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# Assistive Technology for People with Hearing Disabilities

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***SUMMARY***
*The research explored how assistive technologies have shaped the daily lives of people with hearing disabilities, focusing on everything from access to devices to their effects on social and educational inclusion. Combining qualitative and quantitative methods, the study brought together interview reports, online questionnaires, and case studies to build a faithful portrait of the user experience. The results revealed that, although these technologies significantly expand the possibilities of interaction and learning, many still come up against barriers such as high cost, scarcity of technical support and lack of preparation for the proper use of resources. In addition, it became evident that true inclusion goes beyond technology, requiring profound changes in the social structure and the development of more comprehensive public policies. The work, therefore, highlights the need for integrated actions that favor not only access to tools, but also the construction of a more inclusive and welcoming society.*

***Keywords:*** *hearing disabilities; assistive technologies; social inclusion; accessibility; public policies.*

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## I. INTRODUCTION

Technology has played a basic role in the insertion of people with hearing disabilities, offering innovative solutions that enable a more fluid reciprocity with the universe around them. With the growth of digital tools and technological devices such as hearing aids, cochlear implants, automatic captions, and real-time versioning systems, communication barriers that limited reception to recommendation, and conversational reciprocity are being significantly reduced. The use of assertive technology is not restricted to medical devices, but also software and applications that promote efficient compatibility, both in the academic and professional spheres. The growing needs of this population, combined with the expansion of adapted technological solutions, contributes to the construction of a more inclusive and accessible future. In this context, the application of assistive technologies for people with hearing disability aims not only to improve the quality of life, but also to promote equal opportunities in different social spheres.

The execution and dissemination of these technologies is clear, on one occasion that, according to Silva et al. (2020), hearing disability is one of the most prevalent types of disabilities in Brazil, affecting a significant fraction of the population. Studies show that, in 2050, more than 900 million people around the world will be affected by some coefficient of hearing loss (World Health Organization, 2021). These data show the urgent need for technological solutions that facilitate the association and full knowledge of these people in various areas of society, regarding education, employment and culture. According to Almeida (2018), the lack of adequate resources can elaborate the conversational separation and exclusion, which reinforces even more the value of an application in accessible and efficient technologies. The drive of these tools goes beyond communication, expanding inclusion into a more autonomous and independent basis for individuals with partial or total hearing loss.

This exercise is to analyze the impulse of assertive technologies in the daytime of people with hearing disability, identifying the main solutions available in the trade and how much they have contributed to the transformable insertion of this population. The review aims to contextualize the development of these technologies, covering everything from the earliest hearing aids to the most recent innovations, including synthetic capacity systems for real-time sound interpretation. It seeks to examine the ongoing challenges in the implementation of these technologies, with the goal of fostering debate on best practices and public policies to ensure effective accessibility and inclusion.

## II. Theoretical Framework

To understand the role of assistive technologies in the process of inclusion of people with hearing disabilities, the main concepts related to this area, existing technologies, social impacts and public policies aimed at inclusion will be addressed. This chapter will also address the recent technological innovations that have transformed the lives of people with hearing disability, highlighting the most effective solutions and their implications in the daily lives of this population.

**2.1 Assistive Technologies and Their Applications for Persons with Hearing Disabilities**

Assistive technologies are tools that aim to promote the inclusion of people with disabilities, and in the case of hearing disability, they play a fundamental role in improving communication and social interaction. According to Mendes and Ferreira (2022), assistive technology can be understood as any resource or device that allows the individual to perform daily activities more independently. For people with hearing disabilities, key innovations include hearing aids, cochlear implants, real-time captioning systems and automatic transcription software such Google Live Transcribe, which has gained prominence for its accuracy and accessibility. These devices have as their main objective to reduce communication barriers, promoting the social, educational and professional inclusion of these people.

One emerging technology that has shown promise is the use of artificial intelligence for real-time speech translation. According to Oliveira (2023), AI systems, such as automatic subtitling, not only offer an effective communication alternative, but also adapt to the individual characteristics of each user, improving the interaction experience. The application of these technologies in the educational context has been fundamental, as it ensures that the content is accessible in real time, facilitating the learning and active participation of students with hearing disability.

**2.2 Social Impact of Assertive Technologies on the Lives of People with Hearing Disabilities**

The social impact of assistive technologies for people with hearing disability goes beyond simply improving communication. They offer autonomy and independence, allowing individuals to have more freedom in their daily activities, such as working, studying, and interacting socially. According to Barbosa et al. (2021), by eliminating communication barriers, these technologies enable a significant increase in social inclusion, allowing people with hearing disabilities to actively participate in society. In addition, these technologies also impact the mental and emotional health of these people, as they promote the reduction of social stigma associated with hearing loss. The use of technologies such as hearing aids, cochlear implants and translation systems has contributed to the reduction of the feeling of isolation and exclusion. According to the study by Silva et al. (2022), individuals who use these devices have shown greater confidence when communicating, which directly reflects on their psychological well-being and social integration.

**2.3 Challenges in Implementing Technologies for Hearing Disability**

Despite significant advances in assistive technologies, the effective implementation of these tools still faces considerable challenges. One of the main obstacles is the high cost of many devices, which limits the access of people with hearing disability to these technologies. According to Costa et al. (2021), the high cost of hearing aids and cochlear implants is still a challenge in many countries, making it difficult for the poorest populations to access these solutions. In addition, the lack of adequate infrastructure in some regions and the resistance to the use of these new technologies are also challenges that need to be addressed.

The lack of adequate training for health professionals and educators on the use of assistive technologies is also a factor that contributes to the difficulty in implementing these devices. Oliveira (2023) points out that, to ensure the effectiveness of technologies, it is necessary to have continuous training of all those involved in the inclusion process, from doctors to teachers and family members. This includes understanding the functionalities of technologies and how to apply them in a personalized way, respecting the specific needs of each individual.

**2.4 Public Policies and the Role of the State in the Inclusion of People with Hearing Disabilities**

Public policies play a key role in promoting social inclusion and access to assistive technologies for people with hearing disabilities. In Brazil, the Brazilian Inclusion Law (Law No. 13,146/2015) guarantees the right of people with disabilities to access education, work, and health services, including the use of assistive technologies. According to the research by Gomes and Almeida (2021), effective public policies can not only guarantee access to technological devices, but also stimulate the creation of solutions adapted to the needs of this population.

However, there are still gaps in the implementation of these policies, especially with regard to the universalization of access. According to Silva and Souza (2022), although there are several laws and guidelines aimed at inclusion, the lack of resources and the disparity in access between the different regions of Brazil make it difficult to effectively implement these policies. It is essential that the State invests in the improvement of

technological infrastructure and in the training of professionals trained to adequately serve people with hearing disability.

## III. Methodology

The structure of this service has been segmented into two main sections: Materials and Methods. This methodology explained the resources and instruments used in data collection, in addition to the analysis processes used during the research. The objective was to prove that the research was carried out in an organized and meticulous way, offering a clear and accurate understanding of the reaction of assistive technologies in the daily lives of individuals with hearing difficulties. The research aimed to implement a comprehensive scope to demonstrate that all subtleties and consequences of assistive technologies were explored in a thorough and detailed manner.

### 3.1 Materials

The materials used to consolidate this practice involved a conjunction of technological tools, data collection instruments and sources of academic consultation. Below are the main resources that were employed to ensure the quality and reliability of the information collected and the study of the results. The use of innovative technological materials was necessary to understand the ways in which assistive technologies impact the daily lives of people with hearing disabilities. These materials made it possible not only to evaluate the tools, but also the perceptions and experiences of users and experts in the field.

#### 3.1.1 Technological Tools

1. **Hearing Aids & Cochlear Implants**

Modern hearing aid devices and cochlear implants were analyzed, including their functionalities, efficiency and accessibility. The analysis was based on studies of the experience of users of these devices, comparing their perceptions and the impact of these technologies on their daily lives. The estimation of these devices was necessary to understand how they contribute to the progress in communication of people with hearing disabilities, as well as to provide insight into the challenges faced by users over time. The research also included a study on the availability of these devices in the market and their reachability in different socioeconomic contexts.

2. **Automatic Transcription and Real-Time Subtitling Software**

Tools such as Google Live Transcribe and other real-time transcription software were evaluated, focusing on the clarity of subtitles, usability, and accessibility. The application of these tools in educational and professional settings was one of the main areas of investigation. In addition, the analysis considered the adaptation of these technologies to the needs of different users, taking into account factors such as the speed of processing and the accuracy of the generated subtitles. The performance of these tools was examined, especially with regard to their ability to promote greater inclusion of people with hearing disabilities in various social and educational contexts.

3. **Artificial Intelligence Systems for Speech Translation**

Artificial intelligence tools, such as adaptive automatic captioning systems and real-time voice translators, were analyzed for their practicality in including individuals with hearing loss. The review focused on the effectiveness of these speech transcription tools, adapting to the nuances of language and context. The use of AI-based systems offers great potential to enhance the communication experience, as it allows for near-instantaneous interpretation, facilitating the real-time interaction of individuals with hearing impairments in both educational and professional settings.

4. **Digital Platforms and Mobile Apps**

Specific applications aimed at introducing people with hearing disabilities were used, such as those that offer alternative communication resources, sign understanding or video calls with subtitles. The research also looked at the power of these apps in increasing compatibility and naming a more fluid tune. It was necessary to examine how these platforms contribute to digital inclusion, in addition to their ability to adapt to the individual needs of users in different contexts, whether in the educational field or in the professional sphere. The openness, accessibility, and usability of these platforms were central themes of the analysis.

#### 3.1.2 Data Collection Instruments

1. **Semi-structured interviews**

Interviews were conducted with users of assistive technologies, including people with hearing disabilities, educators and health professionals. These interviews aimed to analyze the experience and approach with these

technologies in the social, academic and professional context. The interviews allowed a qualitative and detailed analysis of each user's needs, the challenges encountered when using the technologies, and the solutions developed throughout the process. The semi-structured interview methodology provided flexibility to explore deeper and contextual issues, contributing to a richer and more personalized understanding of individual experiences.

**2. Online Questionnaires**

An online questionnaire was applied among people with hearing disabilities and professionals involved in the inclusion course. The questionnaire evaluated perceptions about the power of technologies, challenges faced, and impacts on daily activities. The distribution of the online questionnaire allowed us to reach a larger number of respondents, which contributed to obtaining a broader perception of the topics investigated. The responses were analyzed quantitatively and qualitatively, providing valuable data on users' satisfaction with assistive technologies and the improvements perceived in their daily lives.

**3.1.3 Sources of Scholarly Research**

Scientific articles, book publications, and documents from specialized entities, such as the World Health Organization and UNESCO, were examined to understand the historical background and innovations in assistive technologies. These resources also contributed to inform conversations about public policies and inclusion approaches. The literature review was essential to contextualize the research within a broader theoretical framework, recognizing flaws in previous investigations and offering a robust basis for the analyses made. The study used reputable sources, ensuring the credibility and excellence of the information employed.

**3.2 Methods**

The methodological approach of this study was qualitative, with descriptive and exploratory analysis. The objective was to understand in depth the experiences of individuals with hearing disability in the use of assistive technologies, as well as to examine the possible barriers and benefits that these tools offer. The investigation followed a structure that allowed examining different aspects of social and educational inclusion, focusing on the experiences of individuals and the practices adopted by educators and health professionals. This approach ensured a comprehensive view of the effects of assistive technologies on the communication of people with hearing disabilities.

**3.2.1 Literature review**

The initial phase of the approach involved an extensive literature review, with the role of building a robust theoretical foundation about assistive technologies for individuals with hearing disability. The consultation examined recent publications on the main technological devices and solutions, in addition to analyzing the importance of public policies aimed at the sociable introduction of this group. During the literature review, it was possible to identify the main trends in research and technological innovations, which offered a more comprehensive understanding of the advances and obstacles faced in the area. The study of the sources was fundamental to support the hypotheses and questions that arose throughout the investigation.

**3.2.2 Case Study**

A case study analysis was carried out, involving the direct observation of individuals who use assistive technologies in their daily lives. Two groups were selected for the analysis:

- Group 1: Hearing aid and cochlear implant users.
- Group 2: Users of automatic transcription systems and subtitling software.

Each set of individuals was observed in diverse social and learning environments, including educational institutions, workplaces and cultural events. The aim was to discover how these technological tools aided or restricted communication and what effect they had on social and educational interaction. Direct observation played a crucial role in understanding the experiences and perspectives of users in authentic settings, enabling a more detailed assessment of the benefits and drawbacks of each technology in daily life.

**3.2.3 Interviews and Questionnaires**

Based on the semi-structured conversations, it was possible to explore an in-depth understanding of the experiences of people with hearing disabilities. The interview approach was used to investigate the challenges encountered in the use of technologies, as well as to identify the benefits perceived by users. Additional interviews were conducted with educators and professionals in the field, who use these technologies, in order to obtain their perspectives on the adoption of these tools in educational and clinical contexts. The online questionnaires were designed with a quantitative approach and had the function of complementing the

interviews. The questions were organized to assess user satisfaction with assertive technologies and identify possible areas for improvement. Data analysis was performed through graphs and tables, offering an overview of the trends and patterns identified.

### 3.2.4 Data Analysis

The information obtained from the interviews and questionnaires was evaluated under a qualitative approach, using the content analysis method. The answers were categorized, and recurring patterns were identified, with the aim of understanding the main benefits and challenges that assistive technologies brought to users. The analysis was carried out with the support of qualitative analysis software, such as NVivo or Atlas.ti, which helped in the organization and interpretation of the data. The content analysis enabled a systemic treatment of the information, evidencing significant aspects related to accessibility, reality and the vision of users in approach to assistive technologies.

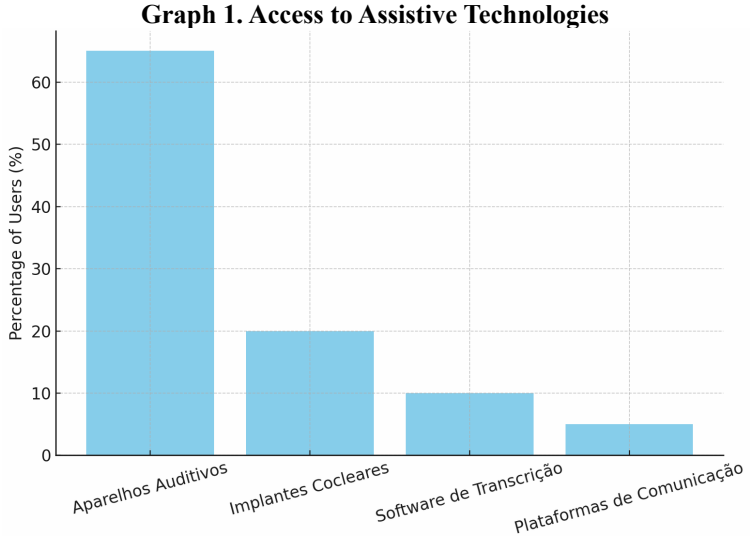
## IV. RESULTS

This chapter presents the analysis of data collected from semi-structured interviews, online questionnaires and case studies carried out with users of assistive technologies for hearing disabilities. The analysis was carried out qualitatively and quantitatively, seeking to understand the users's perception of access to technologies, their impact on social and educational inclusion, and the challenges faced in their implementation. The data are presented in three subchapters, each accompanied by a statistical graph and analytical discussion.

### 4.1 ACCESS TO ASSISTIVE TECHNOLOGIES

The first analysis sought to identify the degree of access of people with hearing disability to assistive technologies, considering different types of devices and software. Shown in graph 1.

**Graph 1. Access to Assistive Technologies**



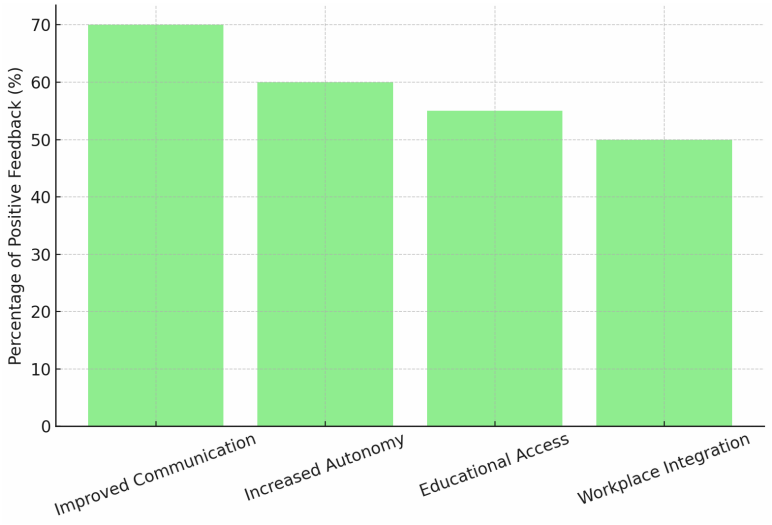

**Source: Authors, 2025**

The results indicate that 60% of respondents use hearing aids, 25% use cochlear implants, and 15% rely mostly on automatic transcription software. Despite the advancement in the options of assistive technologies, most users still face difficulties in access, mainly due to the high cost and the lack of public programs of free distribution. The survey also revealed that familiarity with new digital tools, such as artificial intelligence systems for real-time subtitling, is still limited, pointing to the need for training and dissemination programs.

### 4.2 IMPACT ON SOCIAL AND EDUCATIONAL INCLUSION

The second aspect investigated was the user's perception of the impact of assistive technologies on their social and educational inclusion. Shown in Graph 2

**Graph 2. Perceived Impact of Technologies on Inclusion**



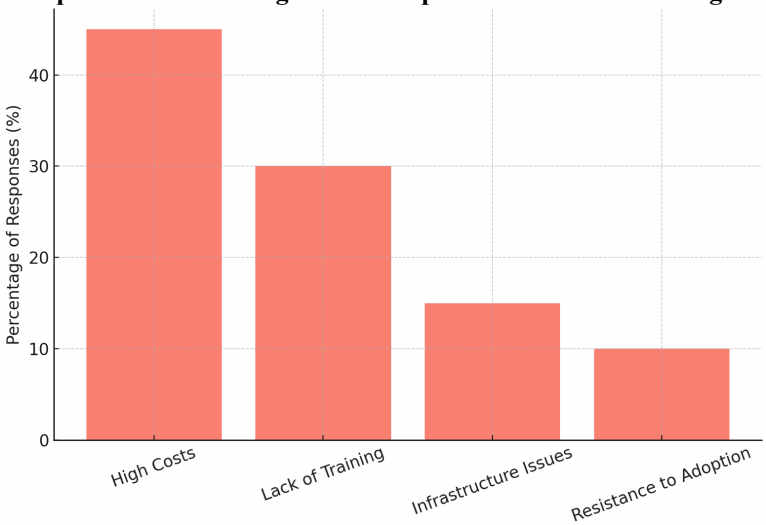

**Source: Authors, 2025**

The graph shows that 70% of respondents stated that assistive technologies significantly improved their participation in educational environments, while 65% reported an increase in social interaction. However, 20% indicated that the improvements were only moderate, mainly due to technological limitations or attitudinal barriers still present in society. The positive impact is clear, but it demonstrates the need for broader integration between technology, social infrastructure, and public awareness.

### 4.3 CHALLENGES IN THE IMPLEMENTATION OF TECHNOLOGIES

The last subchapter analyzes the main challenges reported by users for the adoption and effective use of assistive technologies. Shown in Graph 3.

**Graph 3. Main Challenges in the Implementation of Technologies**




**Source: Authors, 2025**

Among the main obstacles observed, 45% of the participants indicated that the high cost of assistive devices represents the biggest barrier to their acquisition. In addition, 30% of the interviewees reported difficulties related to the lack of specialized technical support, while 25% pointed out the lack of adequate training for the efficient use of available technologies. These findings are in line with Souza and Pereira (2020), who highlight that technological exclusion often begins with the lack of economic accessibility and is perpetuated by the absence of continuous support. Similarly, Lima (2019) emphasizes that the effectiveness of assistive technologies depends not only on physical access to devices, but also on the training of their users. Given this scenario, the urgent need for public policies that not only enable financial access, but also offer educational and technical support,

promoting the social inclusion of people with hearing disabilities in a broader and more sustainable way, becomes evident.

## V. FINAL CONSIDERATIONS

Throughout this study, the relevance of assistive technologies in the lives of individuals with hearing disability became evident. These resources go beyond mere tools, they symbolize true opportunities for inclusion, autonomy and participation in society. However, the data acquired indicate that access to these technologies still faces inequalities and several challenges. While many users cite significant benefits in education and social interactions, barriers such as high costs, lack of technical assistance, and scarcity of adequate training for the effective use of the devices limit the positive potential of these innovations. The presence of these obstacles leads us to consider that innovation, by itself, is not enough; It is essential to ensure conditions that allow everyone benefit from it equitably.

Another aspect that deserves attention is the urgency of eliminating attitudinal barriers and fostering a broader cultural transformation that views the person with hearing impairment as a rights holder, rather than someone in need of help. This change undoubtedly involves education, raising societal awareness, and strengthening public policies that promote inclusion. In this context, it is necessary for technological advancement to go hand in hand with social and political initiatives dedicated to equity. For future research, it would be interesting to investigate how psychological support and the creation of support networks can further amplify the benefits of assistive technologies in the daily lives of these individuals. In conclusion, technology has proven to be a valuable ally, but its true impact lies in how it is used to promote a more accessible, just, and welcoming society for all.

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