significant obstacle to equal participation and involvement in various types of social activities (social, cultural, sports, etc.) [35].

In addition, we often deal with a situation of self-exclusion, e.g. due to overstimulation of people with ASD in social situations [36]. Hypersensitivity to sensory stimuli (e.g. smells, colorful clothes, the pitch of the voice of people in the environment) combined with difficulties in sensory integration of received messages causes people with ASD to avoid or withdraw from aggravating social situations. This is an additional barrier to inclusion, as neither people with ASD nor the social environment in which they function have the opportunity to integrate and get to know each other.

Children with ASD are perceived as “different” and not accepted in their peer group. On the other hand, schools lack qualified teaching staff able to develop the social skills of this group of children with special needs. As a consequence, these children are perceived as “naughty” and “non-adjustable,” which results in poorer performance and a weakening of their motivation to learn. Therefore, the intellectual potential (often very high) of children with ASD is not properly developed, which is a barrier to educational and, consequently, professional inclusion for this group [37].

Addressing these inclusion challenges requires a multi-faceted approach. It involves promoting universal design principles to ensure physical accessibility,

advocating for the implementation of inclusive policies and legislation, raising awareness about the rights and capabilities of persons with mobility and sight impairments, and fostering inclusive attitudes and practices within society. Providing assistive technologies, accessible communication formats, and inclusive educational and employment opportunities are also crucial in facilitating full and meaningful participation. Ultimately, creating an inclusive society entails recognizing and valuing the diverse abilities and contributions of all individuals, ensuring that every person, regardless of their impairment, has equal opportunities to lead fulfilling lives and participate fully in their communities.

The clinical presentation of ASD encompasses symptoms in three main areas: language and speech development disorders, difficulties in social functioning, and restricted and repetitive behaviors and interests. Communication and social dysfunctions are considered one psychopathological dimension, as they often coexist and are difficult to separate. Individuals with ASD may exhibit communication difficulties, such as lack of eye contact and poor facial expressions, which hinder their ability to form close relationships and participate fully in various social activities. Furthermore, the presence of repetitive sensory-motor activities and their limited interests adds to the challenges faced by individuals with ASD in social inclusion.

These specific challenges often lead to self-exclusion from social situations due to sensory hypersensitivity and difficulties in sensory integration. People with ASD may avoid or withdraw from overwhelming social environments, inhibiting the opportunity for mutual integration and understanding between them and their social surroundings. Children with ASD may also encounter difficulties in educational settings, as they may be perceived as different and face a lack of qualified teaching staff capable of developing their social skills.

Again, to address these inclusion challenges, a multi-faceted approach is necessary. It involves promoting universal design principles to ensure physical accessibility, advocating for the implementation of inclusive policies and legislation, and raising awareness about the rights and abilities of individuals with ASD. Fostering inclusive attitudes and practices within society is essential in creating an environment where individuals with ASD feel accepted and supported. Providing assistive technologies, accessible communication formats, and inclusive educational and employment opportunities can play a crucial role in facilitating their full and meaningful participation in society.

### Immersive experiences for empathy

Immersive experiences powered by VR or AR hold immense potential in fostering a profound sense of empathy towards disability. By creating virtual worlds that authentically replicate the everyday struggles and triumphs of individuals with disabilities, these technologies have the extraordinary capacity to transport users into the very heart of their experiences, compelling them to see the world through a different lens.

One of the most remarkable advantages of immersive experiences in VR or AR lies in their ability to evoke a genuine sense of presence and embodiment. Users are not merely observers but active participants, fully immersed in simulated environments that accurately emulate the physical and sensory realities of living with a disability. This deeply immersive encounter can elicit powerful emotional responses, dismantling prejudices and fostering a newfound appreciation for the challenges faced by individuals with disabilities.

Moreover, VR and AR technologies offer interactive and customizable experiences, enabling users to engage directly with the virtual world. They can undertake tasks, navigate obstacles, and confront the very same difficulties encountered by individuals with disabilities. This hands-on approach fosters a profound empathy as users grapple with the physical, emotional, and social barriers that people with disabilities confront each day. Through these immersive experiences, empathy blooms, leading to a greater understanding of the unique perspectives, strengths, and struggles of individuals with disabilities.

The safe and controlled learning environment provided by immersive experiences is yet another compelling advantage. Users can venture into diverse scenarios and situations without real-world consequences, affording them the freedom to experiment, make mistakes, and grow from their experiences. In this nurturing space, empathy flourishes as users gain profound insights into the complexities and intricacies of disability, surpassing the limitations of traditional education or awareness campaigns.

The far-reaching impact of immersive experiences extends to their ability to reach and resonate with a broad audience. As VR and AR technologies become increasingly accessible and affordable, these experiences can transcend societal boundaries, engaging diverse populations in the pursuit of empathy. By dismantling preconceived notions and biases surrounding disability, immersive experiences cultivate a culture of inclusivity and understanding, propelling society towards compassion and embracing the richness of diversity.

In essence, immersive experiences in VR or AR offer unparalleled benefits in fostering empathy towards disability. They grant individuals the transformative opportunity to immerse themselves in the world of others, sharing their joys and tribulations on a deeply visceral level. By nurturing empathy, these groundbreaking technologies have the potential to spark profound social change, foster genuine inclusivity, and shape a world where empathy triumphs, and the power of understanding paves the way to a more compassionate and inclusive society.

The reported results allowed to pave the way for the development of immersive experiences tailored to each type of disability within the Mr. UD project [16,38]. To achieve the goal of promoting empathy and understanding, we have created a user-centered pipeline that places the user at the forefront of the VR experience. In this approach, the user is viewed not simply as a passive observer, but as an active participant who plays a key role in translating stimuli into a manifestation of empathy. By creating a virtual experience that is personalized to the needs and preferences of the user, we aim to create a deeper connection and understanding between the user and the experience itself.

The user-centered pipeline is designed to be highly adaptable and flexible, allowing for customization based on individual needs and abilities. By prioritizing the user's input and feedback throughout the design process, the authors ensure that the VR experience is optimized for maximum impact and effectiveness. Through this approach, the authors aimed to create a transformative experience that encourages users to develop greater empathy and understanding for individuals with disabilities and impairments.

### CONCLUSIONS

In this article, the authors wanted to represent the challenging landscape that people with disabilities must deal with in their daily activities. Some definitions and exploration of the evolution of disability and the role of immersive experiences have been presented. To properly design immersive experiences that address important challenges experienced by individuals with disabilities, questionnaires and interviews were utilized, guided by field experts. These collaborative efforts yielded profound insights into the experiences, needs, and aspirations of individuals with special needs. With this knowledge, practical and actionable guidelines have been developed to empower designers and developers in



creating personalized immersive experiences. Placing user experience at the forefront ensures that each immersive encounter offers an authentic and empathetic journey, bridging the gap between understanding and inclusion. The vision extends beyond the realms of design and development, aiming to foster a society that celebrates diversity, embraces inclusion, and embraces an empathetic attitude. Immersive experiences are utilized to break down barriers, challenge stereotypes, and foster genuine connections between individuals, fostering a deep sense of compassion and understanding.

### Institutional review board statement

Ethical review and approval were waived for this study due to the involved institutions not having a formal Ethics Committee. In the case of the presented studies, all standards of ethical conduct of research were ensured in accordance with the Helsinki declaration. When planning the research process, ethical issues were crucial. The research was planned with respect for the dignity of the participants, their right to refuse to participate or abandon the study at any stage of implementation, ensuring a sense of security while always considering the participants welfare.

For both types of research (questionnaires and interviews), participants were initially informed about the objectives of the study, and that the participation in the research was entirely voluntary. Participants gave informed consent to participate in the study, and their data was anonymized when necessary.

For the questionnaire covering individuals with declared disabilities, 2 back-office groups were created:

- one group responsible for delivering the questionnaires to the individuals, but with no access to the results,
- another group, responsible for receiving and processing the questionnaire results, but with no access to the respondents.

In the first section of the questionnaire, all participants were fully informed about the guarantee of anonymity, the research objectives, how the data would be used only for research purposes and the authors' contact details.

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### Author contributions

**Research concept:** Luis Pinto-Coelho, Anna Laska-Leśniewicz

**Research methodology:** Luis Pinto-Coelho, Anna Laska-Leśniewicz

**Collecting material:** Luis Pinto-Coelho, Anna Laska-Leśniewicz, Elisabeth Pereira, Joanna Sztobryn-Giercuskiewicz

**Interpretation of results:** Luis Pinto-Coelho, Anna Laska-Leśniewicz, Joanna Sztobryn-Giercuskiewicz, Elisabeth Pereira

**References:** Luis Pinto-Coelho, Anna Laska-Leśniewicz, Joanna Sztobryn-Giercuskiewicz, Elisabeth Pereir

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