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Original Article

Design and Validation of a Telerehabilitation Program for People with Aphasia

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ABSTRACT

This article presents the design and validation of a speech therapy telerehabilitation program for people with aphasia, based on linguistic and cognitive processing models. A set of interactive activities was developed and subject to evaluation by a panel of 16 aphasia experts. Descriptive statistical analyses were used to examine the relevance, adequacy, and coherence of these activities, as well as the clarity of the instructions. Cronbach's alpha coefficient was applied to assess the reliability of the activities, with values ranging from 0.916 to 0.963, which indicates high reliability. The program was incorporated into an online platform developed using Genially, including 48 activities designed to promote communication, cognition, and both oral and written language. The design and validation phase of the telerehabilitation program was conducted via Microsoft Teams and included participants with aphasia from various countries who exhibited high communicative functionality. The program's potential to facilitate communication and the exchange of experiences in a virtual environment was also demonstrated. In conclusion, this study highlights the importance of developing programs that leverage information and communication technologies (ICT) to enhance communication, language, and cognition in individuals with aphasia. This strategy is effective in facilitating inclusion and social participation.

Keywords:
Aphasia; Speech Therapy; Social Media; Telerehabilitation

Diseño y validación de un programa de telerrehabilitación para personas con afasia

RESUMEN

Este artículo presenta el diseño y validación de un programa de telerrehabilitación en fonoaudiología, para personas con afasia, sustentado en los modelos de procesamiento lingüístico y cognitivo. Se desarrolló un conjunto de actividades interactivas, evaluado por un grupo de 16 expertos en afasia. El análisis estadístico descriptivo examinó la pertinencia, relevancia y cohesión de estas actividades, así como la claridad en las instrucciones. Para determinar la confiabilidad de las actividades se aplicó el coeficiente alfa de Cronbach, cuyos valores oscilaron entre 0,916 y 0,963, lo que indica una alta confiabilidad. El programa fue incluido en una plataforma web creada con Genially, la cual considera 48 actividades diseñadas para ejercitar la comunicación, la cognición y el lenguaje tanto oral como escrito. La fase de diseño y validación del programa de telerrehabilitación se realizó con Microsoft Teams y consideró la participación de personas con afasia de alta funcionalidad comunicativa de diversos países. Asimismo, el programa favorece la comunicación y el intercambio de experiencias en un entorno virtual, junto con la inclusión y la participación social. El estudio destaca la importancia de crear programas que utilicen las tecnologías de la información y comunicación (TIC) para mejorar la comunicación, el lenguaje y la cognición de los individuos con afasia.

Palabras clave:
Afasia; Logopedia; Medios de Comunicación Social; Telerrehabilitación

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INTRODUCTION

Aphasia is the loss or deterioration of language skills resulting from a disruption in brain function, typically caused by a cerebrovascular event, traumatic brain injury, or tumor (Teive et al., 2011). This condition primarily affects adults and significantly impacts comprehension, expression, reading, writing, and numerical skills. Besides being a primary language disorder, aphasia produces secondary cognitive and communicative consequences, which can potentially lead to social isolation and a loss of social roles and functions (Andrade Calderón et al., 2015). Patients' self-image is also affected, resulting in fear of social interaction and limiting productivity, which in turn impacts family, social, and occupational life (Rodríguez & Lizarazo, 2015). Many people with aphasia depend on others for daily activities and rehabilitation, resulting in emotional burden and a loss of autonomy (Brandenburg et al., 2017).

Several explanatory models have been proposed to understand the complexity of human language and the consequences of aphasia. The linguistic processing model posits that language is a system with interconnected components, such as the phonological, morphosyntactic, and lexical-semantic, which work jointly during communication. Aphasia occurs when one of these components is disrupted, resulting in various types of impairments depending on the affected subsystem (Jiménez-Crespo, 2017). Another widely accepted framework is the cognitive model, grounded in the cognitive neuropsychology of language, which suggests that the processing of the auditory-oral code occurs through multiple components of the language processing subsystem (Benedet, 2003). Both models provide a comprehensive understanding of the linguistic and cognitive abilities affected by aphasia, serving as a basis for developing effective interventions.

Currently, intervention programs address the various manifestations of aphasia using strategies such as augmentative or alternative communication systems and group-based interventions that facilitate participation in daily and social activities (Cruice et al., 2005). However, telerehabilitation, which employs information and communication technologies (ICTs) to deliver remote interventions, is not yet widely available and requires further evidence to validate its effectiveness (Cid, 2020).

Telerehabilitation has recently emerged as an effective therapy alternative for patients with neurological conditions. By utilizing digital platforms, telerehabilitation allows speech-language therapists and people with aphasia to interact, facilitating interventions that incorporate activities grounded in the principles of linguistic processing and cognitive models. These activities combine visual and auditory prompts, offering multimodal stimulation that supports the practice of communicative skills through simulated tasks and problem-solving exercises. Additionally, techniques such as immediate feedback and positive reinforcement help consolidate the progress achieved, thereby enhancing the quality of life for people with aphasia by promoting independence and social participation.

Telerehabilitation has also proven to be effective in improving cognitive and language functions in post-stroke patients. Several studies indicate that remote intervention contributes to the development of cognitive skills and improvements in quality of life. Furthermore, this approach addresses geographical barriers and resource limitations by enabling continuous training in the home environment (Bernini et al., 2021). Kurland et al. (2018) described how home-based programs, supported by tablets and telepractice, effectively improve object and action naming in patients with chronic aphasia, even when faced with digital literacy challenges. These findings reinforce that telerehabilitation is a practical alternative for people with mobility constraints or limited access to therapy services.

Regarding language therapy, Øra et al. (2020) showed that telerehabilitation can enhance language skills in patients with aphasia, with notable improvements in repetition and sentence production. Additionally, Shahouzaie & Gholamiyan (2024) reported functional communication gains among patients with aphasia who participated in a videoconferencing-based telerehabilitation program. Cherney et al. (2021) found that asynchronous telerehabilitation using an online oral reading system can effectively improve language outcomes in people with aphasia. Collectively, these studies support the viability of telerehabilitation as an effective intervention modality for this condition.

However, there are challenges to the implementation of telerehabilitation, such as the need for technological support, high-speed internet connectivity, and training for both patients and healthcare professionals (Mantovani et al., 2020). Bespoke treatment is essential, as needs and severity levels vary among patients. Despite these limitations, telerehabilitation offers a promising alternative for cognitive and language rehabilitation, allowing for continuity of care and facilitating recovery in people with aphasia. By providing the possibility of receiving support at home, it promotes independence, reduces barriers to accessing services, and improves the quality of life of those affected.

The program introduced in this study represents a significant technological innovation for speech-language therapists. Currently, no commercially available tool targets people with aphasia who have progressed beyond the acute phase and possess functional communication skills. This program utilizes synchronous technology and facilitates interaction through a variety of activities designed to enhance communicative functionality.

Objectives and Hypotheses

This study aimed to design a communicative interaction program for people with aphasia using synchronous technological tools. The activities included are expected to be relevant and effective, as judged by experts in aphasia rehabilitation.

METHODOLOGY

Ethical Considerations

This study was conducted in strict accordance with ethical principles for research involving human subjects. An institutional ethics committee approved all procedures. The committee provided formal authorization and classified the study's risk level in accordance with Resolution 008430/93 of the Ministry of Health, ensuring compliance with international ethical standards and guidelines.

Prior to participation, all subjects received a detailed explanation of the study's objectives, procedures, and potential benefits. The team made sure that participants fully understood the information provided and offered the opportunity to ask questions and receive clear answers. All participants signed an informed consent form, indicating their voluntary agreement to participate in the study.

Regarding participant recruitment, measures were taken to preserve privacy and confidentiality. Consequently, data are presented in Table 1 anonymously. Information was stored securely, ensuring that only the research team had access, and specific details that could facilitate participant identification were omitted.

The participation of expert judges was voluntary and anonymous. Data collected from their evaluations were used exclusively for research purposes, and the confidentiality of the information provided by the judges was strictly maintained.

This ethical approach reinforces the study's integrity and ensures that the rights, dignity, and well-being of all participants were respected.

Study Design

The study was conducted using an observational-descriptive approach based on the hypothetical-deductive method. This approach enabled the collection of detailed information regarding language processing and cognition during communicative interactions, supporting the deductive process to produce knowledge about the program's effectiveness.

Sample

A non-probabilistic sample was selected, comprising two groups: (a) speech-language therapists and equivalent professionals (terminology varies by country) with expertise in aphasia management, and (b) people with aphasia who had progressed beyond the acute phase and possessed functional communication skills.

a) Expert Judges: Sixteen speech-language therapists or equivalent professionals with experience in working with adults with neurological injuries were included. The experts' professional experience ranged from 1 to 15 years, with a mean of 5.6 years. Age and gender were not considered, as professional experience was the primary inclusion criterion.

b) People with Aphasia: The sample included seven Spanish-speaking participants with high functional communication abilities, all of whom were part of the "Afasia Vital" group. Participants were selected based on their availability to participate and their functional communication level.

Inclusion and Exclusion Criteria

Expert Judges

Inclusion: Speech-language therapists or equivalent professionals with a minimum of 1 year of experience in aphasia management.

Exclusion: Professionals not working with people with aphasia at the time of the study.

Participants with Aphasia

Inclusion

- Aphasia diagnosis clinically confirmed.
- Etiology: A single documented cerebrovascular accident (CVA) with at least 3 months post-stroke evolution.
- High functional communication (ability to comprehend and produce simple utterances).
- Corrected or functional eyesight and hearing to participate in virtual activities.

- Access to a computer with a stable internet connection and a webcam.
- Availability to participate in all phases of the study. Table 1 presents participant characteristics.

Exclusion

- Individuals with low functional communication skills (inability to maintain simple interactions).
- Diagnosis of multiple CVAs or other etiologies (e.g., traumatic brain injury).
- Uncorrected visual or auditory limitations that would prevent participation in the program.

Table 1. Characteristics of the participants with aphasia.

Subject	Age	Diagnosis	Years Since Onset	Place of Origin
1	56	Motor Aphasia	6 years	Argentina
2	51	Motor Aphasia	6 years	Spain
3	47	Unspecified Aphasia	12 years	Mexico
4	49	Broca's Aphasia	3 years	USA
5	42	Unspecified Aphasia	3 years	Colombia
6	36	Broca's Aphasia	5 years	Colombia
7	43	Broca's Aphasia	4 years	Peru

Note: Created by the author based on the characteristics of the participants.

Materials

The program was developed based on linguistic and cognitive models of language and can be implemented by a speech-language therapist or a similarly qualified professional. It promotes collaboration and interaction among people with aphasia, which may significantly impact clinical practice in speech-language therapy and neurological rehabilitation. The program is structured into three main modules: communication, cognition, and language. Each module includes interactive activities that address different aspects of linguistic and cognitive processing. The structure and content of the program are detailed in Table 2.

Table 2. Description of activities per module.

Module	Activity and Focus
Communication	- Practice of implicit and explicit communication - Emotion recognition - Formulation of assumptions - Interpretation of parodies and cartoons - Interpretation of proverbs and colloquial expressions with literary figures
Cognition	- Memory exercises - Attention tasks - Executive function: planning - Activities with progressively increasing complexity to exercise participants' cognitive abilities
Language	- Auditory language processing - Recognition of environmental, daily-life, and linguistic sounds - Practice of auditory and visual lexical skills - Visual confrontation and recall activities - Organization of elements into complex semantic categories - Construction of syntactically meaningful sentences - Pragmatic exercises - Reading/writing: word construction from letters, completion of missing letters, identification of words based on definitions, and reading comprehension at varying levels of literal and inferential complexity

Note: This table outlines the key aspects considered during the initial design of the program, which informed the development of the activities implemented with participants.

Procedures and Instrumentation

The program was implemented in synchronous sessions via Microsoft Teams with a group of people with aphasia from different countries, including Colombia, Peru, Argentina, Mexico, the United States, and Spain. The appropriateness and acceptability of the activities were assessed through informal evaluations during each session.

The activities were presented and evaluated by expert judges using PowerPoint and structured questionnaires. For the evaluation, judges received a package organized by components in PowerPoint with hyperlinks, along with an Excel matrix containing two tabs: one with a program description and another with an evaluation template. The experts assessed the program, which comprised 58 activities, using a Likert-type scale to rate the

following aspects: total agreement (5), agreement (4), disagreement (3), total disagreement (2), and lack of information (1), with an additional item for observations. The evaluation focused on the relevance, appropriateness, clarity of instructions, and the alignment of each activity to its respective processing module.

The program was assessed using descriptive statistics to examine its reliability. Item variance and overall variance were determined to calculate Cronbach's alpha, which ranged from 0.916 to 0.963, indicating high reliability.

Following validation and adjustments based on expert judge feedback, the final product was designed. The finalized program comprised 48 refined activities focusing on communication, cognition, and language (both oral and written). Additionally, a web developer created a web-based platform and hosted the program using Genially. This provided an interactive platform to introduce the activities dynamically and accessibly, facilitating the implementation of the program by speech-language therapists or equivalent professionals.

Table 3. Overview of the program's structure.

Component	Activity	No. of Activities
Communication	Implicit and explicit communication	3
	Formulation of assumptions	4
	Interpretation of parodies	3
	Interpretation of proverbs and colloquial expressions	3
Cognition	Attention and memory	5
Language	Linguistic processing	4
	Language domains	14
Language: Reading and writing	Reading processes	7
	Writing processes	5
Total		48

Note: This table presents the final structure of the program, following the validation and adjustment process.

RESULTS

Internal Consistency Statistical Analysis

The Jamovi statistical software package was used to analyze the outcomes of the activities evaluated by the expert judges. Data were coded, and we estimated the sum of item variances and the total variance to determine Cronbach's alpha coefficient. This value was used to measure the internal consistency of the assessment instrument.

Table 4 presents the analysis results, detailing the values of the four evaluated criteria: relevance, appropriateness, alignment, and clarity.

Table 4. Results from the expert judgment.

Criterion	Sum of Item Variances	Variance of the Sum	Cronbach's Alpha	Criterion
Appropriateness	30.44	363.52	0.916	Appropriateness
Relevance	21.58	339.13	0.9167	Relevance
Alignment	29.58	329.43	0.9284	Alignment
Clarity	37.05	666.65	0.9633	Clarity

Note: Created by the author. This table shows the results of the expert judges' evaluation.

The values indicate high reliability across all criteria, supporting the instrument's consistency. The results for each criterion are discussed below:

- Appropriateness: Cronbach's alpha was 0.916, suggesting that this criterion is reliable for assessing the suitability of the activities for people with aphasia.
- Relevance: The coefficient was 0.9167, indicating that the items are adequate for evaluating this aspect of the activities.
- Alignment: The value reached 0.9284, confirming the relationship between the activities and the expected level of linguistic processing.
- Clarity: This criterion yielded the highest coefficient (0.9633), indicating a good comprehension of the instructions.

Evaluation of Activities by Expert Judges

In addition to the quantitative analysis, the team considered the feedback of expert judges. Based on these observations, activities that were too complex for participants—particularly in the modules for interpreting caricatures, proverbs, and writing—were identified. As a result, 10 activities were removed, and others were adjusted to ensure the final program's suitability and accessibility.

Below is a brief example of the interface developed using the Genially platform.

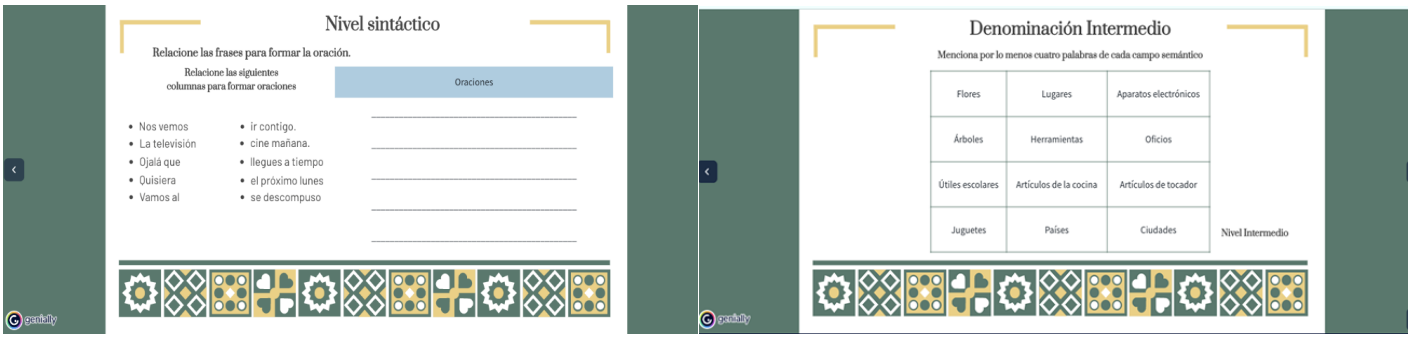

Figure 1. Example image of an activity: syntactic component

DISCUSSION

The program that this research introduces seeks to innovate in the intervention of people with aphasia who are no longer in an acute stage of the condition. It aims to do so by incorporating ICTs and activities designed within an interface adapted for adults with functional aphasia, based on different levels of linguistic complexity. It is designed to benefit patients with functional aphasia, who often discontinue speech-language therapy once they have surpassed the acute phase. This aspect of the program is particularly relevant, as it offers an alternative intervention to continue the therapeutic process beyond the initial stage.

In this regard, it is well established that strengthening language components (phonological, morphological, syntactic, and semantic) and addressing pragmatics through interaction with facilitators are crucial in aphasia recovery. According to Kurland et al. (2018), intensive and targeted practice of these linguistic skills can lead to significant improvements in functional communication. Moreover, working on cognitive and communicative processes is essential, given that cognitive functions directly influence language processing and production. For this reason, intervention at this stage is necessary, as stimulation of both language and cognition is fundamental for promoting interaction and enhancing quality of life in people with aphasia (Cherney et al., 2021).

Furthermore, working virtually allowed participants from different countries to interact while maintaining active and functional participation during group sessions. These findings are consistent with those reported by Øra et al. (2020), who showed that telerehabilitation can improve linguistic skills such as repetition and sentence production, even in individuals with chronic aphasia. The use of virtual platforms facilitated the continuity of the therapeutic process, overcoming geographical barriers while providing a safe and familiar environment for participants.

This proposal aligns with recommendations to create adaptive learning environments that respond to the needs of each patient (Shahouzaie & Gholamiyan, 2024), facilitating interaction without the need for physical travel. This approach enables people from different locations to connect, overcoming geographical limitations and expanding the reach of interventions. In this context, the use of virtual platforms, such as the one implemented in this program through Genially, represents a viable and effective alternative to promote communication and participation among individuals with aphasia, particularly in cases where there are mobility challenges or limited access to in-person services. Mantovani et al. (2020) indicate that telerehabilitation is especially valuable when access to in-person therapy is restricted, providing an efficient and sustainable solution for language rehabilitation in aphasia.

Technology also enables interaction with peers who share the same clinical condition, offering opportunities for daily practice in a safe and familiar environment (Bernini et al., 2021). Furthermore, by facilitating contact among patients with similar challenges, it promotes more symmetrical and empathetic communication while addressing not only linguistic limitations but also the social and emotional needs of people with aphasia. Additionally, technological tools support the development of communicative skills by simulating practical scenarios that reflect real-life contexts, fostering more dynamic learning applicable to everyday life.

Consequently, the tool developed can be beneficial for speech-language therapists, as it facilitates the use of synchronous communication channels and enables people with aphasia to participate in group interventions within a virtual environment. Real-time interaction facilitates the practice of pragmatic and

social skills, which are essential for effective communication (Cherney et al., 2021).

Ultimately, it is crucial for healthcare professionals, particularly speech-language therapists, to incorporate social inclusion as a component of their rehabilitation strategies and to utilize tools that foster group work and socialization among people with aphasia. The literature suggests that social interaction and peer support are critical components of the rehabilitation process, as they promote patient motivation and engagement in therapy (Cruice et al., 2005). Adopting this approach can significantly enhance the quality of life of this population, mitigating the adverse social and emotional impact of aphasia.

CONCLUSIONS

The program offers a viable alternative for people with functional aphasia who are beyond the acute stage, as it promotes independence and facilitates interaction among individuals with the same condition. Additionally, it supports the group-based motivation and peer support processes necessary to overcome the communicative difficulties caused by aphasia.

The program was highly accepted by participants, and expert judges rated it favorably for ease of implementation. This ease of application was also evidenced by the participants' successful completion of the activities. The virtual meeting space was perceived as enriching and motivating, allowing for autonomous interaction and the exchange of experiences without fear of rejection. Furthermore, the evaluation of activities by expert judges revealed a reliability level close to 1, indicating that the proposed activities meet the criteria for appropriateness and relevance. The activities also feature clear instructions for execution and maintain adequate alignment with the program components, making them suitable for patients with aphasia. Overall, these factors facilitate the delivery of interventions through telerehabilitation.

Scope and Limitations

Limitations relate to both the study and the program. The first limitation concerns the small sample size; future research should consider a larger sample of people with aphasia to assess changes in communication, language, and cognition.

As for the program, one limitation is that its design is aimed at people with high functional communication skills. Therefore, it is necessary to develop new proposals adapted to individuals with medium and low functional communication to evaluate their benefits. The second limitation relates to the initial training required to manage technological resources, both for the professional and for people with aphasia.

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