

MUSIC THERAPY IN DOWN SYNDROME: A SCOPING REVIEW OF CONCEPTUAL AND METHODOLOGICAL INCONSISTENCIES

*Musicoterapia na Síndrome de Down: uma Revisão de Escopo sobre Inconsistências
Conceituais e Metodológicas*

*Musicoterapia en el Síndrome de Down: una Revisión de Alcance sobre Inconsistencias
Conceptuales y Metodológicas*

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Abstract - Music therapy has been increasingly reported in the literature involving individuals with Down syndrome. However, its conceptualization, professional implementation, and reporting practices vary widely. This scoping review followed PRISMA-ScR guidelines to map how interventions self-identified as music therapy in individuals with Down syndrome have been conceptualized and reported in the scientific literature. Thirteen electronic databases were searched without restrictions on publication year or language. Studies were included if the intervention was self-identified as music therapy. Seven studies met the inclusion criteria. The included studies were examined with regard to conceptual consistency, intervention characteristics, professional qualifications of the professionals who implemented the intervention, and reported developmental outcomes. Reported outcomes spanned socio-emotional, cognitive, language, and psychomotor domains, with substantial heterogeneity in intervention formats, study designs, outcome measures, and reporting practices. Only three studies explicitly reported the involvement of a credentialed music therapist and described core therapeutic elements. Although reported outcomes were positive across domains, conceptual imprecision and methodological heterogeneity limit generalization. Inconsistent reporting of professional qualifications and therapeutic processes emerged as a central finding, revealing persistent ambiguities in how music therapy has been operationalized in this field.

Keywords: music therapy; Down syndrome; scoping review; developmental outcomes.

Resumo - A musicoterapia tem sido relatada cada vez mais na literatura envolvendo indivíduos com síndrome de Down. No entanto, sua conceitualização, implementação profissional e práticas de relato variam amplamente. Esta revisão de escopo seguiu as diretrizes PRISMA-ScR para mapear como

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intervenções autodenominadas musicoterapia em indivíduos com síndrome de Down têm sido conceitualizadas e relatadas na literatura científica. Treze bases de dados eletrônicas foram pesquisadas sem restrições quanto ao ano de publicação ou idioma. Os estudos foram incluídos se a intervenção fosse autodenominada musicoterapia. Sete estudos atenderam aos critérios de inclusão. Os estudos incluídos foram examinados quanto à consistência conceitual, às características das intervenções, à qualificação profissional dos profissionais que conduziram a intervenção e aos desfechos de desenvolvimento relatados. Os desfechos abrangeram domínios socioemocionais, cognitivos, de linguagem e psicomotores, com substancial heterogeneidade nos formatos das intervenções, delineamentos dos estudos, medidas de desfecho e práticas de relato. Apenas três estudos relataram explicitamente o envolvimento de um musicoterapeuta credenciado e descreveram elementos terapêuticos centrais. Embora os desfechos relatados tenham sido positivos em diferentes domínios, a imprecisão conceitual e a heterogeneidade metodológica limitam sua generalização. O relato inconsistente das qualificações profissionais e dos processos terapêuticos emergiu como um achado central, revelando ambiguidades persistentes na forma como a musicoterapia tem sido operacionalizada neste campo.

Palavras-chave: musicoterapia; síndrome de Down; revisão de escopo; desfechos do desenvolvimento.

Resumen - La musicoterapia ha sido reportada cada vez con mayor frecuencia en la literatura que involucra a personas con síndrome de Down. Sin embargo, su conceptualización, implementación profesional y prácticas de reporte varían ampliamente. Esta revisión de alcance siguió las directrices PRISMA-ScR para mapear cómo las intervenciones autodenominadas musicoterapia en personas con síndrome de Down han sido conceptualizadas y reportadas en la literatura científica. Se realizaron búsquedas en trece bases de datos electrónicas sin restricciones de año de publicación ni idioma. Los estudios fueron incluidos si la intervención era autodenominada musicoterapia. Siete estudios cumplieron los criterios de inclusión. Los estudios incluidos fueron examinados en relación con la consistencia conceptual, las características de las intervenciones, las cualificaciones profesionales de los profesionales que condujeron las intervenciones y los desenlaces del desarrollo reportados. Los desenlaces abarcaron los ámbitos socioemocional, cognitivo, del lenguaje y psicomotor, con una heterogeneidad considerable en cuanto a los formatos de las intervenciones, los diseños de los estudios, las medidas de desenlace y las prácticas de presentación de resultados. Solo tres estudios informaron explícitamente la participación de un musicoterapeuta acreditado y describieron elementos terapéuticos centrales. Aunque los desenlaces reportados fueron positivos en distintos dominios, la imprecisión conceptual y la heterogeneidad metodológica limitan su generalización. El reporte inconsistente de las cualificaciones profesionales y de los procesos terapéuticos emergió como un hallazgo central, revelando ambigüedades persistentes en la forma en que la musicoterapia ha sido operacionalizada en este campo.

Palabras clave: musicoterapia; síndrome de Down; revisión de alcance; resultados del desarrollo.

1. Introduction

Trisomy of chromosome 21, commonly referred to as Down syndrome (DS), represents the most common genetic cause of intellectual disability (Bull, 2020), with substantial public health relevance worldwide (Chen et al., 2022; Sperling et al., 2023). Individuals with DS typically present a heterogeneous clinical profile that may include morphological characteristics, intellectual disability, challenges in emotional regulation, and pronounced difficulties in language development, which often exceed what would be expected based solely on overall cognitive level (Hamadelseed et al., 2023).

Within this context, music has been incorporated into educational, therapeutic, and health-related settings involving individuals with DS (Moreno-Garcia et al., 2020). Neurocognitive research has demonstrated that musical engagement recruits distributed neural networks related to attention, memory, emotion, and behavioral regulation, engaging processes associated with cognitive and social functioning even in populations with neurological or neurodevelopmental conditions (Chen et al., 2022; Hsu et al., 2015; Särkämö et al., 2014). Models of auditory–motor integration and predictive processing further highlight how musical activities engage mechanisms relevant to motor coordination, timing, and sensorimotor coupling (Zatorre, 2005; Zatorre et al., 2007), while theoretical frameworks such as the OPERA hypothesis propose that musical activities may strengthen neural encoding in auditory networks shared by music and speech, and that increased precision in these networks may also benefit speech processing (Patel, 2011). As a result, a broad range of music-based interventions has been described in the literature, including passive approaches such as music listening, as well as active approaches involving singing, rhythmic activities, movement, and improvisation (Pando-Naude et al., 2021).

However, the presence of music or music-based activities within an intervention does not define music therapy. Music therapy is a professional discipline in which trained practitioners use varied musical experiences within a therapeutic relationship to support health, well-being, capacities, and development at individual and social levels. Its scope includes work with individuals, groups, and communities in clinical, educational, cultural, and virtual contexts, and its practice is informed by research, professional education, clinical training, ethical responsibility, and social, cultural, and political conditions (World Federation of Music Therapy, 2026). It is recognized by the World Health Organization as part of traditional,

complementary, and integrative health practices (World Health Organization, 2013) and has been described as an evidence-based intervention when conducted according to established professional, methodological, and ethical standards (Nickel et al., 2005).

According to the Brazilian Union of Music Therapy Associations (UBAM), music therapy is defined as a clinical practice conducted by a qualified professional using music-based interventions to promote health and well-being (UBAM, 2018). However, professional regulation and credentialing requirements for music therapy vary internationally, and in some countries the profession is not formally regulated. In the United States, the American Music Therapy Association (AMTA) defines music therapy as a professional practice that requires the involvement of a credentialed therapist who has completed an approved training program and who applies music-based interventions within a therapeutic framework oriented toward health and well-being rather than artistic achievement (AMTA, 2019). These definitions provide a normative framework for music therapy practice and research, emphasizing the role of qualified professionals, individualized therapeutic goals, and structured therapeutic processes. Such elements are particularly relevant when evaluating whether interventions described in the literature are conceptually aligned with music therapy practice.

Despite these formal definitions, the term “music therapy” has been used inconsistently in the scientific literature, particularly in studies involving individuals with neurodevelopmental conditions (Moreno-Garcia et al., 2020; Nickel et al., 2005). Interventions labeled as music therapy vary substantially in their conceptualization, structure, and professional implementation, and in many cases the presence of music is treated as sufficient to characterize an intervention as therapeutic. Importantly, the inclusion of studies in this review was based exclusively on the self-identification of the intervention as music therapy by the original authors, and does not imply conceptual or professional validation of these practices as music therapy. This distinction is central to the present review, as the inconsistent use of the term constitutes a key problem to be mapped and critically examined rather than a criterion for exclusion.

This conceptual and methodological heterogeneity is evident in studies involving individuals with DS. Research conducted in educational and community contexts has described the use of musical activities such as singing, instrumental performance, movement, and improvisation, reporting associations with social engagement, emotional expression, and

communicative behaviors (Pineda Pérez & Pérez Remón, 2011; Esteban et al., 2012; Moreno-Garcia et al., 2020). In parallel, other studies in which the interventions were self-identified by the authors as music therapy have reported changes across socio-emotional, cognitive, motor, and language domains following music-based interventions (Amin et al., 2020; Moreno-Garcia et al., 2020; Majul Villarreal & Fernández Company, 2019). Additionally, experimental studies conducted in clinical settings have reported reductions in anxiety following receptive music interventions during dental procedures in children with DS (Gómez Scarpetta et al., 2012; Otero Larnia et al., 2021). While these findings are frequently interpreted as supportive of music therapy, the interventions described vary widely in format, duration, outcome measures, and alignment with professional definitions of the practice.

Across this body of literature, methodological limitations are recurrent, including small sample sizes, heterogeneous intervention protocols, limited use of control conditions, variability in outcome measures, and inconsistent reporting of intervention procedures and provider qualifications (Moreno-Garcia et al., 2020; Nickel et al., 2005; Teixeira et al., 2018). These factors constrain the extent to which findings can be meaningfully compared, synthesized, or generalized, and raise fundamental questions regarding how music therapy has been defined, operationalized, and studied in relation to individuals with DS.

Given this combination of conceptual ambiguity and methodological variability, a scoping review represents an appropriate methodological approach. Scoping reviews are particularly suited to mapping the extent, range, and nature of research activity, clarifying key concepts, and identifying gaps in the literature without presupposing intervention effectiveness (Peters et al., 2015). Accordingly, the present scoping review aimed to critically map how interventions self-identified as music therapy in individuals with DS have been conceptualized, operationalized, and reported in the scientific literature, with particular attention to intervention characteristics, professional qualifications of providers, and reported outcome domains. By identifying conceptual ambiguities and methodological limitations, this review seeks to contribute to the development of more rigorous research practices and clearer theoretical foundations within the field of music therapy.

2. Methods

2.1. Study design

This study was conducted as a scoping review in accordance with the PRISMA-ScR (Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews) guidelines. A scoping review methodology was selected to systematically identify and map studies that reported the use of interventions self-identified as music therapy in individuals with DS, with a focus on key methodological characteristics and reported outcome domains. This approach was chosen to allow the identification of conceptual gaps, inconsistencies, and limitations in the existing literature, without aiming to establish causal effectiveness.

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2.2. Eligibility criteria

Studies were included if they met the following criteria:

1. involved participants diagnosed with DS;
2. described an intervention identified by the authors as music therapy, as stated in the title, abstract, or methods section;
3. presented original empirical data, regardless of study design.

Studies were excluded if they:

1. did not involve participants with DS;
2. did not include any music-based intervention;
3. consisted exclusively of conference abstracts, editorials, opinion pieces, or narrative reviews.

No restrictions were applied regarding the professional background of the individual delivering the intervention. This decision was methodological and intentional, as the objective of this scoping review was not to delimit or validate music therapy practice, but to critically map how interventions self-identified as music therapy have been described and reported in the

literature involving individuals with DS. Including studies with heterogeneous professional backgrounds allows the identification of conceptual inconsistencies, omissions, and ambiguities in the reporting of interventions labeled as music therapy, which represents a central focus of this review rather than a methodological limitation (Peters et al., 2015).

2.3. Information sources

A comprehensive literature search was conducted in the following electronic databases: PubMed, Embase, Web of Science, Scopus, CINAHL, PsycINFO, ERIC, EBSCO, Cochrane Library, Europe PMC, LILACS, and SciELO. Databases accessed via EBSCO were searched individually to ensure comprehensive coverage. In addition, Google Scholar was searched to identify potentially relevant records not indexed in the selected databases.

2.4. Search strategy

Search strategies were primarily developed in English for international databases using combinations of controlled vocabulary and free-text terms related to DS and music therapy (e.g., “Down syndrome,” “trisomy 21,” “music therapy,” “music-based interventions,” and “music”). For regional databases indexing Latin American literature (LILACS and SciELO), equivalent terms in Portuguese were also included (e.g., “síndrome de Down” and “musicoterapia”) in order to increase search sensitivity. No restrictions were applied regarding publication year or language. Additional music-related terms were included to increase search sensitivity, with eligibility determined based on the self-identification of the intervention as music therapy.

An example of the complete search strategy used for PubMed is provided in the Supplementary Material. The full database-specific search strategies for all sources, including exact search strings and dates of execution, are publicly available in an open repository with a persistent identifier, as indicated in the Data Availability statement.

2.5. Study selection

All records retrieved from the searches were imported into Rayyan Systematic Review platform for duplicate removal and screening (Ouzzani et al., 2016). Titles and abstracts were independently screened by two reviewers, who were blinded to each other's decisions, to identify potentially eligible studies. Full-text articles were subsequently retrieved and independently assessed against the inclusion and exclusion criteria.

Disagreements at any stage of the selection process were resolved through discussion until consensus was reached. Reasons for exclusion at the full-text stage were documented and are presented in the PRISMA flow diagram.

2.6. Data extraction

Data were extracted using a structured data-charting form developed prior to the review. Extracted information included study design, participant characteristics, intervention characteristics (e.g., format, duration, and frequency), outcome domains, main reported findings, and contextual characteristics of the studies. Information regarding the professional qualifications of the intervention providers and the presence of core therapeutic elements (e.g., individualized therapeutic goals and descriptions of the therapeutic relationship between therapist and participant) was also recorded when available. These variables were extracted to allow the assessment of conceptual alignment between the reported interventions and normative definitions of music therapy practice.

Data extraction was conducted independently by two reviewers, with discrepancies resolved through discussion to ensure consistency.

2.7. Data synthesis

Given the heterogeneity of study designs, intervention formats, outcome measures, and reporting practices, a quantitative synthesis was not appropriate. In addition, conceptual alignment with music therapy practice was examined based on two criteria derived from normative definitions of the field: (1) the presence of a credentialed or formally trained music

therapist responsible for the intervention, and (2) the description of core therapeutic elements characteristic of music therapy practice. These elements included individualized therapeutic goals and the existence of a sustained therapeutic relationship between therapist and participant. Interventions that did not report these elements were considered to have limited conceptual alignment with music therapy practice.

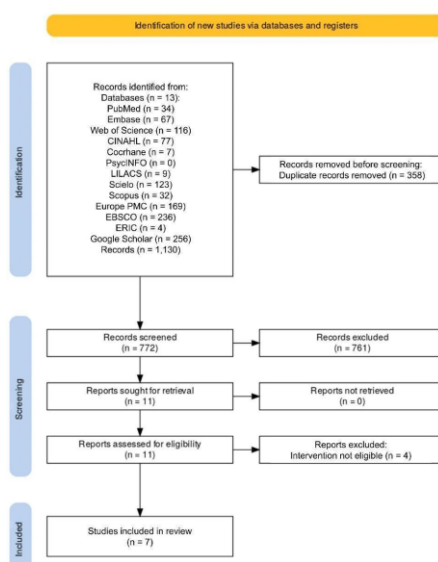
Findings were therefore synthesized narratively. Studies were grouped according to outcome domains and key methodological features, with particular attention to how interventions were described and how outcomes were reported. Procedures undertaken to ensure consistency between reviewers during screening and data extraction are described in detail in the Supplementary Methods.

3. Results

A total of 1130 records were identified through database searches. After removal of duplicates, titles and abstracts were screened for eligibility. Eleven full-text articles were assessed, of which four were excluded at the full-text stage due to wrong intervention or publication type. A total of seven studies met the inclusion criteria and were included in the final synthesis. The study selection process and reasons for exclusion are presented in Figure 1 (PRISMA flow diagram).

Figure 1.

PRISMA flow diagram of the study selection process



Note. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

3.1. Intervention characteristics

Interventions labeled as music therapy showed substantial heterogeneity in format, including individual and group sessions, as well as active and receptive approaches. Session duration ranged from 15 minutes to 1 hour, with interventions spanning from single-session exposures to programs lasting several weeks.

The content of these interventions included singing, instrument playing, rhythmic exercises, movement to music, and music listening. Few studies reported the use of standardized protocols, and descriptions of session structure were often limited.

3.2. Outcome domains

3.2.1. Socio-emotional outcomes

Socio-emotional outcomes were assessed in six of the seven included studies, using behavioral observations, parent reports, clinician-rated measures, or anxiety-related outcomes (Esteban et al., 2012; Gómez Scarpetta et al., 2012; Heal & O'Hara, 1993; Majul Villarreal & Fernández Company, 2019; Pineda Pérez & Pérez Remón, 2011; Otero Larnia et al., 2021). Reported outcomes included changes in social engagement, emotional expression, empathy, attention during tasks, and interaction with peers or therapists, which were consistently described following interventions labeled as music therapy.

3.2.2. Cognitive outcomes

Cognitive outcomes were evaluated in three of the seven included studies, using measures related to attention, memory, or task performance (Amin et al., 2020; Majul Villarreal & Fernández Company, 2019; Pineda Pérez & Pérez Remón, 2011). Cognitive assessments varied widely in format and measurement tools. Studies reporting cognitive outcomes described task-specific changes following interventions labeled as music therapy, particularly in measures related to attention, memory, or task performance, although outcome measures were heterogeneous and not directly comparable across studies.

Table 1.

Characteristics of the included studies, including participant characteristics, intervention format, intervention type, and provider qualifications.

Paper	Country	n	Age	Music-based intervention	Format	Provider qualification
Heal & O'Hara (1993)	United Kingdom	1	28 years	Improvisational music therapy (active, piano-based)	Individual	Credentialed music therapist
Pineda Pérez & Pérez Remón (2011)	Cuba	18	3–6 years	Music-based activities with singing, rhythm, and movement	Group	Music educators (not music therapists)
Esteban et al. (2012)	Spain	9	19–37 years	Structured music therapy (active) program	Group	Credentialed music therapist
Gómez Scarpetta et al. (2012)	Colombia	30	5–14 years	Receptive music listening (recorded classical music)	Individual	Not reported
Majul Villarreal & Fernández Company (2019)	Spain	2	Adults (age not specified)	Improvisational music therapy focused on therapeutic alliance	Individual	Credentialed music therapist
Amin et al. (2020)	Indonesia	10	Children (age not specified)	Passive music listening (monaural beats)	Group	Not reported
Otero Larnia et al. (2021)	Peru	12	5–12 years	Receptive music listening (recorded classical music)	Individual	Health professionals (non-music therapists)

Note. n = sample size. All participants included in the studies had DS.

3.2.3. Language and communication outcomes

Language and communication outcomes were assessed in three of the seven included studies, using expressive or receptive language measures, observational tools, or caregiver reports (Esteban et al., 2012; Majul Villarreal & Fernández Company, 2019; Pineda Pérez & Pérez Remón, 2011). Studies examining language and communication outcomes described changes in communicative behaviors following interventions labeled as music therapy, such as increased vocalizations, verbal output, or responsiveness during interaction. However, assessment tools and outcome definitions varied across studies.

3.2.4. Psychomotor outcomes

Psychomotor outcomes were evaluated in two of the seven included studies, both of which incorporated movement-based musical activities (Esteban et al., 2012; Pineda Pérez & Pérez Remón, 2011). Reported outcomes included changes in motor coordination, body awareness, and rhythmic movement following movement-based musical activities labeled as music therapy, although assessment methods differed substantially across studies.

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3.3. Professional background of intervention providers

Information regarding the professional background of individuals delivering the interventions was inconsistently reported. Three of the seven included studies explicitly stated that the intervention was conducted by a trained music therapist (Esteban et al., 2012; Heal & O'Hara, 1993; Majul Villarreal & Fernández Company, 2019). One study reported interventions delivered by music educators (Pineda Pérez & Pérez Remón, 2011). The remaining three studies did not report the professional qualifications of the intervention providers (Amin et al., 2020; Gómez Scarpetta et al., 2012; Otero Larnia et al., 2021).

This variability in reporting limited the ability to determine whether the interventions labeled as music therapy were delivered by formally trained music therapists across studies. The conceptual alignment of the interventions and the main reported outcomes are summarized in Table 2.

Table 2.

Conceptual alignment of interventions self-identified as music therapy according to reported professional qualifications, therapeutic elements, and main outcomes.

Paper	Credentialed music therapist	Therapeutic elements described	Conceptual alignment	Main reported outcomes
Heal & O'Hara (1993)	Yes	Yes	Strong alignment	Improvements in emotional expression and emotional intelligence
Pineda Pérez & Pérez Remón (2011)	No	No	Limited alignment	Improvements in language, social skills, learning, and motor abilities
Esteban et al. (2012)	Yes	Yes	Strong alignment	Improvements in emotional intelligence and empathy
Gómez Scarpetta et al. (2012)	Not reported	No	Limited alignment	Reduction in dental anxiety
Majul Villarreal & Fernández Company (2019)	Yes	Yes	Strong alignment	Strengthened therapeutic alliance
Amin et al. (2020)	Not reported	No	Limited alignment	Improvements in attention, cognition, psychomotor, and visual skills
Otero Larnia et al. (2021)	No	No	Limited alignment	Reduction in dental anxiety

Note. Conceptual alignment was determined based on two criteria: (1) presence of a credentialed music therapist and (2) description of core therapeutic elements, including individualized therapeutic goals and a therapeutic relationship. “Strong alignment” indicates that both criteria were reported; “Limited alignment” indicates that one or none of these criteria were reported.

4. Discussion

Before interpreting the reported outcomes, it is necessary to address a central conceptual issue identified in this scoping review. Although all included studies described their interventions as music therapy, only three of the seven studies explicitly reported the involvement of a credentialed music therapist and provided sufficient information regarding core therapeutic elements, such as individualized clinical goals and a sustained therapeutic relationship (Esteban et al., 2012; Heal & O'Hara, 1993; Majul Villarreal & Fernández Company, 2019). One study involved music educators, and three studies did not report the professional qualifications of the intervention providers (Amin et al., 2020; Gómez Scarpetta et al., 2012; Otero Larnia et al., 2021). Rather than constituting a flaw of the present review, this heterogeneity represents a primary finding, as it illustrates the widespread conceptual imprecision in the use of the term “music therapy” in the literature. Consequently, the reported outcomes must be interpreted with caution, as observed changes may reflect the general effects of music-based activities rather than music therapy as a professionally defined practice (Nickel et al., 2005; Said & Abramides, 2020).

An additional consideration concerns how the interpretation of reported outcomes might change if the analysis were restricted only to studies conceptually aligned with music therapy practice. In the present review, only three studies reported the involvement of a credentialed music therapist and described core therapeutic elements such as individualized therapeutic goals and a sustained therapeutic relationship. Although positive outcomes were reported across multiple developmental domains in the broader set of studies, restricting interpretation to conceptually aligned interventions would substantially reduce the available evidence base. This observation further illustrates how conceptual imprecision in the literature complicates the interpretation of reported outcomes and highlights the importance of clearer reporting standards in future research.

Overall, the predominance of small samples and non-randomized designs substantially limits causal inference and the generalizability of reported outcomes, particularly when interventions labeled as music therapy are not sufficiently described in terms of professional qualifications and therapeutic processes. Marked heterogeneity was observed in intervention formats, techniques, duration, and delivery settings, including individual and group-based

approaches, which hampers comparability and precludes identification of specific active therapeutic components. In addition, wide variability in intervention duration, ranging from single-session exposures to long-term programs, further limits comparability and hampers conclusions regarding dose–response relationships (Peters et al., 2015).

Across the included studies, reported changes were described in socio-emotional, cognitive, language, and psychomotor domains. Rather than indicating consistent therapeutic effects, this pattern likely reflects the broad engagement of cognitive, emotional, and motor systems elicited by musical activities (Zatorre et al., 2007), reinforcing the need to distinguish between general music-based effects and music therapy as a professionally defined practice.

Reduction of anxiety emerged as one of the most frequently reported outcomes, particularly in studies conducted during dental procedures (Gómez Scarpetta et al., 2012; Otero Larnia et al., 2021). In both cases, the intervention consisted of passive music listening, specifically recordings of *The Four Seasons* by Antonio Vivaldi. The lack of individualized therapeutic goals, absence of a described therapeutic relationship, and limited information regarding the professional qualifications of the intervention providers suggest that the observed effects are more likely attributable to the general anxiolytic and attentional properties of music listening rather than to music therapy as a professionally defined practice (Zatorre, 2005). This distinction is critical, as it illustrates how outcomes labeled as music therapy effects may, in practice, reflect non-specific effects of music exposure.

Furthermore, group-based interventions were associated with reported changes in socio-emotional skills, as evidenced by reported changes in empathy and social interactions (Esteban et al., 2012; Pineda Pérez & Pérez Remón, 2011). These findings align with previous evidence linking musical practice to the development of socio-emotional competencies in children (Said & Abramides, 2020), including those with atypical development (Said et al., 2023), supporting the role of music as a tool for social, emotional, and affective stimulation.

Interventions described as music therapy were associated with reported changes in language and expressive skills, which may be discussed in light of the OPERA hypothesis, proposing interactions between musical practice and speech and language processing (Patel, 2011). Additionally, improvements in psychomotor skills were observed, corroborating neuroscientific evidence that musical practice involves simultaneous activation of multiple cortical and subcortical regions, including the basal ganglia and cerebellum, structures associated with motor coordination, planning, and learning (Zatorre et al., 2007).

However, methodological limitations were widely identified. Incomplete descriptions of procedures hinder the identification of specific stages or techniques responsible for the reported effects. Moreover, outcome assessments based on subjective perceptions of parents and teachers (Pineda Pérez & Pérez Remón, 2011) may introduce observation bias, compromising measurement objectivity. The absence of control groups in most studies, except Gómez Scarpetta et al. (2012) and Otero Larnia et al. (2021), limits causal inference, as the influence of external factors, such as therapist attention or novelty effects of musical intervention, cannot be ruled out.

The small number of available studies ($n = 7$) highlights the scarcity of robust research on this topic and reinforces the need for future studies with rigorous experimental designs, detailed protocol descriptions, and involvement of qualified music therapists.

In summary, this scoping review indicates that interventions labeled as music therapy for individuals with DS are associated with a range of reported changes across developmental domains. However, substantial methodological heterogeneity and conceptual imprecision limit generalization and preclude conclusions regarding clinical effectiveness. Future research should prioritize rigorous study designs, transparent reporting of intervention protocols, clear differentiation between music therapy and other music-based interventions, and the involvement of qualified music therapists, in order to strengthen the conceptual and methodological foundations of research in this field.

5. Conclusion

This scoping review mapped how interventions self-identified as music therapy in individuals with DS have been conceptualized, implemented, and reported in the scientific literature, with particular attention to intervention characteristics, professional qualifications of providers, and reported developmental outcomes. The findings indicate that, although interventions labeled as music therapy have been associated with reported changes across socio-emotional, cognitive, language, and psychomotor domains, substantial conceptual imprecision and methodological heterogeneity persist across studies. In many cases, core elements that characterize music therapy as a professional discipline, including the involvement of credentialed music therapists, individualized therapeutic goals, and explicit descriptions of

therapeutic processes, were absent or insufficiently reported (Nickel et al., 2005; Moreno-Garcia et al., 2020).

Importantly, these limitations do not merely constrain the interpretation of outcomes but constitute a central finding of the present review, as they reflect persistent ambiguities in how music therapy has been operationalized and represented in the literature involving individuals with DS. Strengthening the evidence base in this field therefore requires not only more rigorous study designs but also greater conceptual clarity and transparency in the reporting of interventions, with explicit differentiation between music therapy and other music-based practices (Peters et al., 2015; Said & Abramides, 2020). Addressing these issues is essential for advancing a coherent, clinically meaningful, and professionally grounded body of research in music therapy.

6. Statement on the Use of Artificial Intelligence Tools

The use of Artificial Intelligence (AI) tools in this study was strictly assistive in nature and is classified as A1 (assistive support) according to the framework proposed by Young (2026). At this level, AI is used to support comprehension, organisation, clarity, or accessibility, while all intellectual and scientific decisions remain entirely human.

The Rayyan platform was used to support the organization of the study screening process, including duplicate identification and initial record selection.

The AI-based language model ChatGPT was used exclusively as an auxiliary tool for: translating the manuscript into English, reviewing grammar and spelling in English, translating the abstracts into Portuguese and Spanish and checking formatting and structural aspects of the manuscript, without modifying scientific content.

No AI tools were used for generating original scientific content, data analysis, interpretation of results, or formulation of conclusions. All conceptual, methodological, and analytical decisions were carried out entirely by the authors, who take full responsibility for the final content of the manuscript.

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Data Availability Statement

The supplementary materials associated with this study, including additional methodological details, complete database-specific search strategies, and the full data extraction table, are publicly available on Zenodo at <https://doi.org/10.5281/zenodo.20013633>.

Supplementary Material

Supplementary materials include complete database-specific search strategies, and the full data extraction table used in this review.



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