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Music Therapy Assessment with the IMCAP-ND: A Pilot Study

Marisa M. Raposo [1*], Ana Maria Abreu [2], Leticia L. Dionizio [1], Teresa Leite [3], Alexandre Castro-Caldas [4]

[1] MusicoterapiAçores, Portugal
[2] Institute of Health Sciences, Universidade Catolica Portuguesa, Portugal
[3] Lusíada University, Portugal
[4] Universidade Catolica Portuguesa, Portugal
* musicoterapiacores@gmail.com

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Abstract

Background: Music therapy (MT) appears to be a valuable complementary intervention for children diagnosed with neurodevelopmental conditions, namely, autism spectrum disorders (ASD), who often present cognitive, academic, communicative, and social difficulties. Music therapy has been increasingly recommended as a standard support service for communication and social interaction in this specific neuropediatric setting. Objective: The aim of this pilot study was to determine the recruitment and protocol feasibility of music therapy for autistic children and explore trends towards the clinical utility of the IMCAP-ND [1] quantitative measure on assessing the focus on sound receptions, joint attention, turn-taking, auditory perception, sensory integration, social interaction, entrainment, and empathy, as a preparation for a future study wherein we will pursue with an MT intervention assessment. Furthermore, here we use the European Portuguese translated version of the IMCAP-ND^{PT} scales to contribute to its validation and adaptation. Methods: Five autistic children received a weekly music therapy session of approximately 45 minutes for six months, totaling a minimum of 20 and maximum of 24 completed sessions per child. The IMCAP-ND^{PT} and the Griffiths Mental Development Scales (GMDS) scales were applied pre- and post-test. Results: We tested the research design and the session's protocol. All participants completed MT intervention and showed increase in social-emotional capacities, cognitive and perception skills, and overall responsiveness. However, our results indicate a need to review the inclusion criteria concerning participants with a single diagnosis (ASD), previous contacts with musical instruments, and the application of standardized music therapy settings.

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Conclusions: The design and protocol were perceived as acceptable and feasible, though some improvements were suggested for subsequent original research, and the IMCAP-NDPT version was considered usable. Our initial findings suggest the potential of music therapy for autistic children. Further intervention with efficacy assessment through a larger-scale randomized trial is needed, considering the content based on pilot findings.

Keywords: music therapy; neurodevelopmental disorders; autism spectrum disorders; pilot study

Introduction

Brain plasticity has been shown to be associated with learning new skills (Chang, 2014; Gallen & D'Esposito, 2019; Green & Bavelier, 2008); more specifically, acquiring new musical abilities has been linked to brain modularity (Bringas et al., 2015; Jäncke, 2009; Wan & Schlaug, 2010). Music seems to arouse the brain (Altenmüller & Schlaug, 2015) and it is widely recognized that musical tasks such as playing, listening, or creating compositions activate a variety of hierarchically structured and coordinated cognitive functions: multisensory integration, memory-related and attention processes, perception-action intervention ("mirror neuron system" arousal), core changes in emotional activations, musical syntax and meaning as well as social cognition (Koelsch, 2009; Wang & Agius, 2018; Zatorre & McGill, 2005).

Musical activities such as assisted music composition or the use of specific songs with the instruction embedded in the lyrics can stimulate brain dopaminergic regions that regulate neuroplasticity mechanisms (for example, long term potentiation). Moreover, these are associated with motivation, reward, and learning.

Music therapists should be able to provide the client with an enhanced learning setting for developing skills through music, consequently serving as a reward for the achievement of non-musical behaviors (Salimpoor et al., 2011; Stegemöller, 2014), as in autism research, music's scaffolding capacity is often used as a motivational tool also in everyday life (Finnigan & Starr, 2010). Many autistic children have a specific interest in their auditory worlds and can demonstrate remarkable capacities to reproduce and restyle the musical stimuli that they encounter in their environments (Lisboa et al., 2021; Ockelford, 2008).

Improvisational music therapy (IMT) is the most recurrent music therapy (MT) approach with autism (Gattino, 2012; Wigram & Gold, 2006). It is one of several developmental social-pragmatic approaches, in which improvisation models function as a facilitating basis for monitoring the child's leadership and following their focused interests while expanding their scope (Carpente, 2013). A solid empathy-based therapeutic relationship is created, which is the basis of reciprocal interactions grounded on the concept of "musical attunement" (affect synchronization through music). Therefore, the development of social communication is encouraged based on the child-therapist relationship and their mutual interactions (Carpente & Gattino, 2018).

When following an IMT approach, music therapy appears to promote social, emotional, and motivational development in autistic children, as was shown by a randomized controlled trial (RCT) in which IMT produced noticeably more and longer events of joy, emotional synchronicity, and initiation of engagement behaviours, when compared to toy play sessions (Kim et al., 2009). Recent literature on music therapy has demonstrated the benefits of IMT in the developmental support services for autistic children, particularly in the improvement of joint attention (Kim et al., 2008), non-verbal communication (Gattino et al., 2011; Raposo, 2019; Raposo et al., 2020), involvement in activities (Carpente, 2016a; Kim et al., 2009), social interaction (Dionizio & Raposo, 2018; Thompson et al., 2013), self-regulation (Carpente, 2014) and the quality of the parent-child relationship

(Thompson & McFerran, 2015).

Since the beginning of MT history, the possibility of using music as a form of support for autistic clients has been described in the literature (Geretsegger et al., 2014; Gold et al., 2006; Reschke-Hernández, 2011). During a music therapy assessment, it is possible to recognize a child's various potentials and difficulties.

With the increasing amount of international multicentre studies, there is a need for assessment measures to become largely available throughout different countries (Ridder et al., 2017). Moreover, a systematic review concluded that most MT tools are designed for assessing autistic people, developmental and learning disabilities, and specific needs, though validation procedures are described in only less than half of the original outcome measures (Spiro et al., 2017).

According to Leite (2015), most organizations showing interest in music therapy and supporting its practice in Portugal within their institution are in the field of special education, gerontology and/or music. There are no known Portuguese published articles (systematically investigated evidence) regarding music therapy and autistic children or with the subject of music therapy assessment and validity studies. Though the community recognizes the benefits of music therapy within clinical practice (Franca et al., 2021; Leite, 2015), these assumptions are not supported by data; they are based only on anecdotal evidence.

As stated by Leite (2015, p.176), "The only Portuguese-based music therapy publication is a compilation of articles issued by the APMT at the time of the Pre-Congress of 1997 for the EMTC. This publication was entitled *Cadernos de Musicoterapia*. Aside from this publication, several articles have been published in academic journals and mainstream magazines about the therapeutic use of music and its application in the field of education," but not specifically about music therapy. More recently, Franca et al. (2021) published a pilot study regarding telehealth music therapy services in Portugal during the early period of confinement during the COVID-19 pandemic.

Considering the potential benefits of music therapy for autistic children and the need for more evidence-based intervention programs, the goal of this pilot study is to verify and to improve a protocol for the recruitment and intervention as a preparation for a future outcome study with a pre- and post-test comparison, while contributing to the process of validation of the European Portuguese version of the Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders (IMCAP-ND^{PT}) with initial psychometric properties.

Methodology

Study Design

For this pilot study, an intervention protocol was outlined with a pre- and post-quantitative measure design while qualitative data was also provided, so we used a mixed-method approach. Inclusion criteria were the attribution of a formal diagnosis of ASD based on a cut-off test (The Autism Diagnostic Observation Schedule – ADOS) and the presentation of ASD main characteristics defined by the Diagnostic and Statistical Manual of Mental Disorders/DSM–V (American Psychiatric Association [APA], 2013). The design and data collection were approved by the board of the Hospital do Divino's Espirito Santo de Ponta Delgada after a favorable report by the Health Ethics Committee of this hospital.

Procedure

Participants were selected in the context of their regular child development consultation. During the meeting, if the team member who was attending verified that the child met the inclusion criteria, they would propose study participation to their legal representative. If the parents agreed to receive more information, a first session was scheduled with the music therapist in order to further explain the study intentions, to collect the informed consent and schedule the regular timetable.

Raw data was collected on paper by the primary researcher (the team member who referred the child to the study would provide a brief description of the child's clinical diagnosis as well as their personal information). When the children revealed an innovative skill or a new musical preference, this information was written down. Throughout the research process, we followed an intervention protocol and provided the same musical instruments for every participant to ensure consistency.

The sessions were carried out by two music therapists who received specific training for compliance with the intervention protocol. Participants who were initially randomly selected for the study were subsequently assigned to each of the therapists for convenience and availability of room and schedule.

Children had MT weekly sessions of approximately 45 minutes during a six-month period, with a minimum attendance to 20 completed sessions. Cancelled sessions were not rescheduled. For instance, if a child was only capable of attending for 20 minutes, we would respect that need and interrupt the sessions, but if this situation happened very often, this child would be excluded from the study in order to maintain sample homogeneity. Fortunately, this situation did not occur and all children did attend full sessions of approximately 45 minutes.

The first and last two assessment sessions were videorecorded in audiovisual mode for assessment purposes with a fixed camera positioned in one corner of the room, affording visual access to all the setting's dimensions, and ensuring the recording of every interaction with the child, and they were assessed in the following days after they occurred. The audiovisual materials were digitally stored on a Google Drive restricted access folder and assessed by the two raters who were certified for use of the IMCAP-ND^{PT} instrument tool. In order to refresh the memorized information regarding each construct, raters were advised to briefly consult the IMCAP-ND procedures and protocols' guidelines and the clinical manual (Carpente, 2013) before starting this assignment, so that the semantic interpretation of each item would be in agreement with the authors' intentions.

Each rater scored 10 assessment moments. That is, the first two sessions of each child were rated as one baseline moment and the last two sessions had also one IMCAP-ND score sheet filled as a post-intervention phase. As autistic children can possibly have difficulties with new situations and changing routines (Lau et al., 2020), the two sessions rated at once would provide some consistency on their rated behaviour. The raters were, therefore, advised to only start scoring after firstly observing the full two sessions of the child.

Improvisational music therapy models are based on the same developmental social pragmatic principles of DIRFloortime®, which involves the implementation of child-led strategies in order to promote communication skills within a social context (Carpente, 2016b). Therefore, due to the need to follow the child's leadership and areas of expertise, the central sequence of activities of the session was slightly changeable from the session structure presented in Figure 1. That is, activities 3, 4, and 5 could have their order inverted, if necessary, for the music therapy session to be flexible enough, as it happens in clinical practice, outside of research projects.

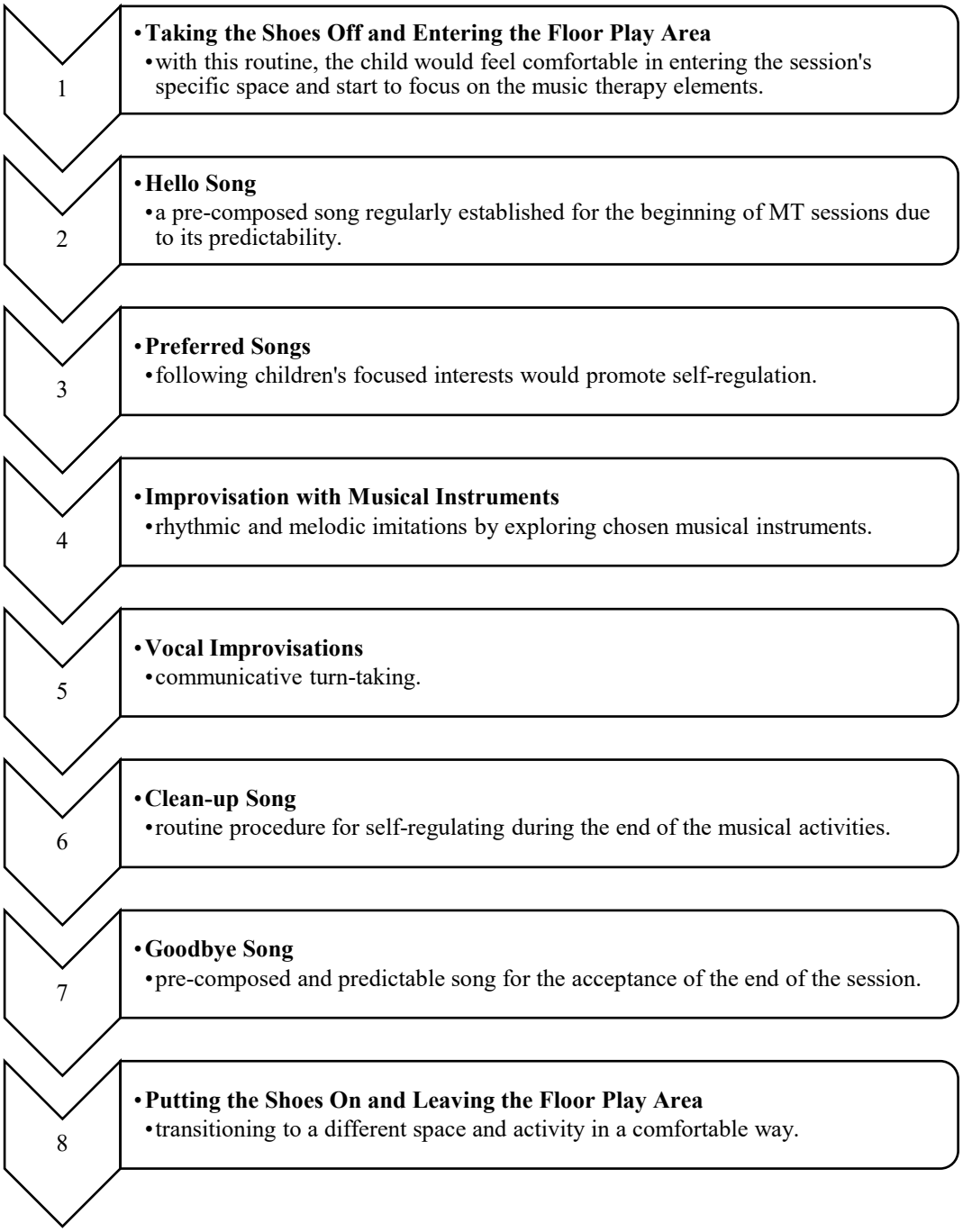

Figure 1. Intervention Protocol.

We did not have any other predetermined plan besides these activities: the hello song, the clean-up, and the goodbye song. The main core of the sessions was improvisational. Even with preferred songs, we were able to improvise upon them. The main goal was to always follow the leadership of the child.

Measures

In terms of methodological design, this pilot mixed-method study comprised the use of complementary quantitative instruments regarding data collection on sound receptions, joint attention, turn-taking, auditory perception, sensory integration, social interaction, entrainment, and empathy. There was a pre- and post-test with two scales: the Griffiths Mental Development Scales (GMDS), a generalist instrument that outlines the child's

global profile in various areas of development, and the Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders (IMCAP-ND[PT]), specific to the MT assessment.

We used the first edition of the GMDS, which is for individual application and has two distinct sections of use: one version for the 0- to 2-year-old age group and another for the 2- to 8-year-old age group (Luiz et al., 2007). This scale is divided into different development subdomains such as locomotion, personal-social domain, hearing and language, eye and hand coordination, performance, and practical reasoning.

Regarding the scale's psychometric properties, construct validity was verified across cultures and over time (Luiz et al., 2001; Reyes et al., 2010). There is also acceptable evidence of the scale's validity and accuracy (Ferreira et al., 2007a, 2007b; Griffiths, 1984). The second edition was adapted and validated for the Portuguese population. Internal consistency was tested and the Portuguese pilot study carried out in 2012 showed promising results. The third review is in the process of validation for the Portuguese population.

As for the IMCAP-ND, it is comprised by a set of three scales, I: Musical Emotional Assessment Rating Scale; II: Musical Cognitive/Perception Scale; and III: Musical Responsiveness Scale. These scales have the purpose of assessing how clients of varying ages with neurodevelopmental disorders interpret the activity and get musically involved creating with the therapist, in a music-centered approach, along with the additional clinical observations. Carpente (2013, 2014) stated that when he created the IMCAP-ND scales, he was clearly influenced by his academic background in the Nordoff-Robbins Music Therapy model.

Participants

Before the pilot study initiated, meetings were held with the interdisciplinary team, in order to verify the feasibility of referring children from the Pediatrics service to conduct this research. Five autistic children were referred to MT from the Hospital do Divino's Espirito Santo de Ponta Delgada Pediatrics service and met the inclusion criteria. Recruitment went through several setbacks due to the exclusion conditions described below, regarding multiple diagnosis other than ASD, familiarity with musical instruments, and scheduling a timetable for the regular sessions that interfered with the other therapies the children were attending.

The inclusion criteria were the following: a) children needed to have a formal referral by a professional of the Developmental Pediatrics Department at the Hospital do Divino's Espirito Santo de Ponta Delgada; b) at the time of referral to the study, the diagnosis of ASD had to be confirmed by a cut-off test applied by the neurodevelopment team; c) they should have clear difficulties in major areas regarding autism core traits, such as communication and social substantial support needs, described both by the parents on the initial interview and assessed by the professional during the development consultation; d) participants should be aged between 0 and 8 years old at the time of the post-test; e) every participant could be attending the conventional therapies, such as speech-language therapy, occupational therapy, psychology, and psychomotricity at school, at the hospital, or at a therapeutic center; and f) the informed consent form must have been previously signed by a legal representative, who had understood the general purposes of the study.

Participants were excluded if they presented one of the following criteria: a) children who had previously attended music therapy sessions or regular weekly music lessons, as musical proficiency could influence the child's interaction with the instruments and could not be a variable to assess on this study; b) participants who had been involved in a DIRFloortime® structured program, with daily sessions with their parents at home and being supervised by a professional periodically, as this social-pragmatic approach is similar

to IMT and results could be biased; c) if referred, children with known hearing and profound visual disabilities due to distinct interactions with the materials; or d) participants with multiple diagnosis other than ASD, as their participation could be compromised by non-autistic difficulties. Table 1 presents information about each participant and their attendance.

Table 1. Attendance and Absence to Music Therapy Sessions.

Participant Identification	Gender	Age in Months	Attended Sessions	Missed Sessions	Drop Out
A	M	28	23	1	0
B	M	63	22	2	0
C	M	45	22	2	0
D	M	48	20	4	0
E	M	65	22	2	0

A brief contextualization of the five children, which was based on therapists' summaries of the therapy processes in relation to the aims of the study, will be expounded.

Participant A. A was a 28-month-old child who was referred for MT by the developmental pediatrics department at the Hospital do Divino's Espirito Santo de Ponta Delgada, in order to work on his sensory, communicative, and social skills through specific musical stimuli that could promote his motivation to acquire essential developmental skills. He was also about to start speech-language therapy and was already attending children's daycare. A was diagnosed with ASD, whose features were detected by his parents, was in a non-verbal phase and had a particularly oppositional behavior when asked to participate in new activities. His intellectual potential was noticeable from the observation of his capacity for hand-eye coordination and performance. He was very resistant to activities of joint attention, did not allow sharing objects in sessions or with other children in different contexts and showed various self-stimulating behaviors while playing with musical instruments. At the personal and social level, he resisted the tasks that implied help by an adult, such as daily routines (e.g., dressing, undressing, bathing), trying to do them autonomously. Moreover, he showed a low resistance to frustration during the mentioned everyday activities, since due to his age, it was not expected that he could successfully perform them independently.

His initial focus on the sessions was to align identical and sequenced materials in an upright position, such as Boomwhackers vertically on a table or hand bells and did not allow sharing the same musical instrument during performance. Along the music therapy process, participant A started to vocalize more frequently, enjoyed movement activities (laughed considerably in dancing vs. suddenly "stopping music and standing still" moments), purposefully began to enter the musical activity suggested by the therapist and allowed her to share the instruments with him.

Participant B. B was a 63-month-old only-child who was diagnosed with ASD due to a delay in speech development, echolalia, tactile hypersensitivity, and social interaction. He attended daycare since he was two years old, having been previously cared by a nurse throughout the day. Adaptation in kindergarten was hard for him, with difficulty in complying with rules and routines besides in interacting with peers. At the time of the pilot study, he was already more flexible with new proposed situations and entered the room with minimal request. He was a motivated child, showed plenty of interest in music, explored musical instruments producing sounds, used his voice more consistently along the sessions (intentional primitive communication) to imitate the content of the songs and gradually expressed what he felt. He had musical influences in the family, as his father

and paternal grandfather played the guitar. However, he did not have any guitar proficiency, as these were not formal music lessons, which was the defined exclusion criteria regarding familiarity with musical instruments.

At the end of the process, he seemed excited to spontaneously begin meaningful musical interactions with the intention to invite the therapist to participate in the session with singing, playing the piano, or sharing the xylophone.

Participant C. C was a 45-month-old child diagnosed exceedingly early with ASD, due to the evident characteristics but also to the fact that he had an older sister with the same diagnosis, though with less support needs in terms of communication and socialization. He went to kindergarten and already produced some words in an idiosyncratic way. He stood out due to a peculiar form of manipulating objects, with which there was not always the intention of producing sound and, when exposed to new situations, he was visibly anxious and entered in emotional meltdown with an exacerbated cry.

C was able to interpret the emotions revealed by his mother and respected her orientations, demonstrating his level of comprehension. A strong emotional bond with the mother was noticeable and he always looked for her whenever he felt uncomfortable with any changes with new proposed activities.

During the first sessions, C felt that vertically rotating or standing in the guitar would comfort him, as well as visually following the small balls inside the ocean drum would be self-regulating during the “Hello” song. These self-soothing behaviors continued at the end of the intervention process, though he also started to get overwhelmed and excited when he felt instruments vibrate, having the intense tactile input, such as feeling the xylophone with one hand while playing with the other, taking turns with the HAPI drum, and putting hands on the instruments while the therapist played. Of all the five children, participant C was the one who most needed receptive music listening to calm down after arousal musical activities and could co-regulate himself.

Participant D. D was a 48-month-old child in a verbal phase with difficulties mostly related to his capacity for joint attention, phonological awareness, and remaining focused on the same cognitive activity without motor distractions on his part. He attended kindergarten in a school, was an only child, and showed no anxiety about separation from his parents.

He repeatedly requested for new musical activities and exploring other instruments due to his difficulties in selective, divided, alternate, and joint attention. His communicative interactions were notoriously dependent on his degree of intense interest in the proposed activity.

D missed four sessions which were not consecutive, mostly because he fell asleep before the scheduled session. He was having sleeping issues due to poor adjustment to the absence of the afternoon nap, though on most days he did not need it anymore. Nonetheless, he completed the minimum of 20 sessions that were established as an inclusion criterion. The music therapy sessions provided him with a trusting space in which he was able to gradually sing more and he seemed to feel that his constant movements were welcomed and integrated as important parts for the musical activities.

Participant E. E was a 65-month-old child who revealed an extremely docile behavior, in terms of social-emotional development. He was in a verbal phase, even though with speech inconsistencies, as he was acquiring greater language functionality.

He attended kindergarten and conventional therapies for the diagnosis of ASD, with mild support needed to complete academic work or recreation activities (ASD level I, according to the DSM-V [APA, 2013] criteria). Although he made some resistance in changing between activities, his pleasure in music performances allowed him to end up accepting the transitions of songs and musical instruments. E always requested the same preferred repertoire in a repetitive and passionate behavior and demonstrated fixations during musical-play.

E had difficulty in understanding the therapist's speech in relation to the verbal instructions to perform a certain task within the musical activity. Moreover, he did not understand, overall, the nature of the questions with a subjective and creative answer. As it became increasingly easier to establish a working alliance, participant E allowed improvising songs with a question-answer structure, so that he could practice not repeating the question and instead answering it with an option to complete the song.

He remained in the session for the appropriate period and had some autonomy in his daily personal care. During the week, he would ask his mother to come to the music therapy sessions, as he was interested in attending them.

The five case vignettes illustrate the way in which music therapy may allow autistic children to express themselves. Despite their diversity in their individual use of musical instruments and voice, the description illustrates how they might have developed communicative and social skills.

Data Analysis

For the data analysis we used descriptive as well as non-parametric inferential statistics. Data was computed using the statistical analysis program IBM SPSS (Statistical Package for Social Sciences) version 22.0 for Windows.

In order to make the statistical choice for a non-parametric test, we based our decision on the assumption that in samples with $n \leq 12$ subjects, normality tests have little power to discriminate distributions that follow a Gaussian curve, i.e., small samples do not allow inferences about the type of distribution in the population (Motulsky, 2003). Therefore, we did not provide normality data on the article.

Regarding the interrater reliability, the two raters on this pilot study assessed the pre- and post-intervention of the five children. That is, each rater scored two assessment moments per client (10 in total) and during statistical analysis of inter-rater agreement, the raters' scores were compared, not added together.

The reference values for Cohen's Kappa test, according to Landis and Koch (1977), are the following: values between .81 and 1 correspond to an excellent agreement; between .61 and .80 to a substantial agreement; between .41 and .60 a moderate agreement; between .21 and .40 a fair agreement; between 0 and .20 a slight agreement; and a value of 0 corresponds to a poor agreement. Cohen's Kappa coefficient revealed excellent agreement in 63 of the 109 scale items analyzed, substantial agreement in 25 items, moderate agreement in 12 items, fair agreement in eight items, and slight agreement in one item. There were no items with poor agreement.

Considering the small sample size ($N = 5$), we decided to use the Wilcoxon non-parametric test in the phase of confronting the two assessment instruments with paired samples in two moments of evaluation with a 6-month period of intervention. The purpose was to verify whether there were statistically significant differences in children between their initial and final assessments. Results were also complemented with an effect size measure (r), as it is not influenced by the sample size, attempting to measure responsiveness properties.

Lastly, we also intended to verify whether IMCAP-ND^{PT} provided additional data, correlated or unrelated to GMDS, using Spearman correlations, the latter which are important to outline a global profile of child development, with the purpose of suggesting in our future randomized controlled trial that IMCAP-ND may have additional beneficial value to support the differential diagnosis, signaling difficulties in neurodevelopment and valuing the music therapy intervention.

Results

This section includes, firstly, a description of the first three minutes of the first and the last session of participant A, the pre- and post-test IMCAP-ND^{PT} differences for the five children, then the Spearman correlations between the outcome variables of the two assessment tools.

Description of the First Three Minutes of the First Session

Child A entered the music therapy room with minimal instructions and, with the help of his mother, agreed to take off his shoes and to go the musical floor area.

He occasionally produced vocalizations. The therapist demonstrated one possible way of playing the xylophone (with glissandos). He enjoyed the proposal and did it himself with the mallet. As the "Hello" song started with the therapist accompanying with the guitar, he occasionally looked at the therapist or the guitar and then played the xylophone with a different rhythmic pattern; he did not show interest in following the pulse, the guitar rhythmic cues, or the therapist's pauses.

As he looked to his mother, this was incorporated in the "Hello" song; the therapist followed his lead and sang an improvised "Hello Mommy" song. He was struggling while playing the glissandos in the xylophone as sometimes the mallet got stuck between the bars. Then, A purposefully moved the xylophone away from the therapist, so that he was the only player. When the therapist played a different pattern (repeating the C note three times), he stood up from the mat and went to his mother.

During this transitioning period between activities, he produced some vocalizations. Given the context, the therapist orally validated his intention to end the activity, reinforcing his non-verbal communication.

As the therapist showed a board of visual animals to start a familiar song, "Old McDonald Had a Farm," which the mother had previously mentioned on the initial interview that she had already sang to the child, he returned again to the xylophone glissandos, though alternating the behaviour of playing the instrument with leaving the musical floor area. Participant A demonstrated no interest in the tambourine and did not make eye contact with the instrument while the therapist beat a simple and intense rhythmic pattern.

The therapist attempted to guide A to regain his focused attention in the musical-play by showing him a shaker in a form of a tube through which he could see the movements of the small balls inside, so that visual input was also given simultaneously with the sound input. The therapist demonstrated a way of alternating vertical movements to produce sounds with the shaker. The child accepted to have it on his hands. He did not want to imitate the movement, he used it firstly like a mallet to beat the tambourine. The therapist suddenly added pauses to prompt his response in using the shaker by himself. He chose to return to his specific and passionate interest in the xylophone glissandos, which did not seem to be synchronized with either the animal song or with the guitar pattern.

When trying to musically connect with him, the xylophone sensory explorations did not correspond either to playing while the therapist played or, alternatively, playing while the therapist made musical pauses. Child A seemed to be focused on exploring this musical instrument in his own way and did not want to interact with the therapist or collaborate in the animal song with visual or vocal cues.

There were other possible ways to follow the child's interests but we did keep in mind that the first session was part of the IMCAP-ND assessment and we had to collect enough data to fill all of the scale's items regarding the child's reaction to vocal or visual support.

Description of the First Three Minutes of the Last Session

Child A entered the music therapy room, quickly went to the tatami (mat) area and franti-

cally started to shake the eggs. The therapist and the child attempted to start and stop musical sounds at the same time while singing “Hello” songs. This interaction lasted for a few seconds and during the time the therapist was playing the guitar, the child climbed up to a small table in order to observe a flower wall decor.

The therapist followed his focused interest and started to sing about the flower in the “Hello” song. He got motivated with this connection and verbalized in his idiosyncratic way words like “hello” and “flower.”

Afterwards, he took the initiative to get the visual cards and selected a preferred song (the “House” song), vocalized a sound like “house” and again climbed up to the table, as it seemed to be a vestibular need. He followed the verbal instruction to place the card on the board and the therapist started to sing that song while accompanying it with a tambourine and giving a mallet to the child and caregiver.

Child A immediately accepted the mallet and tried to play the tambourine in the same pulse as the therapist. As he was so emotionally available to explore this musical attunement, the therapist started to make the music more complex with diverse rhythmic patterns, including the sound of knocking on the door and gave a few seconds of pause between the knocking sounds, so that A could wait and continue to give sustained attention to the activity. He corresponded, they started to take turns in playing the tambourine, beating the rhythm and pronouncing “house” (“casa” in Portuguese language) separating the two syllables. These rhythmic improvised imitations were considered the step 4 of the activities’ protocol. IMCAP-ND has a helpful description on the Musical Responsiveness Scale (III): Self-Regulation as the extent to which the client maintains attention and availability for interaction in the musical media. Thus, we assessed this emotional availability based on Carpente’s IMCAP-ND criteria (Carpente, 2013).

Suddenly, A stopped the turn taking prompt responses, vocally said “uh oh” to indicate concern (which was an anticipating behavior) and then dropped the mallet onto the floor so that it would produce an intense sound and purposeful movement. This was also the moment when he went down to the floor and returned the house card to the board, as a form of demonstrating he wanted to end the activity. The therapist described his intentions orally and followed them accordingly.

As he could effectively communicate his intentions of transitioning to another song and continued to be emotionally regulated, the therapist took the initiative to propose another preferred song (the “Four Seasons” song) instead of waiting for him to decide for another one, since he was accepting to alternate between taking the role of soloist or accompanist, not only leading but also following in the musical interrelatedness context.

IMCAP-ND Responsiveness Measurement Properties

As responsiveness is an instrument’s ability to detect change over time, we compared the pre- and post- IMCAP-ND assessments of the five autistic children who had a weekly music therapy session throughout six months in this pilot study. Table 2 presents the Wilcoxon test results, as well as the effect size *r* for the Musical Emotional Assessment Rating Scale’s results (Scale I).

There were significant statistical differences in 25 of the 58 items of Musical Emotional Assessment Rating Scale (MEARS - Scale I), with the superior post-test scores compared to pre-test ones. These differences were predominantly found in the affect subdomain (70% of its items with significant differences, namely in improvements in facial expression, prosody, and proprioception) and in musical interrelatedness (61% of its items with significant differences, namely in taking initiatives, in the ability to change the performance according to the other, differentiating between the role of soloist and that of an accompanist, as well as being able to insert original ideas into the therapist’s musical spaces), as it is presented in Table 2.

Table 2. Wilcoxon Test and Effect Size (r) - IMCAP-ND / Scale I.

Wilcoxon test / IMCAP-ND Scale I / (N = 5)	Asymp. Sig. (2-tailed)	Effect Size (r)[2]
I.a focuses (frequency)	.05*	r = - .63 [a]
I.b maintains (frequency)	.05*	r = - .63 [a]
I.c shares (frequency)	.10	r = - .52 [a]
I.d shifts (frequency)	.08	r = - .55 [a]
II.e facial (frequency)	.03*	r = - .67 [a]
II.f prosody (frequency)	.03*	r = - .67 [a]
II.g body (frequency)	.08	r = - .55 [a]
II.h motion (frequency)	.03*	r = - .71 [a]
III.i joins (frequency)	.06	r = - .59 [a]
III.j adjusts (frequency)	.03*	r = - .67 [a]
III.k takes turns (frequency)	.11	r = - .51 [a]
III.l stops (frequency)	.16	r = - .45 [b]
IV.m imitates (frequency)	.06	r = - .60 [a]
IV.n synchronizes (frequency)	.08	r = - .55 [a]
IV.o predicts (frequency)	.03*	r = - .67 [a]
IV.p ends (frequency)	.10	r = - .52 [a]
V.q initiates (frequency)	.03*	r = - .67 [a]
V.r changes (frequency)	.03*	r = - .67 [a]
V.s differentiates (frequency)	.05*	r = - .63 [a]
V.t assimilates (frequency)	.06	r = - .60 [a]
V.u connects (frequency)	.06	r = - .59 [a]
V.v interjects (frequency)	.05*	r = - .63 [a]
V.w completes (frequency)	.08	r = - .55 [a]
V.x leads follow (frequency)	.03*	r = - .71 [a]

*** significant as $p < 0.001$
** significant as $p < 0.01$
* significant as $p < 0.05$
[a] large effect size (≥ .50)
[b] medium effect size (≥ .30)
[c] small effect size (≥ .10)
[d] no effect

In addition, effect size is a complementary approach of quantifying the size of the difference, as it is not directly influenced by the sample size (Cohen, 1988) and the effect size (r) was applied.

This magnitude of the result allows us to provide an estimate of the scope of our findings. A small effect size corresponds to values between $r = .10$ and $r = .29$, a medium effect size between $r = .30$ and $r = .49$ and a large effect size corresponds to values above $r = .50$ (Cohen, 1988).

To interpret the results, we considered the context and the contribution. In the field of neurodevelopmental disorders, a small effect can have a significant impact in the child's quality of life; moreover, they can accumulate and produce bigger effects over time. Therefore, even small music therapy effects can be significant if they trigger larger consequences for the child. Another important issue is the contribution to knowledge. As there is a lack of music therapy evidence-based research and practice, even if small positive effects are found, they are important to consolidate the existing bibliography (Fritz et al., 2011).

Improvements were identified in this pilot study with a large effect size ($r > .50$) on 52 items, as it is demonstrated in Table 2. In the remaining six items of Scale I, although no significant statistical differences were obtained, there was still a medium effect size ($r > .30$) in items related to turn taking, interrupting the activity at request and the necessary support for the child to maintain, change the focus of attention or join in an interactive task).

Table 3. Wilcoxon Test and Effect Size (r) - IMCAP-ND / Scale II.

Wilcoxon's test / IMCAP-ND Scale II / (N = 5)	Asymp. Sig. (2-tailed)	Effect Size (*r*)
I. reacts / rhythm	.18	*r* = - .42 [b]
I. reacts / melody	.03*	*r* = - .67 [a]
I. reacts / dynamic	.06	*r* = - .59 [a]
I. reacts / phrase	.06	*r* = - .60 [a]
I. reacts / timbre	.04*	*r* = - .66 [a]
II. focuses / rhythm	.03*	*r* = - .67 [a]
II. focuses / melody	.06	*r* = - .60 [a]
II. focuses / dynamic	.06	*r* = - .59 [a]
II. focuses / phrase	.16	*r* = - .45 [b]
II. focuses / timbre	.04*	*r* = - .65 [a]
III. recalls / rhythm	.10	*r* = - .52 [a]
III. recalls / melody	.10	*r* = - .52 [a]
III. recalls / dynamic	.04*	*r* = - .66 [a]
III. recalls / phrase	.16	*r* = - .45 [b]
III. recalls / timbre	.04*	*r* = - .65 [a]
IV. follows / rhythm	.04*	*r* = - .65 [a]
IV. follows / melody	.06	*r* = - .60 [a]
IV. follows / dynamic	.04*	*r* = - .66 [a]
IV. follows / phrase	.05*	*r* = - .63 [a]
IV. follows / timbre	.04*	*r* = - .66 [a]
V. initiates / rhythm	.06	*r* = - .59 [a]
V. initiates / melody	.06	*r* = - .59 [a]
V. initiates / dynamic	.04*	*r* = - .65 [a]
V. initiates / phrase	.06	*r* = - .60 [a]
V. initiates / timbre	.04*	*r* = - .66 [a]

*** significant as $p < 0.001$
** significant as $p < 0.01$
* significant as $p < 0.05$
[a] large effect size (≥ .50)
[b] medium effect size (≥ .30)
[c] small effect size (≥ .10)
[d] no effect

We also compared the pre- and post- IMCAP-ND assessments of the five autistic children for the Musical Cognitive / Perception Scale (MCPS – Scale II). Table 3 presents the Wilcoxon test results, as well as the effect size (*r*).

Regarding Musical Cognitive / Perception Scale (MCPS - Scale II), there were significant statistical differences in 17 of the 30 items. These differences were mostly verified in the subdomain follows, in which 83% of the items obtained significant differences, namely, in the ability to change the musical element to correspond to components specifically provided by the therapist. In the remaining categories (reacting, focusing, recalling, and initiating), significant differences were obtained in 50% of the items in each subdomain, again suggesting the need for further research with greater power.

In addition, improvements were seen with a large effect size (Cohen, 1988) in 27 items ($r > .50$), as it is shown in Table 3. In the remaining three items, although no significant statistical differences were obtained (possibly due to the small sample size), there was still a medium effect size ($r > .30$ in items related to the ability to react to the rhythm, focusing on it and recalling musical phrases) in this pilot study.

As for the Musical Responsiveness Scale (MRS - Scale III), statistically significant differences were also identified in 24 out of the 36 items. These differences were found predominantly in the subdomains of preferences (75% of their items with significant differences, namely in tempo and pitch preferences) and self-regulation (75% of their items with significant differences), with the subdomain of efficiency having significant differences in 50% of its items (the relative success that the client has in the musical

environment when performing perceptual tasks).

Additionally, the effect size was measured (Cohen, 1988). In the item efficiency in the medium tempo there were no significant differences, but a medium effect was detected ($r > .30$). In the remaining 35 items, improvements were found with significant statistical differences and with a large effect magnitude in this pilot study.

IMCAP-ND Scales I and II are quantitative and therefore have totals and averages for the frequency of behaviours and the support that is needed for the client to demonstrate each developmental skill. Thus, we also compared the pre- and post- IMCAP-ND totals for the Musical Emotional Assessment Rating Scale (MEARS) and for the Musical Cognitive / Perception Scale (MCPS). Table 4 presents descriptive statistics (mean, mean difference, and standard deviation), as well as the Wilcoxon test total results and the effect size (*r*).

As demonstrated by the Wilcoxon test and effect size (*r*), presented in Table 4, the Scale II totals in which the greatest progress was verified (higher differences between the mean of the post- and pre-test) were in the ability to follow, in which there was an average rise of 1.48 points on the scale (II_IV: the specific item description regards the ability to change the musical element to match components specifically provided by the therapist), as well as in the initiating skill (II_V: spontaneously begins a meaningful musical interaction with intent to invite therapist), in which there was an average increase of 1.32 points.

Table 4. Descriptive Statistics, Wilcoxon Test, and Effect Size (r) – IMCAP-ND Totals.

Scales I and II	Pre or Post-Test	Mean	Mean Diff.	Standard Deviation	Wilcoxon p value	Wilcoxon Effect Size
I. Musical Attention Total (frequency)	Pre Post	2.35 3.10	0.75	.60 .74	.04*	*r* = - .65 [a]
I. Musical Attention Total (support)	Pre Post	3.00 3.75	0.75	.18 .64	.04*	*r* = - .64 [a]
II. Musical Affect Total (frequency)	Pre Post	2.20 3.20	1.00	.91 .78	.04*	*r* = - .65 [a]
II. Musical Affect Total (support)	Pre Post	2.60 3.85	1.25	.82 .82	.04*	*r* = - .65 [a]
III. Adaption to Musical-Play Total (frequency)	Pre Post	1.95 3.05	1.10	.87 1.22	.04*	*r* = - .64 [a]
III. Adaption to Musical-Play Total (support)	Pre Post	2.85 3.75	0.90	.55 .95	.07	*r* = - .58 [a]
IV. Musical Engagement Total (frequency)	Pre Post	1.65 2.55	0.90	.86 1.27	.04*	*r* = - .64 [a]
IV. Musical Engagement Total (support)	Pre Post	2.45 3.45	1.00	.69 .89	.07	*r* = - .58 [a]
V. Musical Interrelatedness Total (frequency)	Pre Post	1.50 2.50	1.00	.86 1.06	.04*	*r* = - .64 [a]
V. Musical Interrelatedness Total (support)	Pre Post	2.30 3.33	1.03	.96 .95	.04*	*r* = - .64 [a]
II.I Reacts / Total	Pre Post	2.44 3.52	1.08	.64 .98	.04*	*r* = - .65 [a]
II.II Focuses / Total	Pre Post	1.88 3.00	1.12	.46 .86	.04*	*r* = - .66 [a]
II.III Recalls / Total	Pre Post	1.24 2.36	1.12	1.15 1.40	.04*	*r* = - .64 [a]
II.IV Follows / Total	Pre Post	1.36 2.84	1.48	.73 1.18	.04*	*r* = - .64 [a]
II.V Initiates / Total	Pre Post	1.76 3.08	1.32	.89 1.23	.04*	*r* = - .64 [a]

*** significant as $p < 0.001$
** significant as $p < 0.01$
* significant as $p < 0.05$
[a] large effect size (≥ .50)
[b] medium effect size (≥ .30)
[c] small effect size (≥ .10)
[d] no effect

On Scale I, although with values slightly lower than those of Scale II, there were greater developments in the support needed to give for musical affect, with an average increase of 1.25 points on the scale, followed by progress in the behaviors' frequency regarding adaption to musical-play, with an average rise of 1.10 points, as it is demonstrated in Table 4 (the client follows what the therapist is doing as an activity partner, but does not necessarily respond to specific musical elements, being a parallel activity).

Since there was a pre- and post-test with two scales, Table 5 presents the Griffiths Mental Development Scales (GMDS) scores, which is a generalist instrument that outlines the child's global profile in various areas of development.

In this feasibility study, through the application of the Wilcoxon test, significant statistical differences and large effect magnitudes were found in all sections of the GMDS scales, as Table 5 presents.

Considering the total average differences for domains A (6.40), B (7.80), C (8.80), D (7.40), and E (8.60), it should be noted that the largest advances were in the hearing and language domain (section C), followed by the performance domain (section E). These results are in agreement with the areas in which music therapy can play a determining role as a stimulus, promoting development. In turn, minor progress was observed in areas in which music therapy is not seen as a driving intervention, per se, as is the case of domain A (locomotion).

In relation to the percentiles shown in Table 5, according to child growth, the developmental challenges of autistic children are most notorious from the age of three, when a differential diagnosis is often attributed. For this reason, percentile increases were not anticipated, although there were likely improvements in the specific skills involved in music therapy intervention.

Table 5. Descriptive Statistics, Wilcoxon Test and effect size (r) – GMDS Totals.

GMDS (N= 5)	Pre or Post-Test	Mean	Mean Difference	Standard Deviation	Wilcoxon p value	Wilcoxon Effect Size
Total A (Locomotion)	Pre Post	58.40 64.80	6.40	5.68 6.91	.04*	r = - .65 [a]
Total B (Personal-Social)	Pre Post	53.40 61.20	7.80	8.29 8.81	.04*	r = - .64 [a]
Total C (Hearing/ Language)	Pre Post	48.60 57.40	8.80	18.08 15.55	.04*	r = - .64 [a]
Total D (Eye-hand Coordination)	Pre Post	56.00 63.40	7.40	7.97 9.26	.04*	r = - .64 [a]
Total E (Performance)	Pre Post	58.20 66.80	8.60	5.07 10.11	.04*	r = - .64 [a]
General Quotient	Pre Post	40.05 53.53	13.48	14.01 18.75	.35	r = - .30 [b]
Mental Age	Pre Post	92.39 89.59	-2.80	12.88 18.52	.04*	r = - .64 [a]
Scale A Locomotion Percentile	Pre Post	107.86 97.22	-10.64	17.28 12.04	.04*	r = - .64 [a]
Scale B Personal-Social Percentile	Pre Post	84.35 86.15	1.80	6.21 14.31	.89	r = - .04 [c]
Scale C Hearing/ Language Percentile	Pre Post	81.58 77.37	-4.21	37.90 29.49	.35	r = - .30 [b]
Scale D Eye-hand Coordination	Pre Post	92.94 92.04	-0.90	12.85 92.04	.89	r = - .04 [c]
Scale E Performance Percentile	Pre Post	104.44 105.64	1.20	10.27 22.07	.89	r = - .04 [c]

*** significant as $p < 0.001$Post
** significant as $p < 0.01$
* significant as $p < 0.05$
[a] large effect size (≥ .50)
[b] medium effect size (≥ .30)
[c] small effect size (≥ .10)
[d] no effect

Throughout childhood growth, it is common that the developmental differences are consistently more marked when compared to what is expected for nonautistic children, as the brain is much more sensitive to experience in the first few years of life than in later years and neuroplasticity underlies much of the learning that occurs during this period (Tierney & Nelson, 2009). Thus, although the hearing and language category in Table 5 was the one that most evolved in absolute terms between the pre- and the post-test with music therapy being added to the so-called conventional therapies' program, as this is one of the areas with the greatest support needs for autistic children, in terms of percentile, it was the second area with a decrease of the percentile by 4.21.

Convergent Validity

Convergent validity refers to the extent to which two scales that measure similar constructs are correlated; hence, Table 6 presents the spearman correlations of the IMCAP-ND and GMDS scores.

Table 6. Spearman Correlations between IMCAP-ND^{PT} and GMDS Post-test Results.

IMCAP-ND	GMDS	Type of Correlation	Correlation Coefficient	Sig. (2-tailed)
I.b maintains (frequency)	Total B (personal-social)	Null	*r* = .00	p = 1.00
I.b maintains (frequency)	Total E (performance)	Null	*r* = .00	p = 1.00
II.h motion (frequency)	Total C (hearing and language)	Positive	*r* = .89	p = .04*
II.h motion (frequency)	Total D (eye/ hand coordination)	Positive	*r* = .89	p = .04*
II. Musical Affect total (frequency)	Scale C Hearing/ Language Percentile	Positive	*r* = .90	p = .04*
V.q initiates (frequency)	Total A (locomotion)	Positive	*r* = .95	p = .01*
V.q initiates (frequency)	Total C (hearing and language)	Positive	*r* = .89	p = .04*
V.v interjects (frequency)	Total B (personal-social)	Positive	*r* = .98	p = .01**
V.v interjects (frequency)	Total D (eye/ hand coordination)	Positive	*r* = .95	p = .01*
V.v interjects (frequency)	Total E (performance)	Positive	*r* = .98	p = .01**
V.w completes (frequency)	Total A (locomotion)	Positive	*r* = .95	p = .01*
V.w completes (frequency)	Total C (hearing and language)	Positive	*r* = .89	p = .04*
V. Musical Interrelatedness total (frequency)	Total A (locomotion)	Positive	*r* = .90	p = .04*
V. Musical Interrelatedness total (frequency)	Scale A Locomotion Percentile	Null	*r* = .00	p = 1.00
II.I reacts / rhythm	Total A (locomotion)	Positive	*r* = .89	p = .04*
II.I reacts / rhythm	Total B (personal-social)	Positive	*r* = .89	p = .04*
II.I reacts / rhythm	Total E (performance)	Positive	*r* = .89	p = .04*
II.I reacts / dynamic	Total C (hearing and language)	Positive	*r* = .92	p = .03*
II.I reacts / phrase	Total C (hearing and language)	Positive	*r* = .92	p = .03*
II.II focuses / dynamic	Total B (personal-social)	Null	*r* = .00	p = 1.00
II.III Recalls total	Scale C Hearing/ Language Percentile	Positive	*r* = .90	p = .04*
II.IV follows / timbre	Total C (hearing and language)	Positive	*r* = .92	p = .03*

II.V initiates / rhythm	Total C (hearing and language)	Positive	*r* = .92	p = .03*
II.V initiates / dynamic	Total C (hearing and language)	Positive	*r* = .92	p = .03*
II.V initiates / phrase	Total A (locomotion)	Positive	*r* = .90	p = .04*

Results have shown positive correlations between IMCAP-ND and GMDS in the domains of locomotion, personal-social domain, hearing and language, eye and hand coordination, performance, and practical reasoning, as it is shown in Table 6. These domains relate to skills which are associated with musical affect and interrelatedness, as well as the clients' reaction and initiative towards different musical components. Most null correlations were found regarding musical attention maintenance and focusing on dynamics. No negative correlations were found between the two assessment instruments.

Discussion

The purpose of this pilot study was to verify the feasibility of the protocols for techniques, activities, and data collection for carrying out an experimental study. There are inherent challenges to the implementation of music therapy studies and practices in medical settings. The music therapy profession is not yet legally regulated or recognized in Portugal as a health profession. As a result, the resistance to a new approach which does not show similar amount of scientific systematically investigated evidence compared to conventional therapies has impact on the very research that attempts to counter these cultural constraints. In this sense, we should strive to alleviate further research obstacles.

Protocol Improvements After the Pilot Study

There were several particular constraints that should be improved in future studies. In the matter of familiarity with instruments, many autistic children have a specific interest in their auditory worlds and can demonstrate remarkable capacities to reproduce and restyle the musical stimuli that they encounter in their environments (Lisboa et al., 2021; Ockelford, 2008). Therefore, we tried to control the musical stimuli variables in what was considered possible as inclusion criteria (not being able to have regular weekly music lessons or previous music therapy sessions), since differences in musical proficiency could eventually imply variability in the interest of performing specific musical instruments. We did not specifically investigate the link between musical proficiency and the efficacy of music therapy intervention for autistic children though this is a pertinent question for future studies.

We also recognize that in autism research, music's scaffolding capacity is often used as a motivational tool in everyday life (Finnigan & Starr, 2010), though we did not control the amount of music that children were exposed in their community and society settings in this pilot study. Indeed, there is a need for new research centered on the everyday life of autistic people (Happé & Frith, 2020). In particular, studies that investigate how to foster improvements in autistic children's quality of life, namely with music ecological approaches, so that these benefits might also be easily measurable in research.

In this pilot study, this was the way we found to guarantee homogeneity for the sample regarding musical proficiency. In the future, we aim to collect bigger samples, encompassing different groups with various previous musical proficiencies in order to assess the influence of instrument proficiency in music therapy intervention. Future studies should also have identical musical instruments and the same augmentative communication visual cards in different settings, as simple visual aspects can influence the interaction between the child and the object and on this pilot study, it was only possible to guarantee

similar conditions.

As legal representatives recognized the potential music therapy benefits and tried to continue the free-of-charge music therapy interventions after the pilot study, though the number of sessions was clear and determined on the informed consent form, for ethical purposes, this issue should be reinforced periodically during sessions in a future study. That is, children will only have music therapy sessions for the specific time of the research program.

Music therapy for autistic children in Portugal is not provided by any health or educational public system. Nonetheless, external charity foundations help to support these services for the period that children need their interventions, though with a narrow range and only accessible for a small number of children compared to the ones that could possibly benefit from music therapy. As the participation in this pilot study was also free of charge, parents might accept to participate and hope to have follow-up intervention past the six-month period of this pilot study. Hence, in a subsequent randomized controlled trial, parents might be encouraged to continue music therapy interventions but this would probably occur in private practice. Accordingly, researchers would have to reinforce the information that participating in the study would not guarantee free music therapy services.

Participants with multiple diagnosis besides ASD were excluded. Nonetheless, there is a high frequency of co-occurrence of autism and epilepsy. Future studies should underline the idea that children with known musicogenic epilepsy would not be admitted due to the contra-indication of participation.

IMCAP-ND Responsiveness Measurement Properties

The current pilot exploratory study has highlighted statistical results based on p-value and simultaneously on the effect size regarding music therapy as potentially promoting improvements in autistic children in terms of affect (perception and communication, namely in terms of facial expression, prosody, and movement) and in the musical social interrelatedness. More specifically, we found improvements in their initiatives, in the ability to change the performance according to the other, differentiating between the role of soloist and that of an accompanist as well as being able to insert original ideas into the therapist's musical spaces. Also, the results might suggest positive benefits of music therapy regarding the attention to sound input, since 83% of the items related to the competence to follow the musical elements of the other obtained significant positive results.

Nevertheless, several items related to musical attention, adaptation to musical-play, musical engagement, and responsiveness did not achieve statistical significance, although they still presented medium to large effect sizes (Cohen, 1988). Particularly, the mentioned effect sizes without correspondent statistical significance were found in sharing, shifting the focus of attention, joining the musical-play led by the therapist, taking turns, stopping with non-verbal suggestions, synchronizing musical elements, providing musical endings, and giving closure to music with own musical ideas.

This may be due to the small sample size (Leppink et al., 2016) as well as to the 6-month limit period of intervention that was determined for this pilot study. In music therapy clinical practice, intervention periods in such complex activities for some autistic children are usually longer, as therapeutic approaches require several years of support services. Given the chronic course of neurodevelopmental differences, time is crucial to ensure the stability and evidence clinical improvements (Rabeyron et al., 2020).

Based on the particular characteristics of each child, it should be noted that the five children were not at the same baseline regarding the specific items that did not achieve statistical significance (attention and responsiveness). For example, participant A was only

28 months of age and had no joint attention capacities, since he did not allow sharing objects in sessions. Whereas participant E (65-month-old) revealed an extremely docile behavior, in terms of social-emotional development, was in a verbal phase and besides always requesting the same preferred repertoire in a repetitive self-soothing behavior, was able to give prompt responses in a shared musical-play. Thus, the heterogeneity of participants could have a part in the lack of significant differences between pre- and post-test.

A wide range of variables were assessed in this preliminary study (sound receptions, joint attention, turn-taking, auditory perception, sensory integration, social interaction, entrainment, and empathy), as it is intended to obtain reliable outcomes in a future randomized controlled trial. However, this decision came along with larger difficulties in data analysis and clearness in presenting results. Moreover, there was statistical significance in some items and a $p > .05$ in others which refer to a broad same domain (in the attention field, for example). These discrepancies clearly suggest a need to use a larger sample in future original studies and calculate sample size for instance with G-power, which is a tool to compute statistical power analyses for many different *t* tests (Sullivan & Feinn, 2012). However, this was not our aim at the time as the current research focusses on obtaining preliminary effects. From another perspective, it should be noted that the results of large sample studies present very often extreme statistical significance despite small or even trivial effect sizes, whereas small sample results have difficulties in obtaining statistical confidence (Bjorn, 2013).

Indeed, effect size may clarify to the readers the magnitude of differences found, while statistical significance assesses whether the findings are expected to be attributed to chance. Both effect size and statistical significance are considered essential to understand the broad impact of the research (Sullivan & Feinn, 2012), though with careful deliberations in a pilot study.

Taking these considerations into account, small sample size could have compromised obtaining statistical significance in some domains, besides the medium to large effects still detected in items with no statistical significance. According to Carpente and Gattino (2018), the sample size of this pilot study is in consonance with some of the earlier music therapy assessment instruments that have tested for inter-rater reliability: The Music Therapy Communication and Social Interaction Scale (MTCSI), n = 8; KAtegoriensystem MUsikTHErapie (KAMUTHE), n = 7. Future studies should also consider, a priori, multicenter referrals, as it would be more efficient to have a considerable sample size if many hospitals and therapeutic centers could also be included in the research.

In summary, the results highlighted some trends towards the benefits of music therapy particularly on the affect subdomain. Actually, affect attunement is intrinsically linked to sharing of inner feelings states (Trondalen & Skårderud, 2010) and is the core element of improvisational music therapy for individuals with developmental conditions, who have substantial needs for support on this area (Aigen, 1995; Kanner, 1943). Thus, these findings agree with the already existing literature, that emphasize the process of dealing with emotional processes as an essential component of improvisational music therapy processes (Bruscia, 1987; Erkkilä et al., 2008).

Convergent Validity

The initial results of IMCAP-ND^{PT} convergent validity, when compared to external reference standards (GMDS), are promising for the clinical utility of this music therapy assessment tool as a measure for pediatric ASD. Nonetheless, variations in outcome variables require further exploration.

The major number of positive correlations were found between IMCAP-ND domains and the specific area of hearing and language (C components) of GMDS which may be

explained by the benefits of music therapy for autistic children on auditory perception, verbal, and non-verbal communication (Gattino et al., 2011; Geretsegger et al., 2014; Gold et al., 2006; Kim et al., 2008; Wigram & Gold, 2006).

There were also a few null correlations, but none of them were in the core areas in which music therapy studies frequently show benefits for autistic children. Hand-eye coordination may also be enhanced by the practice of musical instruments during sessions. There was only one null correlation for each domain locomotion and performance.

Limitations and Future Directions

As this was a pilot study, several limitations were expected, and these aspects should be improved in a subsequent study:

1. Small sample size may have compromised results. Therefore, in a subsequent study, we intend to increase the number of participants to measure the music therapy support service for autistic children, as well as to have a control group, in which participants should only have weekly conventional therapies (no music therapy intervention) and an experimental group with weekly music therapy sessions besides other conventional therapies (a randomized controlled trial). Thus, we could analyze if the benefits come specifically from music therapy interventions. However, we point out that the main aim of this study was not to assess increase in performance in the communicative and social domains (sound receptions, joint attention, turn-taking, auditory perception, sensory integration, social interaction, entrainment, and empathy), but to verify feasibility and protocol adaptability to proceed to another study where we will apply these differences and pursue with a comparative assessment.
2. Regarding convergent validity, future research should explore if null and positive correlations are still found on the referred items, as small sample size could have influenced the two raters' assessments.
3. Furthermore, regarding validity purposes, one of the two raters that assessed sessions by the audiovisual recordings was one of the music therapists that conducted the weekly sessions, as the Portuguese certified music therapists on IMCAP-NDPT were contacted and no other professionals were available for this task that required considerable dedication of own time. Future studies should try to consider two independent raters that are not responsible for conducting music therapy sessions and convergent validity should be again tested.
4. As it was suggested in Carpente and Gattino's (2018) article regarding inter rater reliability of the original version of the IMCAP-ND, to avoid a bias while rating the videos, test-retest procedure is advised and it is, actually, planned for a future randomized controlled trial, so that results might be confirmed or reevaluated.
5. As there is a 1:4 female-to-male ratio in autistic children or sometimes assumed as a 1:3, female participants should be included in future studies. The five children of this pilot study were randomly assigned and were five boys.
6. We did not include participants who had formal music learning or previous music therapy sessions. In the future, we aim to collect bigger samples, encompassing different groups with various previous musical proficiencies in order to assess the influence of instrument proficiency in music therapy intervention.
7. It is possible that some participants were more closely involved with music than others, as we described (musicians in the community or family). Since music is present in our societies, having the same music community opportunities would be reasonable to consider as a variable to be measured in future studies, though we could not control it in this pilot study. We were able to control music formal

learning but not exposure, for instance, listening to music at home, which also contributes to music proficiency and acceptance towards this kind of stimuli. Future studies could explore a possible link of having higher music community opportunities and engaging in the following music therapy intervention.

8. As ASD correspond to a large spectrum of different characteristics and support needs, if future studies could gather information from larger samples, children could be grouped by their scores in the cut-off diagnosis test, which was not possible to implement on this pilot small-scale study.

Conclusion

In summary, procedural and intervention protocols were improved, and the research findings appeared to confirm the initial assumption; therefore, this pilot study encourages a subsequent music therapy efficacy study in the specific support for autistic children. As there are no known randomized controlled trials on the effectiveness of music therapy in Portugal with validated assessment instruments and structured protocols for techniques, activities and data collection, this pilot study stands out for fulfilling these criteria, which allowed it to improve the measures to be implemented and precede a further study of effectiveness.

About the Authors

Marisa M. Raposo is a Neurologic Music Therapist (NMT), founder of MusicoterapiAçores, post-graduate in Neuropsychology. She holds a PhD in Cognition and Language Sciences from the Institute of Health Sciences at the Universidade Católica Portuguesa, an MA in Music Education for children with special educational needs and disabilities, a master's degree in Music Therapy and a bachelor's degree in choral conducting and music education. MMR was the 2017 Portuguese representative at the Scientific Committee of the III Congreso Iberoamericano de Investigación en Musicoterapia (Valencia, Spain) and the Portuguese representative at the Scientific Committee of the 11th European Music Therapy Conference in 2019 (Aalborg, Denmark).

Ana Maria Abreu holds a PhD in Brain, Behavior and Cognition, an MSc in Neuropsychology and a BSc in Applied Psychology. AMA's main concerns fall in the intersection of mind, brain and behavior, namely using methods of Experimental Psychology. AMA is an ad-hoc reviewer for more than twenty peer reviewed journals. She is a member of editorial and scientific committees, and lecturer of diverse Psychology and Neuroscience related themes, having supervised many undergraduate and graduate students. AMA has published in several national and international research venues, in fields ranging from Sports Psychology to Educational Psychology, Social Psychology and Marketing.

Leticia L. Dionizio, brazilian Music Therapist. Since 2018 she has been a collaborator at MusicoterapiAçores. She is currently a master's student at the Music, Art and Process Institute-IMAP (Spain), bachelor's in music therapy from the Federal University of Minas Gerais – UFMG. In 2016, she participated in the Latin American Music Therapy Congress as a scholarship student. She published articles in the Brazilian Journal of Music Therapy with special focus on Music Therapy and Spirituality and in periodicals and annals of national and international events.

Teresa Leite, Clinical Psychologist, Music Therapist, University Associate Professor. She holds a bachelor's degree in Psychology (ISPA), a master's degree in Music Therapy (NYU) and a PhD in Clinical Psychology and Group Psychotherapies (Adelphi University). Associate Professor at the Universidade Lusíada de Lisboa, scientific coordinator of the

Masters in Music Therapy and Professor in undergraduate and masters' courses in Psychology. Visiting Professor in the Master of Music Therapy at the Pontifical University of Salamanca. President of the board at the Portuguese Association of Music Therapy (APMT)'s General Meeting. Effective member of the Portuguese Order of Psychologists, specialized in clinical psychology. She practices psychotherapy, music therapy and family and couple therapy in private practice in Lisbon. Supervisor and trainer in foster homes for children and young people at risk. Supervisor of music therapists and clinical psychologists.

Alexandre Castro-Caldas is the current coordinator of the National Council for Health Sciences at the Universidade Catolica Portuguesa, Head of the Institute of Health Sciences from 2014 to 2022. ACC was, up to 2004, Full Professor of Neurology at the Lisbon Faculty of Medicine and Director of the Neurology Service of Lisbon's Santa Maria Hospital. ACC was also president of the Portuguese Society of Neurology (1989-1992) and presided over the International Neuropsychological Society (2001-2002). He has authored more than 200 scientific articles/chapters and some books on the Brain. ACC was graced with many awards, among which the Great BIAL Medicine Award (2000), and the Distinguished Career Award from the International Neuropsychological Society (2009).

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[2] $r = \frac{Z}{\sqrt{n}}$