

Digital resource-mediated speech therapy versus prompt approach in speech motor function in children aged 2 to 7 years

Terapia de fala mediada por recursos digitais versus abordagem prompt na função motora da fala em crianças de 2 a 7 anos

Terapia del habla mediada por recursos digitales frente al enfoque prompt en la función motora del habla en niños de 2 a 7 años

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How to cite: Pereira AFM, Monteiro AM, Silva EAS, Silva JCS, Barbosa MA. Digital resource-mediated speech therapy versus prompt approach in speech motor function in children aged 2 to 7 years. REVisA. 2026; 15(2): 85-91. Doi: <https://doi.org/10.36239/revisa.v15.n2.p85a91>.

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Received: 17/01/2026

Accepted: 17/03/2026

RESUMO

Objetivo: Avaliar a eficácia das intervenções motoras da fala mediadas por tecnologias digitais em comparação com a terapia PROMPT convencional na melhora da função motora da fala em crianças de 2 a 7 anos com transtorno motor da fala. Métodos: Protocolo de revisão sistemática baseado nas diretrizes do Joanna Briggs Institute e PRISMA 2020, registrado no PROSPERO (CRD420251154026). Serão incluídos ensaios clínicos randomizados, estudos quase-experimentais e ensaios controlados que comparem intervenções digitais (tele saúde, aplicativos, realidade virtual, programas computadorizados) com terapia PROMPT aplicada por fonoaudiólogos treinados. A seleção será realizada por dois revisores no Rayyan, com extração padronizada de dados e avaliação metodológica via RoB-2, ROBINS-I e GRADE.

Descritores: Distúrbios da Fala; Reabilitação dos Transtornos da Fala e da Linguagem; Terapia da Linguagem.

ABSTRACT

Objective: To evaluate the effectiveness of digital technology-mediated speech motor interventions compared to conventional PROMPT therapy in improving speech motor function in children aged 2 to 7 years with speech motor disorder. Methods: Systematic review protocol based on the Joanna Briggs Institute and PRISMA 2020 guidelines, registered in PROSPERO (CRD420251154026). Randomized clinical trials, quasi-experimental studies, and controlled trials comparing digital interventions (telehealth, apps, virtual reality, computer programs) with PROMPT therapy applied by trained speech-language pathologists will be included. The selection will be performed by two reviewers in Rayyan, with standardized data extraction and methodological evaluation via RoB-2, ROBINS-I, and GRADE.

Descriptors: Speech Disorders; Rehabilitation of Speech and Language Disorders; Speech Therapy.

RESUMEN

Objetivo: Evaluar la eficacia de las intervenciones motoras del habla mediadas por tecnologías digitales en comparación con la terapia PROMPT convencional en la mejora de la función motora del habla en niños de 2 a 7 años con trastorno motor del habla. Métodos: Protocolo de revisión sistemática basado en las directrices del Joanna Briggs Institute y PRISMA 2020, registrado en PROSPERO (CRD420251154026). Se incluirán ensayos clínicos aleatorizados, estudios cuasi-experimentales y ensayos controlados que comparen intervenciones digitales (telesalud, aplicaciones, realidad virtual, programas informáticos) con la terapia PROMPT aplicada por logopedas cualificados. La selección será realizada por dos revisores en Rayyan, con extracción de datos estandarizada y evaluación metodológica mediante RoB-2, ROBINS-I y GRADE.

Descriptores: Trastornos del habla; Rehabilitación de los trastornos del habla y del lenguaje; Terapia del lenguaje.

Introduction

Motor Speech Disorders (MSD) encompass conditions that impair a child's ability to plan, coordinate, and execute the articulatory movements required for speech production. These conditions may be associated with alterations in the neurological mechanisms of speech, as well as difficulties in integrating visual and auditory systems with global motor functions ⁽¹⁾. MSD are classified into three main categories: Speech Motor Delay, Childhood Dysarthria, and Childhood Apraxia of Speech. These disorders significantly affect communication development and a child's quality of life, requiring specific and early therapeutic interventions, especially during the critical years of speech development, between 2 and 7 years of age ⁽²⁾.

Children with MSD, such as childhood apraxia of speech, often require intensive and individualized therapy to improve the planning and execution of speech movements. PROMPT therapy (Prompts for Restructuring Oral Muscular Phonetic Targets) is a widely used, evidence-based approach for the treatment of MSD, focusing on providing tactile-kinesthetic inputs to restructure speech production ⁽²⁾. However, access to conventional PROMPT therapy may be limited due to resource constraints, costs, or the availability of certified therapists.

In recent years, digital technologies have emerged as promising tools to support or mediate speech therapy, offering the potential for greater access, engagement, and scalability ^(3,4). The use of applications and telehealth platforms for motor speech interventions has been explored with the aim of overcoming geographic barriers and increasing the frequency of therapeutic practice ⁽³⁾.

Despite the growing adoption of digitally mediated interventions and the established effectiveness of PROMPT therapy, the comparative effectiveness of these two approaches in improving motor speech function in children aged 2 to 7 years with MSD remains uncertain. It is essential that clinical decision-making be informed by robust evidence comparing the outcomes of traditional and innovative interventions.

This systematic review aims to evaluate the effectiveness of digitally mediated motor speech interventions compared with conventional PROMPT therapy in improving motor speech function in children aged 2 to 7 years with motor speech disorders.

Method

This study is a systematic review protocol of quantitative effectiveness studies, conducted in accordance with the Joanna Briggs Institute (JBI) methodology ⁽⁵⁾ and based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 guidelines ⁽⁶⁾. The systematic review was planned based on the following research question: What is the effectiveness of speech-language therapy interventions mediated by digital technologies, compared with conventional PROMPT therapy, in improving motor speech function in children aged 2 to 7 years with motor speech disorders? This question guides the identification, selection, evaluation, and analysis of relevant studies ⁽⁷⁾.

Conducted in successive stages based on the research question, the systematic review proposes performing a literature search, article selection, data extraction, and assessment of the methodological quality of the included studies. Subsequently, results will be synthesized, the certainty of the evidence will be assessed, and the findings will be presented in accordance with PRISMA 2020 guidelines. It is noteworthy that this protocol was duly registered on the PROSPERO platform under the number CRD420251154026.

Eligibility Criteria

The PICO model is widely used in the formulation of clinical research questions, especially in systematic reviews, as it provides a clear and objective structure that facilitates the identification of key elements of the investigation ⁽⁸⁾. The acronym refers to four fundamental components: P (*Population/Patient*) = children aged 2 to 7 years with motor speech disorders; I (*Intervention*) = speech therapy interventions mediated by digital technologies; C (*Comparator/Control*) = conventional PROMPT therapy; and O (*Outcome*) = improvement in motor speech function.

This structure provides methodological focus to the investigation and ensures greater consistency in the process of evidence analysis and synthesis, making it more rigorous and reproducible.

Articles involving children aged 2 to 7 years diagnosed with motor speech disorders, such as childhood apraxia of speech and childhood dysarthria, will be included, provided that the diagnosis was established using clinical or standardized criteria. Participants must be undergoing speech-language therapy at the time of the intervention. In addition, the review will consider only articles that investigate interventions mediated by digital technologies, such as telehealth, mobile applications, virtual or augmented reality, and computer-based programs, as long as these approaches are specifically aimed at motor speech rehabilitation. Only studies published in English, Spanish, and Portuguese will be included.

Additionally, only studies using conventional PROMPT therapy, delivered by trained speech-language pathologists, as the comparative intervention will be accepted. Regarding methodological design, randomized controlled trials, quasi-experimental studies, and controlled clinical trials will be included. Studies may be conducted in clinical, school, or home settings, with no restrictions regarding geographic location or socioeconomic context.

Conversely, articles with participants outside the established age range will be excluded, as well as studies involving children with comorbidities that severely affect cognitive functioning—such as profound intellectual disability—or with structural anomalies unrelated to motor speech planning, such as isolated cleft palate. Articles that investigate only non-digital interventions or that use digital technologies aimed at other objectives, such as general language stimulation or literacy, will also be excluded. Finally, articles that do not present a direct comparison between the digital intervention and PROMPT therapy or another structured intervention will not be considered.

Search Strategy

Studies will be independently screened by at least two reviewers (or a person/machine combination), with a process in place to resolve discrepancies. The databases to be searched will include CINAHL (*Cumulative Index to Nursing and Allied Health Literature*), Embase (via Ovid), LILACS (*Latin American and Caribbean Health Sciences Literature*), MEDLINE, PsycINFO, PubMed, and Scopus. Search strategies will be constructed using combinations of descriptors and adapted to each database, as described in Table 1.

Table 1 - Search strategies used in the databases. Goiânia, Goiás, Brazil, 2025.

Base de dados	Estratégias	Artigos recuperados
CINAHL - Cumulative Index to Nursing and Allied Health Literature	AB (children or kids or youth or child or childhood or school age) AND AB (speech disorders) AND AB (speech therapy or speech pathology or speech language pathology or speech language therapy)	827
Embase - Embase via Ovid	'speech disorder':ab,ti AND 'speech therapy':ab,ti AND 'child':ab,ti	9
LILACS - Latin American and Caribbean Health	((("Distúrbios da Fala") OR ("Transtorno Fonológico") OR ("Transtornos do Desenvolvimento da Linguagem") OR ("Transtornos da Articulação") OR (Apraxias)) AND ((Criança) OR (Pré-Escolar))) AND (("Reabilitação dos Transtornos da Fala e da Linguagem") OR ("Terapia da Linguagem") OR (Fonoaudiologia) OR (Fonoterapia))) AND (("Resultado do Tratamento") OR ("Avaliação de Resultados da Assistência ao Paciente") OR ("Medida da Produção da Fala"))	30
MEDLINE, PubMed	((("Child"[Mesh]) AND ((("Speech Disorders"[Mesh]) OR ("Apraxias"[Mesh]))) AND (((("Speech Therapy"[Mesh]) OR ("Rehabilitation of Speech and Language Disorders"[Mesh]) OR ("Language Therapy"[Mesh]) OR ("Speech-Language Pathology"[Mesh]))) AND (((("Treatment Outcome"[Mesh]) OR ("Speech Production Measurement"[Mesh]) OR ("Speech Articulation Tests"[Mesh]))	460
PsycInfo	(((((title: (Speech Disorders))) OR ((abstract: (Speech Disorders))) OR ((title: (Speech Therapy))) OR ((abstract: (Speech Therapy))) OR ((title: (Rehabilitation of Speech)) OR (title: (Language Disorders))) OR ((abstract: (Rehabilitation of Speech)) AND (abstract: (Language Disorders)))) AND (((title: (Child))) OR ((abstract: (Child)))) AND ((Any Field: (randomized clinical trial)))	13
Scopus	(((TITLE-ABS-KEY (child) OR TITLE-ABS-KEY (child preschool))) AND ((TITLE-ABS-KEY (Speech Disorders) OR TITLE-ABS-KEY (Speech Therapy) OR TITLE-ABS-KEY (Rehabilitation of Speech)))) AND (TITLE-ABS-KEY (randomized clinical trial)) AND (LIMIT-TO (DOCTYPE , "ar")) AND (LIMIT-TO (EXACTKEYWORD , "Child, Preschool") OR LIMIT-TO (EXACTKEYWORD , "Preschool Child") OR LIMIT-TO (EXACTKEYWORD , "Randomized Controlled Trial") OR LIMIT-TO (EXACTKEYWORD , "Child") OR EXCLUDE (EXACTKEYWORD , "Adult")) AND (LIMIT-TO (LANGUAGE , "English"))	593

Data Selection

The articles will be imported into the *Rayyan – Intelligent Systematic Review* manager for duplicate removal and subsequent independent, blinded, double screening (by pairs), following the inclusion and exclusion criteria. Screening will be

conducted first by title and abstract, followed by full-text reading. In cases of disagreement, a third reviewer will be consulted to reach consensus.

Data Extraction

The screening and selection of studies identified in the databases will be performed independently by two reviewers using the Rayyan platform, a digital tool that facilitates the peer-review process by allowing studies to be marked as included, excluded, or uncertain, as well as enabling blinded resolution of disagreements. This approach contributes to greater transparency, efficiency, and standardization in the selection process.

Data extraction will be conducted by one reviewer and independently verified by a second reviewer using a standardized and previously tested form. Any discrepancies between reviewers will be resolved through discussion or, if necessary, with the involvement of a third reviewer. The authors of the included studies will not be contacted to obtain additional information. Data from the included studies will be extracted based on the following variables:

1. **Year of publication** – Indication of the year in which the study was published.
2. **Author(s)** – Name(s) of the main author(s) of the study.
3. **Study title** – Full title of the scientific publication.
4. **Country / study setting** – Country or region where the study was conducted.
5. **Study design** – Type of methodological design (e.g., randomized controlled trial, quasi-experimental study, etc.).
6. **Study population** – General description of the sample, including number of participants and relevant clinical characteristics.
7. **Age range of the population** – Mean age or age range of the participants included in the study.
8. **Technology used** – Type of digital technology employed in the intervention (e.g., telehealth, mobile application, virtual reality).
9. **Motor speech/articulation function measures** – Instruments used to assess outcomes related to motor speech function (e.g., VMPAC, Kaufman, etc.).
10. **Main efficacy outcome** – Summary of the main findings related to the effectiveness of the intervention.
11. **Risk of bias (RoB)** – Assessment of the methodological quality of the study based on an appropriate tool (e.g., RoB 2).
12. **Initial level of evidence (GRADE)** – Preliminary classification of the certainty of evidence according to the GRADE approach.

Additional information will not be requested from study investigators if the necessary information is unclear or unavailable in the study publications or reports.

Risk of Bias or Study Quality Assessment

Risk of bias will be assessed using the Cochrane RoB 2 tool and ROBINS-I. Funnel plots will be used when at least 10 studies are included in the synthesis. Egger's test will be applied to assess potential small-study effects or publication bias.

The certainty of the evidence for each outcome will be evaluated using the GRADE (Grading of Recommendations, Assessment, Development and Evaluation) approach. This process considers the domains of risk of bias, consistency, directness, precision, and publication bias. The evidence will be classified as high, moderate, low, or very low certainty. The GRADEpro software will be used to produce Summary of Findings (SoF) tables.

Final Considerations

The synthesis of findings will be conducted in a narrative and, when possible, quantitative manner. The results of the included articles will initially be presented in comparative tables, organized according to type of intervention, participant characteristics, and instruments used to measure outcomes. Subsequently, a descriptive analysis will be performed, considering the magnitude of effects, direction of associations, and consistency of findings across studies. Whenever sufficient clinical, methodological, and statistical homogeneity is present, a meta-analysis using appropriate statistical models will be considered.

In addition, the results will be discussed in light of current evidence on motor speech interventions, highlighting convergences, divergences, potential explanations for variability in findings, and practical implications for speech-language pathology. Knowledge gaps and suggestions to guide future research will also be identified.

Acknowledgments

This study was funded by the authors themselves.

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