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ARTICLE

The Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders (IMCAP-ND) for use in Portugal: Translation and psychometric evidence

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ABSTRACT

There is a comprehensive need for music-centred assessment tools as specific outcome measures of music therapy efficacy for people with neuro-developmental disorders (NDD), namely, autism spectrum disorders (ASD), as music facilitates communicative and social skills of these individuals and allows unique ways to assess their particular deficits. This research explored the initial psychometric properties of the Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders' European Portuguese version (IMCAP-ND^{PT}), by examining 1) translation and adaptation, 2) inter-rater reliability, 3) test-retest reliability and 4) criterion and convergent validity. Study I had a sample of 87 children aged between 21 and 91 months, 30 of them with neurotypical development and 57 with several neurodevelopmental disorders, while studies II, III and IV had autistic children aged between 26 and 65 months (n = 10, n = 12 and n = 11, respectively). The translated and transculturally adapted version of IMCAP-ND^{PT} seemed adequate for its purposes. This outcome measure obtained statistical significance when differentiating between groups with and without pathology. Findings also revealed a moderate / satisfactory test-retest repeatability (95% CI – CCI = .424 p= .022 ranging to CCI= .791 p= .000) and solid interobserver agreement (95% CI – ICC from .924 to .996 single measures p = .000, (κ) between two raters ranging from .81 to 1.00 in 63 of 109 items of the three scales as well as Pearson's r ranged between .7 and .9; α = .997). Regarding criterion and convergent validity, positive significant correlations were found between several Musical Emotional Assessment Rating Scale (MEARS) and Musical Cognitive/Perception Scale (MCPS) items and totals and the Griffiths Mental Development Scales (GMDS) domains, varying from .60 to .90; no negative or null correlations were found. The results showed a noticeable level of inter-rater reliability as well as a good internal consistency. Thus, the IMCAP-ND Portuguese version can be used more confidently in clinical practice; nevertheless, future studies are recommended with a larger sample.

KEYWORDS

music therapy,
autism spectrum disorder,
neurodevelopmental disorder,
assessment,
reliability,
validity evidence

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INTRODUCTION

Over the past two decades, music therapy assessment has been increasingly recognised as contributing to auxiliary diagnostic impressions of children with NDD (Jacobsen et al., 2019; Wigram & Gold, 2006). Music therapy intervention has been linked to particular improvements on the core difficulties of autistic individuals: in joint attention (Kim et al., 2008), non-verbal communication (Finnigan & Starr, 2010; Gattino et al., 2011; Raposo, 2019), verbal communication (Lim & Draper, 2011; Raposo et al., 2020), engagement (Carpente, 2016b; Kim et al., 2009; Simpson & Keen, 2011), social interaction (Geretsegger et al., 2014; Thompson et al., 2013), self-regulation (Carpente, 2016b) as well as on the quality of the parent-child relationship (Schwartzberg & Silverman, 2016; Thompson & McFerran, 2015).

Music therapy assessment can play an important role in identifying strengths and impairments that can lead to a more precise intervention (Else & Wheeler, 2010). Still, music therapy studies need to become more engaged in research linked to evidence-based practice (EBP), so that music therapy will be overall accepted as an evidence-based treatment (EBT), since most research in this area starts with clinical practice generating a theory (Baker & Young, 2016).

There is an increasing number of international and multicentre music therapy studies that use standardised protocols and measures, which implies having translated and cross-cultural adapted versions of outcome measures, tested for validity and reliability (Ridder et al., 2017). In the field of ASD and developmental and learning disabilities, music therapists still often use other assessment tools developed by allied health professionals rather than music therapy specific ones (Kern et al., 2013). Nonetheless, there are already several outcome measures such as the Improvisational Assessment Profiles (IAPs), the Music Therapy Coding Scheme (MTCS), the Nordoff-Robbins Scale I: Child-Therapist(s) Relationship in Coactive Musical Experience, the Nordoff-Robbins Scale II: Musical Communicativeness and the Nordoff-Robbins Scale III: Musicing: Forms of Activity, Stages and Qualities of Engagement. The above-mentioned assessment tools' validities and/or reliabilities are yet to be tested and verified (Spiro et al., 2017).

Music therapy intervention has another EBP challenge: techniques are generally known for their flexibility and music therapists are constantly adapting their behaviours to the client's interests, following the child's needs at each moment of the session (Raposo et al., 2020). Therefore, music therapy practices are not easily quantifiable, since the procedures cannot be prescribed in advance, it is challenging to isolate and account for all the variables and the outcomes are unique and heterogeneous (Rickson et al., 2016).

The aim of this paper is to present the initial psychometric properties of the IMCAP-ND^{PT} version, by examining 1) translation and adaptation, 2) inter-rater reliability, 3) test-retest reliability and 4) criterion and convergent validity of this assessment tool for use in Portugal.

METHOD

Study design

In methodological terms, an intervention protocol was outlined with a quantitative measure design. The IMCAP-ND has 109 items divided in three subscales (MEARS, MCPS and MRS – Musical Responsiveness Scale).

There were several studies, with different purposes, in this research:

Study I. Regarding study I, we followed Urbina's (2004) and Wild et al.'s (2005) similar steps towards translating assessment tools, as well as we took into consideration Behling and Law's (2000) statements of common problems during translations and the specific translation and adaptation procedures for music therapy outcome instruments provided by Ridder et al. (2017).

Translation deals with the process of rendering words, sentences, or texts into a different language or the written or spoken rendering so produced (American Psychological Association, 2015). The cross-cultural adaptations refer to the need to adapt the distinct translated terms to the different cultural concepts and understandings of health, music and illness, to the target population (modified from Ridder et al., 2017).

This study was based on the IMCAP-ND single-session application which was part of the translation procedures, in order to verify if there were significant differences between a group of children with various developmental disorders (n = 57) and children with neurotypical development (n = 30). Group 2 subjects had various NDD, mostly autism spectrum disorders (n = 37; 42.5%), cerebral palsy (n = 7; 8%), global developmental delays (n = 5; 5.7%) and, with lower representation, trisomy 21 (n = 3; 3.4%), premature babies with primarily motor sequelae (n = 2; 2.3%), language disorders (n = 2; 2.3 %) and sensory processing disorders (n = 1; 1.1%).

Study I was the only multicentre study, with participants from various regions of Portugal (Lisbon and Santarem, besides the Azores, where all the other studies took place).

Study II. Regarding studies II and III, the reliability is the extent to which an assessment procedure consistently gages/measures a construct/characteristic within the same population (Jacobsen et al., 2018). In study II, inter-rater reliability was part of a music therapy efficacy pilot trial and was done with a comparison of 10 IMCAP-ND applications by each of the two raters to five autistic children who had 20 sessions of music therapy intervention and the IMCAP-ND as a pre- and post-measure completed by each rater (n = 10).

Study III. In study III, test-retest reliability was part of the subsequent clinical trial that consisted of an IMCAP-ND comparison between pre- and post-test of the same rater to 12 autistic children, six of them in a control group with only conventional therapies and six that had 20 additional music therapy sessions besides multidisciplinary intervention (n = 12). Test-retest reliability specifically analysed IMCAP's MEARS and MCPS subscale totals.

Study IV. Regarding study IV, criterion validity deals with any measure of validity based on determining the strength of the relationship between scores on the test and an independent criterion that is accepted as a standard against which the test may be judged (Colman, 2015). Convergent validity occurs when two measures are significantly correlated with each other, positively or negatively, and show evidence of similarity of the evaluated constructs. It is important to compare the three IMCAP-ND scales with a standardised instrument which conveys strong valid and reliable properties concerning its scores. The GMDS fulfills these measures and is regarded as a "gold standard" instrument across disciplines in assessing the mental development skills (Li et al., 2020).

Study IV (criterion and convergent validity) had the same sample of study III (with the exception of the exclusion of one participant due to GMDS incomplete assessment) and it was the only study in which there was a comparison between two scales' post-test results (IMCAP-ND and GMDS). It also assessed autistic children, five of them in a control group with conventional therapies and six that had 20 additional music therapy sessions besides multidisciplinary intervention (n = 11).

Thus, study I was quasi-experimental, with an ex post facto design (typical development or a developmental disorder), while study II inter-rater reliability was based on data from a pilot six-month music therapy pre- posttest intervention that preceded the experimental clinical trial with autistic children, with the latter having both the test-retest reliability (study III) and convergent validity (study IV) also tested. Therefore, while all children of studies II, III and IV participated in study I, the pilot and the clinical trial had different samples for their own purposes.

Ethical approval for this research was obtained by the Internal Review Board (IRB) at Hospital do Divino Espirito Santo, Ponta Delgada (HDES). Data collection was extended to other institutions. The clinic managers of CDIJA, Consultorio Filipe Cymbron (CFC-CDR), Cresce com Amor and Terapia ao Quadrado also authorized the studies. Written informed consent was obtained from all legal representatives, who understood the general purposes of each study.

ETHICS

Participants were recruited to collaborate on this music therapy research as they came to their regular developmental paediatrics appointment. Institutions were contacted by the researcher for convenience.

Data collection occurred at the five above-mentioned medical institutions, mainly at the hospital. The HDES offers music therapy assessment and treatment for children with neurodevelopmental disorders, such as ASD. The studies included children who complied with the following inclusion criteria: a) children needed to have a formal referral to music therapy and a diagnosis assigned by a professional of the Developmental Paediatrics Department at HDES, CDIJA, CFC-CDR, Cresce com Amor or Terapia ao Quadrado; b) in study I, children with typical development, who went to HDES, had a referral by the four selected schools; c) participants for studies II, III and IV needed a formal ASD

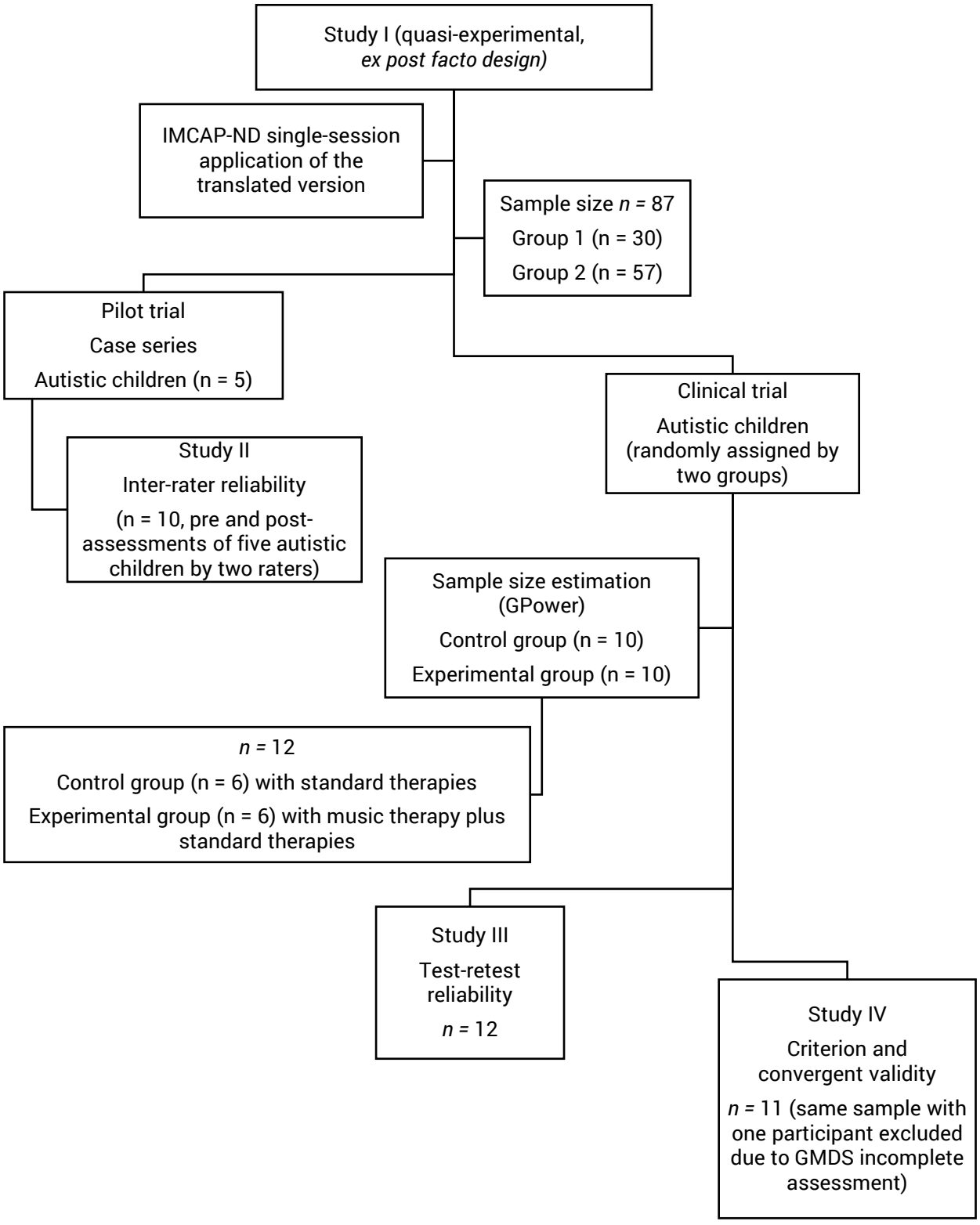

Figure 1: Sample size flow diagram

diagnosis based on a cut-off test (The Autism Diagnostic Observation Schedule – ADOS) and, additionally, had to present with ASD main characteristics defined by the Diagnostic and Statistical

Manual of Mental Disorders / DSM–V (American Psychiatric Association, 2013); d) participants must be between ages zero and eight years old in all studies; d) besides the group of children with neurotypical development in the first study, all other participants with NDD, including those with ASD in the following studies, could attend the conventional therapies, such as speech-language therapy, occupational therapy, psychology and psychomotricity at a school, hospital or therapeutic centre.

Regarding exclusion criteria: a) children could not have previously attended music therapy sessions or weekly music lessons, as the instruments could not be familiar objects; b) participants could not be involved in a DIRFloortime structured program (Binns & Cardy, 2019), with daily sessions with their parents at home and being periodically supervised by a professional, as this social-pragmatic approach, which impacts children's foundational communication capacities, is similar to improvisational music therapy (IMT) and results could be biased (Carpente, 2016b); c) children with multiple diagnoses besides ASD were excluded from the reliability and validity studies, since their results could be compromised by non-ASD impairments; d) and as there is a high frequency of co-occurrence of autism and epilepsy, children with known musicogenic epilepsy were definitely not admitted due to the contra-indication of treatment.

Measures

The Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders (IMCAP-ND)

The IMCAP-ND is a criterion-referenced assessment instrument which consists of three scales that can be used to measure communicative, emotional, relational, and cognitive functions of individuals with NDD, namely, ASD, attention deficit hyperactivity disorder, speech and language disorders and several genetic pathologies as well, regardless of their chronological age (Carpente, 2013). The Musical Emotional Assessment Rating Scale (MEARS – Scale I) assesses communication and involvement through musical play; the Musical Cognition / Perception Scale (MCPS – Scale II) assesses specific cognitive and perceptive skills and the Musical Responsiveness Scale (MRS – Scale III) has a focus on social interaction and being able to share prompt responses (Carpente, 2014).

As the therapist verifies how the client understands, interprets, and creates music with them, it is possible to observe, listen and classify responses and annotate additional clinical observations. Music therapy sessions need to have specific requirements for the IMCAP-ND to be administered: the therapist needs to improvise music experiences based on the client's lead and interests, as well as to target precise musical responses, which are relevantly associated with the neurological impairments of the client (Carpente, 2013). This approach (IMT) agrees with the developmental social pragmatic models' fundamentals; there is an intention of creating empathic relationships with children, nurturing reciprocal interactions through musical attunement, which then provides moments of affect synchronisation and, consequently, leads to social communication development (Carpente, 2016b). Reliability and convergent validity were already established in the original IMCAP-ND version (Carpente & Gattino, 2018; Carpente et al., 2022).

The Griffiths Mental Development Scales (GMDS)

The GMDS is considered to be one of the most widely researched outcome measure for the assessment of infants and young children throughout the world (Luiz, 1994). It is divided in two sections: one for the 0- to 2-year-old age group and the other for 2- to 8-year-olds, until its second edition (Luiz et al., 2007).

The GMDS consists of six subscales in major domains of development: locomotion (A), personal-social (B), hearing and language (C), eye and hand coordination (D), performance (E), and practical reasoning (F) (Luiz et al., 2006a, 2006b).

The original validation research on this instrument was conducted in the 1960s (Luiz et al., 2007) and various international studies found favorable results on Griffiths Scales' reliability and validity (Griffiths, 1984; Hanson, 1982; Heimes, 1983; Lister, 1979). The second edition was adapted to the Portuguese population by Borges et al. (2012). Internal consistency was tested but GMDS-ER still needs validation; the third review is in the process of validation for the Portuguese population.

The comparison between IMCAP-ND and GMDS

The GMDS were used on the convergent validity analysis as a "gold standard" instrument across disciplines in assessing the mental development skills (Li et al., 2020). GMDS use is very common in the Portuguese paediatric setting.

The activities that take place in both IMCAP and GMDS sessions seem to imply personal and social capacities (GMDS category B) and social emotional competencies, the basis for all the IMCAP's first subscale (MEARS – Musical Emotional Assessment Rating Scale).

Besides the different approaches (IMCAP application implies improvisation activities whereas GMDS application implies an adult direct instruction to complete a task), there might be similar issues assessed. For example, GMDS category C (hearing and language) assesses the child's various uses of communication, while IMCAP's MEARS items regarding musical affect also evaluate the use of prosody, facial expression, and body movements to assess verbal and non-verbal communication.

When comparing the active participation of the child, IMCAP application implies that the client directly uses the musical instruments to demonstrate their developmental abilities; therefore, eye and hand coordination and every other aspect of performance can be observed. In GMDS, these competencies are assessed in categories D and E (eye and hand coordination and performance).

Procedures and logistics

Translation and cross-cultural adaptation

The process was initiated through the translation of IMCAP-ND from English to European Portuguese. The back-translation was carried out by a bilingual translator and, afterwards, five bilingual music therapists evaluated each item of the three subscales in terms of clarity, precision and relevance. They were instructed to classify the items with a Likert-type score from 1 to 5, considering: 1 – strongly disagree; 2 - disagree; 3 - neither agree nor disagree; 4 – agree; 5 – strongly agree. Further explanations were given towards the concepts of clarity, precision and relevance.

The bilingual music therapists served as expert judges; they were not specialised with a degree in translation but were bilingual and specialised only in music therapy. When most of the judges' answers were not assigned at level 5, they were then encouraged to propose changes, so that there was consensus within translation, according to the Delphi technique (Linstone & Turoff, 2002), through which a group of specialists in different geographic areas can lead to dense results on complex and comprehensive themes.

We found that all items had a majority of classifications between levels 4 (agree) and 5 (totally agree), which was considered positive for this translation. Overall, it was also verified that, regarding the items with score 3 (neither agree nor disagree), bilingual music therapists were not referring to the accuracy of the Portuguese translation, but rather to the original clarity of the item itself, which goes beyond the scope of this study.

After delivering the back-translated version without consulting the original English tool, the bilingual translator also gave suggestions towards discrepancies. The process of harmonisation with the discussion of terminology and cross-cultural adaptations was similarly opened for the supervisor responsible for the previously validated Brazilian IMCAP-ND (Carpente, 2016a).

The concepts that were most subject for discussion were "musical affect", "attend to", "connects", "perceptual", "musical-play" and "responsiveness". As some terms were essential in the assessment scales, experts in linguistics were also consulted.

Study I. IMCAP-ND single-session application

Eight music therapists that attended to the IMCAP-ND Portuguese course agreed to directly collaborate on this study. Five of them participated as bilingual judges for the clarity, precision and relevance of the translated version, one carried out the retroversion, one other music therapist accepted to execute music therapy sessions for data collection, and one conducted counsel and supervision, since he had substantial experience in scales' validation and was responsible for the previously validated Brazilian version (Carpente, 2016a). Four other music therapy colleagues participated in collecting data only following the activities' protocol and providing video recordings, as they could not have access to the IMCAP-ND without having course qualifications.

The aim was to have a sample of 30 participants in each group, so that parametric tests could be applied. Unexpectedly, the experimental group reached 57 participants as it was simpler to contact their legal representatives, since children with some pathology regularly attend to medical appointments at the hospital. There were no specifications regarding a particular neurodevelopmental disorder diagnosis in group two, so this was a facilitating element.

As to the excluded participants of group 1 (children with neurotypical development), there were a few reasons for their exclusion: the misinterpretation of the age limit, symptoms associated with speech disorders though not yet having a formal diagnosis and scheduling difficulties.

There was a single music therapy assessment (with IMCAP-ND). Sessions were individual, approximately 45-minutes in duration, and arranged by phone or email with the legal representative. At the beginning, parents would receive the music therapy information through a brief PowerPoint presentation, which also included clarifications of the study's procedures. Biographic data was collected and then the child and the therapist would initiate the musical-play.

Generally, parents stayed in the room during music therapy sessions, except occasionally when it was determined that their presence was negatively compromising the child's attention and involvement.

Due to improvisational music therapy's main principle of following the child's needs, the central sequence of activities was slightly changeable, that is, activities 3, 4 and 5 could have their order inverted, if necessary.

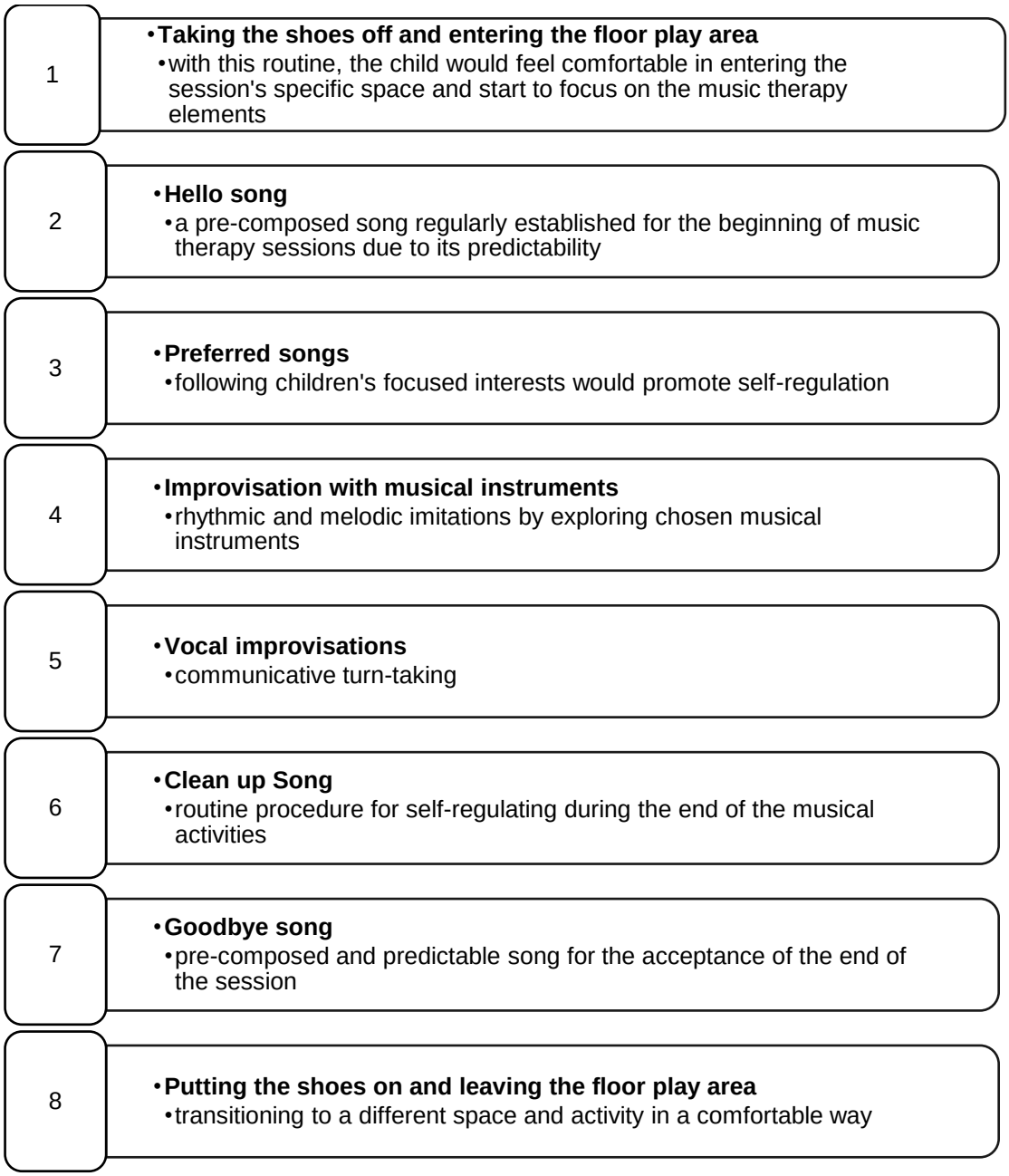

Figure 2: Intervention protocol for every session of the four studies

Study II. Inter-rater reliability

Participants from studies II, III and IV were selected in the context of their regular child development consultation; during the meeting, the team member would suggest study participation to their legal representative if they met the inclusion criteria. During the first session scheduled with the music therapist, further explanation was given, the informed consent fulfilled and the regular timetable was scheduled. The sessions took approximately 45 minutes during a six-month period, with a minimum attendance of 20 completed sessions. The audiovisual materials were recorded with a fixed camera positioned in one corner of the room, affording visual access to all the setting's dimensions and of every interaction with the child.

The two raters of Study II attended the same IMCAP-ND course in Porto (Portugal) on June 2017 and were also advised to consult the procedures and protocols' guidelines (Carpente, 2017) and the clinical manual (Carpente, 2013) before their task, due to semantic interpretation of each item.

As the IMCAP-ND scales are susceptible to the music therapist's subjective interpretation of observation data, it is particularly relevant to have inter-rater agreement (Bell et al., 2014; Magee et al., 2016). Inter-rater agreement with two raters was measured using kappa's coefficient (Cohen, 1960), applied to both frequency and support items of the three IMCAP-ND subscales using Landis and Koch's criteria (1977). Frequency specifically refers to the amount of behaviours presented on a specific matter whereas support refers to the type and intensity in which support will be delivered by the therapist in order for the client to demonstrate a particular target music response (Carpente, 2013).

The IMCAP-ND application was collected from autistic children who had 20 weekly music therapy sessions besides their conventional therapies (n = 10) and data for this inter-rater reliability study was collected from two raters.

Study III. Test-retest reliability

Test-retest reliability is used to measure stability over time and is an appropriate consideration for constructs that appear to have little changes from one observation to the subsequent other (Sattler, 2001). In this study, temporal reproducibility was measured through Cohen's kappa and Intraclass Correlation Coefficient (ICC) using data from twelve children who participated in a clinical trial, six of them in a control group with conventional therapies and six that had 20 additional music therapy sessions besides multidisciplinary intervention (n = 12). The time between the test and retest application through the audiovisual material observation was six months.

Study IV. Criterion and convergent validity

The main purpose of assessing convergent validity in this study was to answer the following questions: do IMCAP-ND^{PT} scales correlate with GMDS scores? If there is a positive correlation, can IMCAP-ND^{PT} be used as a complementary measure to obtain additional data in developmental disorders? In this psychometric procedure, the researchers considered Spearman correlations of both IMCAP-ND^{PT} items and GMDS total scores, in order to have a broad range of research, since there were no previous studies testing this type of validity in the Portuguese music therapy field.

This study had the same sample as study III (with the exception of the exclusion of one participant due to an incomplete GMDS assessment). Data was collected from autistic children, five of them in a control group with conventional therapies and six that had 20 additional music therapy sessions besides multidisciplinary intervention (*n* = 11).

Due to the pandemic restrictions caused by the 2019-nCoV virus, this study was substantially affected and its sample was limited.

Data analysis

Data were analysed using the Statistical Package for the Social Sciences (SPSS) version 25.0 for MacOS 10.13.6.

> In samples with n ≤ 12 subjects, the normality tests have little power to discriminate distributions that follow a Gaussian curve, that is, small samples do not have enough information to be able to make inferences about the type of distribution in the population. (Motulsky, 2003, p.207)

The IMCAP-ND and GMDS variables were described in means and standard deviations and these data did not always present a normal distribution (assessed using the Shapiro-Wilk W). For this reason, different analyses were carried out using both parametric and non-parametric tests, the latter also being applied for IMCAP-ND scale III, as it has ordinal items. Each of these tests will be described according to the validity and reliability main statistics/procedures below.

RESULTS

Group differences

The student's t-test for independent samples did not reveal a significant difference regarding age, for $p < 0.05$, between group 2 with NDD (M = 53.35) and group 1 with neurotypical children (M = 51.40) in the mean age (t = - .423, p = .674).

Tables 1 and 2 illustrate the group differences using student's t-test for all the items and totals scores which had normal distribution or slight deviations to normality in IMCAP-ND scales I (MEARS) and II (MCPS), as well as Mann-Whitney U test for the scale III (MRS) ordinal items.

Student's t-test for independent samples revealed for $p < 0.01$ an extremely significant difference in all items between group 1, of children with neurotypical development (*n* = 30), and group 2, of children with neurodevelopmental disorders (*n* = 57), in all of scales I and II dimensions and totals, with emphasis on the differences in the "I_V_Musical Interrelatedness" total [t = 17,303, p = 0.000]: group 1 revealed a significantly higher result (M = 4.13) compared to group 2 (M = 1.56).

	Group 1 (*n* = 30)		Group 2 (*n* = 57)		*t student*
Subscale I (MEARS)	Mean	SD	Mean	SD	
I. musical attention totals (frequency)	4,68	0,50	2,39	0,92	t = 15,074 p =,000***
II. musical affect totals (frequency)	4,50	0,38	2,15	0,86	t = 17,594 p =,000***
II. musical affect totals (support)	4,68	0,30	2,82	1,02	t = 12,669 p =,000***
III. adaption to musical-play totals (frequency)	4,46	0,37	2,02	1,06	t = 15,681 p =,000***
III. adaption to musical-play totals (support)	4,72	0,22	2,61	1,08	t = 14,189 p =,000***
IV. musical engagement totals (frequency)	4,23	0,56	1,59	0,97	t = 16,045 p =,000***
IV. musical engagement totals (support)	4,53	0,45	2,37	1,13	t = 12,659 p =,000***
V. musical interrelatedness totals (frequency)	4,13	0,49	1,56	0,89	t = 17,303 p =,000***
V. musical interrelatedness totals (support)	4,49	0,39	2,29	1,04	t = 14,213 p =,000***
Subscale II (MCPS)					
II. focuses / total	4,48	0,58	2,01	0,84	t = 16,111 p =,000***
III. recalls / total	4,25	0,51	1,44	1,07	t = 16.457 p =,000***
IV. follows / total	4,47	0,50	1,58	1,02	t = 17,807 p =,000***

Table 1: Student's t-test for Subscales I (MEARS) and II – MCPS items with slight deviations from normality[1]

	Group	Mean rank	Sum of ranks	Mann-Whitney U	Z	Exact sig. (2-tailed)
Preference: tempo range fast	G1	66,95	2008,50	166,500	-6,349	,000***
	G2	31,92	1819,50			
Preference: dynamic range loud	G1	66,30	1989,00	186,000	-6,162	,000***
	G2	32,26	1839,00			
Preference: attack primarily staccato	G1	68,27	2048,00	127,000	-6,746	,000***
	G2	31,23	1780,00			
Efficiency: tempo range slow	G1	69,15	2074,50	100,500	-6,904	,000***
	G2	30,76	1753,50			
Efficiency: attack primarily staccato	G1	69,08	2072,50	102,500	-6,892	,000***
	G2	30,80	1755,50			
Self-regulation: tempo range fast	G1	68,28	2048,50	126,500	-6,645	,000***
	G2	31,22	1779,50			
Self-regulation: dynamic range soft	G1	69,77	2093,00	82,000	-7,057	,000***
	G2	30,44	1735,00			
Self-regulation: attack primarily staccato	G1	67,93	2038,00	137,000	-6,595	,000***
	G2	31,40	1790,00			
Self-regulation: attack primarily legato	G1	70,33	2110,00	65,000	-7,195	,000***
	G2	30,14	1718,00			

Table 2: Mann-Whitney U test for Subscale III (MRS)

The Mann-Whitney U test revealed for $p \leq 0.001$ the existence of an extremely significant difference between group 1 (N = 30) and group 2 (N = 57) in the clients' musical preferences, in the efficiency of their performance as well as in their self-regulatory capabilities.

It is relevant that group 1 showed greater preference for a faster tempo (U = 166,500, $p = 0.000$), a louder dynamic (U = 186,000, $p = 0.000$) and primarily staccato attacks (U = 127,000, $p = 0.000$). In terms of efficiency, it should be noted that group 2 was significantly less efficient when asked to participate in a slow tempo range (U = 100,500, $p = 0.000$) and primarily staccato attacks (U = 102,500,

[1] *** significant as p < 0,001; ** significant as p < 0,01; * significant as p < 0,05

p = 0.000). Regarding self-regulation, it was evident that group 1 had better control of their attention and availability for interaction in a faster tempo range (U = 126,500, *p* = 0.000) and during primarily staccato attacks (U = 137,000, *p* = 0.000).

Inter-rater reliability

Inter-rater agreement between music therapists M. and C. was measured in ten observations (*n* = 10). The Kappa coefficient (Cohen, 1960) was applied to the frequency and support items of the three subscales using Landis and Koch's criteria (1977).

In scale I (MEARS), regarding the frequency results, an almost perfect agreement was observed in 25 out of the 48 items (95% confidence interval ranging from .815 to 1.00), substantial agreement in 15 items (95% confidence interval ranging from .625 to .804), moderate agreement in 3 items (95% confidence interval ranging from .412 to .571), fair agreement in 4 items (95% confidence interval ranging from .231 to .394) and a slight agreement in 1 item (95% confidence interval (κ) = .130).

		Frequency	Support
Level 1: Musical attention	Focuses	1.00[a]	.804[b]
	Maintains	.429[c]	.706[b]
	Shares	.722[b]	.661[b]
	Shifts	.846[a]	.344[d]
Level 2: Musical affect	Facial	.231[d]	.787[b]
	Prosody	1.00[a]	.868[a]
	Body	1.00[a]	1.00[a]
	Motion	.130[e]	.706[b]
Level 3: Adaption to musical-play	Joins	.625[b]	.833[a]
	Adjusts	.726[b]	.342[d]
	Takes turns	.855[a]	1.00[a]
	Stops	.714[b]	1.00[a]
Level 4: Musical engagement	Imitates	.872[a]	1.00[a]
	Synchronises	.861[a]	.787[b]
	Predicts	.744[b]	1.00[a]
	Ends	394[d]	1.00[a]
Level 5: Musical interrelatedness	Initiates	1.00[a]	.625[b]
	Changes	.412[c]	.846[a]
	Differentiates	.733[b]	.571[c]
	Assimilates	.733[b]	.865[a]
	Connects	.859[a]	1.00[a]
	Interjects	.861[a]	.815[a]
	Completes	1.00[a]	.861[a]
	Leads/follows	.865[a]	.697[b]

Table 3: Cohen's Kappa coefficients[2]

[2] [a]Almost perfect agreement (.81 to 1); [b]Substantial agreement (.61 to .80); [c]Moderate agreement (.41 to .60); [d]Fair agreement (.21 to .40); [e]Slight agreement (0 to .20); [f]Poor agreement (0) (Landis & Koch, 1977).

Regarding ICC for Scales I and II total scores, all coefficients were above 0.75 (95% confidence interval ranging from 0.924 to 0.996 single measures p = .000), that is, there is excellent repeatability, according to the scale of values of Menz et al. (2004).

Additionally, in the MEARS scale, Wilcoxon test revealed disagreements in only 2 of 48 items (Shifts support: z = -2.000 p = .046; Motion frequency: z = -2.449 p = .014). In the MCPS scale, disagreement was found in either 2 of 25 items (Reacts Totals: z = -2.333 p = .020; Initiates timbre: z = -2.000 p = .046). In the MRS subscale, disagreement was shown in only 3 of 12 items also (Preferences medium tempo range: z = -2.336 p = .025; Preferences fast tempo range: z = -2.336 p = .025; Self-regulation medium dynamic range: z = -2.000 p = .046). Thus, the Wilcoxon test revealed at p > 0.05 that the variation between the medians of the two observers was not significantly different, that is, the null hypothesis was not rejected. Therefore, observers were mostly in agreement when assigning their ratings.

Test-retest reliability

Temporal stability was analysed through test-retest reproducibility from the calculation of Cohen's kappa and ICC of 12 cases. Cohen's kappa coefficient revealed poor agreement only in 2 of the 109 items of the 3 subscales, a slight agreement in 16 items, considerable agreement in 57 items, moderate agreement in 29 items and substantial agreement in 5 items, according to Landis and Koch's criteria (1977).

For this test-retest reliability, the ICC was .424 to .791, which corresponds to a moderate / satisfactory repeatability, according to Menz et al. (2004).

MEARS and MCPS scales totals	Frequency	Support
Musical attention	CCI = .424 p = .022	CCI = .455 p = .014
Musical affect	CCI = .577 p = .003	CCI = .591 p = .002
Adaption to musical play	CCI = .519 p = .005	CCI = .582 p = .004
Musical engagement	CCI = .641 p = .001	CCI = .604 p = .004
Musical interrelatedness	CCI = .612 p = .001	CCI = .705 p = .000
Reacts	CCI = .490 p = .006	---
Focuses	CCI = .531 p = .007	---
Recalls	CCI = .581 p = .002	---
Follows	CCI = .791 p = .000	---
Initiates	CCI = .604 p = .001	---

Table 4: Intraclass correlation coefficient (single measures)

Convergent validity

Convergent validity with IMCAP-ND and GMDS scales was measured in 11 observations (n = 11). Positive significant correlations were found between several MEARS and MCPS items and totals and the GMDS domains (locomotion, personal-social domain, hearing and language, eye and hand coordination, performance, and practical reasoning), varying from .60 to .90; no negative or null correlations were found.

IMCAP-ND	GMDS	Correlation coefficient	Sig. (2-tailed)
I_I_b_maintains_frequency	Total D	*r* = .777	p = .005**
I_II_h_motion_frequency	Total B	*r* = .848	p = .001***
I_III_l_stops_frequency	Total B	*r* = .786	p = .004**
	Total D	*r* = .777	p = .005**
I_IV_m_imitates_frequency	Total B	*r* = .820	p = .002**
	Total C	*r* = .792	p = .004**
	Total D	*r* = .877	p = .000**
I_V_s_differentiates_frequency	Total B	*r* = .807	p = .003**
	Total C	*r* = .847	p = .001***
	Total D	*r* = .771	p = .006**
I_V_x_leads_follow_frequency	Total B	*r* = .781	p = .005**
	Total D	*r* = .834	p = .001***
II_III_recalls / melody	Total B	*r* = .820	p = .002**
	Total C	*r* = .792	p = .004**
	Total D	*r* = .877	p = .000***
II_III_recalls / phrase	Total B	*r* = .782	p = .004**
	Total C	*r* = .740	p = .009**
	Total D	*r* = .799	p = .003**
II_IV_follows / melody	Total B	*r* = .759	p = .007**
	Total D	*r* = .732	p = .011*
II_IV_follows / dynamic	Total D	*r* = .736	p = .010**
	Total E	*r* = .721	p = .012*
II_V_initiates / dynamic	Total D	*r* = .792	p = .004**
I_II_Musical_affect_total_frequency	Total B	*r* = .827	p = .002**
	Total D	*r* = .710	p = .014*
I_III_Adaption_to_musical-play_total_frequency	Total B	*r* = .841	p = .001***
	Total C	*r* = .726	p = .011*
	Total D	*r* = .825	p = .002**
I_IV_Musical_engagement_total_frequency	Total B	*r* = .799	p = .003**
	Total C	*r* = .737	p = .010**
	Total D	*r* = .778	p = .005**
I_V_Musical_interrelatedness_total_frequency	Total B	*r* = .721	p = .012*
	Total D	*r* = .760	p = .007**
II_III Recalls / total	Total B	*r* = .750	p = .008**
	Total D	*r* = .810	p = .003**

Table 5: Spearman positive correlations between IMCAP-ND^{PT} and GMDS scores (convergent validity)

DISCUSSION

Procedure and intervention protocol

The main clinical trial was preceded by a pilot study, after which there were protocol improvements regarding inclusion and exclusion criteria, the use of identical musical instruments in different institutions on this research and the full comprehension of all the informed consent terms that followed the preliminary research were then applied and considered effective.

Study I. IMCAP-ND single-session application

This study explored the group differences that could be identified with a single-session application of the IMCAP-ND three scales for use in Portugal. Data revealed statistically significant differences (p <0.01) in all items between the group of neurotypically developed children (n = 30) and the group with neurodevelopmental disorders (n = 57), with emphasis on the differences in the "Musical Interrelatedness" total [t = 17,303, p = 0.000], as well as positive results were found on the average means for attention, reaction and initiative. Indeed, individuals with neurodevelopmental disorders, namely ASD, spend less time attending to social stimuli than typically developing (TD) controls (Chita-Tegmark, 2016) and this suggests an impact on their musical interrelatedness competencies.

Regarding the Musical Responsiveness Scale (MRS), it is relevant that group 1 showed greater preference for a faster tempo, a louder dynamic and primarily staccato attacks. Children with neurodevelopmental disorders often have mild to moderate gross motor difficulties while playing (Lucas et al., 2016) and these struggles might have an impact on their preferences for less intense music characteristics, so that they can control their environment while playing musical instruments.

In terms of efficiency, it should be noted that group 2 was significantly less efficient when asked to participate in a slow tempo range and primarily staccato attacks, as well as regarding self-regulation, it is evident group 1 had better control of their attention and availability for interaction in a faster tempo range and during primarily staccato attacks. Besides the attention difficulties of children with various neurodevelopmental disorders, we should also consider the recent focus on the specific movement and sensory abnormalities in autistic children, namely in cortical and cerebellar differences (Hardy & LaGasse, 2013). Jansen and Thaut (2018) suggest that music-based developmental interventions for attention and motor control may have a new functional role in supporting autistic children due to the significant effect of auditory-motor entrainment on motor and attention functions and brain connectivity.

Overall, as it was previously assumed, the results of this study confirm the need for more music therapy assessment instruments to be validated (Lipe, 2015; Waldon & Gattino, 2018; Wheeler & Murphy, 2016) and, possibly, for assuming in the future IMCAP-ND as an additional cut-off test for detecting neurodevelopmental delays in some areas, such as in social-emotional responses, cognitive functions (attention, memory, planning and making decisions) and responsiveness capabilities, since the results were all statistically significant between groups of children with and without such disorders.

Study II. Inter-rater reliability

There are many studies that examined inter-rater reliability for music therapy assessment tools, such as the Client–Therapist Relationship in Musical Activity Scale - CTRMAS (Mahoney, 2010) and the Music Therapy Communication and Social Interaction Scale - MTCSI (Bell et al., 2014), that were applied to a variety of neurodevelopmental delays; however, there are only a few that specifically focus on ASD, as in Carpente and Gattino's IMCAP-ND[2013] original version research (2018).

The inter-rater reliability results in this study (*n* = 10) are in line with both MTCSI (*n* = 8), CTRMAS (*n* = 10) and IMCAP-ND original version (*n* = 30), even though we had a similar small sample size with only the first two assessment tools.

IMCAP-ND scores seem to successfully assess symptoms of ASD during music-centred activities (Carpente & Gattino, 2018). In scale I (MEARS), Cohen's kappa results showed a substantial to almost perfect agreement in 83% of the items (95% confidence interval ranging from .625 to 1.00), according to Landis and Koch's (1977) criteria. The results of the present study appear to be consistent with inter-rater reliability of IMCAP-ND original version (Carpente & Gattino, 2018), having both a high degree of inter-rater reliability, as the values of mean exact agreement for weighted kappa in IMCAP-ND^{2013} showed promising results in the MEARS (.98), MCPS (1.00), and MRS (1.00) (Carpente & Gattino, 2018), though with IMCAP-ND^{PT} version having slightly lower results and higher variability between raters, who had less experience as IMCAP-ND raters than the IMCAP-ND^{2013} assessors. The inter-rater reliability ranges between different items should also be explored in future studies, as there were vast differences (Level 2: Musical Affect / Facial κ = .231; Level 5: Musical Interrelatedness / Initiates κ = 1.00), despite most items obtained higher levels of agreement.

Study III. Test-retest reliability

This study explored test-retest reliability using Cohen's kappa and ICC to compare IMCAP-ND^{PT} scores, obtained from the same participants within a six-month interval (*n* = 12).

Regarding technical adequacy, when comparing the IMCAP-ND^{PT} ICC results with those from the Music Attentiveness Screening Assessment, Revised (MASA-R), which is another music therapy scale that underwent test-retest reliability procedures, we found that the IMCAP-ND^{PT} ICC was .424 to .791, which corresponds to a moderate / satisfactory repeatability, according to Menz et al. (2004). MASA-R test-retest reliability for all age groups using ICC fell into acceptable ranges for both items (Item I, ICC = .88, 95% CI [.80, .93]; Item II, ICC = .91, 95% CI [.85, .94]). As we had a smaller sample and a large period for stability over time (six months instead of a two-week delay), our results are acceptable but lower than MASA-R.

In fact, MASA-R results are higher than the previous study of MASA (test-retest reliability on the first MASA item was moderately high [Pearson *r* = .84] while on the second item it was lower [*r* = .63]), as they improved it with a larger and more heterogeneous sample, which may have reduced the impact of error variance on reliability estimates for each item (McMillan & Schumacher, 2006; Waldon & Broadhurst, 2014).

To increase the confidence on IMCAP-ND^{PT} following referral and as a reliable assessment tool to compare baseline to intervention, further studies of score stability with a larger sample are necessary. Moreover, regarding test-retest reliability, data has to be carefully interpreted as the comparison between test-retest applications is usually closer in time. The results could also be biased due to the rater's inexperience in rating during the first assessment moment (the rater attended the IMCAP Portuguese certification course and started his rating experience with this procedure). These factors could explain why higher agreements on inter-rater reliability were obtained, compared with test-retest reliability.

Study IV. Convergent validity

This study explored the convergent validity between the item and total scores of MEARS and MCPS (from IMCAP-ND) with the totals of the GMDS in areas such as locomotion, personal-social domain, hearing and language, eye and hand coordination, performance, and practical reasoning, as both scales assess social-emotional competencies and cognitive and perception processes.

Data revealed statistically significant results for convergent validity with respect to MEARS frequency scores and totals: of the 96 correlations found, 25 (26.04%) were in the personal-social GMDS B domain, 22 (22,92%) in eye and hand coordination GMDS D domain, 15 (15,63%) in the hearing and language GMDS C domain, 13 (13.54%) in the performance GMDS E domain, 11 (11.46%) in the practical reasoning GMDS F domain and, lastly, 10 (10.42%) in the locomotion GMDS A domain.

As to the MCPS frequency scores and averages, of the 63 correlations found, 19 (30.16%) were in eye and hand coordination GMDS D domain, 17 (26.98%) in the personal-social GMDS B domain, 11 (17.46%) in the performance GMDS E domain, 7 (11.11%) in the locomotion GMDS A domain, 6 (9.52%) in the hearing and language GMDS C domain, and, at last, 3 (4.76%) in the practical reasoning GMDS F domain.

Nevertheless, there were no correlations between the MEARS item “r - changes” and the MCPS items “focuses on rhythm, melody, phrase or timbre” and any GMDS total scores, which was not expected to some extent, as there were other positive correlations found regarding attention skills and flexibility in changing own performances, which is essential when following a child-led perspective and freedom to move between activities (Carpente, 2013).

The correlations found between MEARS and MCPS with GMDS ranged from $r(11)= .604$, $p=.049$ to $r(11)=.896$, $p=.000$, which are considered moderate to strong, according to Dancey and Reidy (2004)’s criteria for the strength of correlations ($R < 0.39$ = weak; $0.4 < R < 0.69$ = moderate; $R > 0.7$ = strong).

There were no null Spearman correlations. Most correlations were considered moderate, although 45% of all were strong. The most frequent correlations were with GMDS personal-social and eye/hand coordination domains, which is congruent with the idea of music therapy used to boost social-emotional responses and encouraging eye/hand coordination when exploring musical instruments.

Even though IMCAP-ND does not have diagnostic purposes, similar to GMDS, both can be helpful in targeting children's specific responses towards different materials, such as toys and musical instruments. Thus, IMCAP-ND results might be an aid for children’s formative and developmental assessment (Waldon & Gattino, 2018).

Limitations and future directions

The results of this research should be comprehended taking into account the encountered limitations. Although the first study obtained a relatively large multicentre sample (n = 87), the inter-rater reliability, test-retest reliability and the convergent validity studies had small samples (n = 10, n = 12, n = 11, respectively). Multicentre studies with larger sample sizes need to be carried out specifically on the validity evidence of IMCAP-ND for use in Portugal. Moreover, despite having a larger sample and a

control group, compared to the previous pilot study, the GMDS dimension F - "practical reasoning" should be further explored with more children between two and eight years old with developmental delays that attend weekly music therapy sessions, as there is a gap of not having any data on this domain from children up to two years old and, suddenly, at the post-test, when they turn three, GMDS scales assign a new percentile of practical reasoning that should be carefully interpreted with subjects in these transitioning ages.

This exploratory inter-rater study had a considerable constraint of not having two different music therapists to conduct weekly sessions and two other independent judges for rating IMCAP-ND scores through audiovisual recording; since no other professionals were available for this task, which required substantial dedication of their own time, one music therapist did both tasks (sessions and rating), one music therapist was only an independent rater and another music therapist was only an experimentalist (only did the sessions, following the protocol, as she was not IMCAP-ND qualified rater). Future studies should try to include at least two independent raters certified with the IMCAP-ND^{PT} course training.

Although there was homogeneity with regards to the professionals' academic training, all of whom had the same certification course in IMCAP-ND, standardisation of professional experiences could be more precise, as the music therapists' clinical backgrounds were diverse. Furthermore, since music therapy is not yet legally recognised in Portugal as a health profession, and there is mental resistance to this complementary therapy which does not have as broad of scientific evidence as other conventional treatments, we experienced inherent challenges for the implementation of music therapy sessions in medical settings, due to cultural constraints, though it was possible to comply with procedure and intervention protocols.

Future studies should also have subjects separated by their ASD severity of symptoms, grouped by their scores in the cut-off diagnostic test, due to the diversity included on the spectrum and, ultimately, this study did not use the most current edition of the GMDS (the Griffiths-III), as this version still lacks validation for use in Portugal. In addition, further research should compare IMCAP-ND scores with other standardised instruments for assessing neurodevelopmental disorders.

CONCLUSION

This study has the singularity of being the first psychometric validation of a neurodevelopmental music therapy specific assessment instrument for the Portuguese population. The translation of this tool to European Portuguese was carried out effectively and semantic equivalence of IMCAP-ND^{PT} was obtained. Moreover, it is remarkable that the research was rigorous towards the use of protocols on techniques, activities, and data collection (audiovisual recording for confirmation purposes).

Additionally, it was demonstrated that IMCAP-ND scales can contribute to assist diagnostic impressions with additional clinical information, as suggested by Wigram and Gold (2006) and reaffirmed by Jacobsen et al. (2019), as it can be one of the utilities of music therapy assessments. This can effectively promote music therapy to be widely spread and relevant on the assessment work of multidisciplinary clinical teams.

While comparing this study with the original validation (Carpente, 2013; Carpente & Gattino, 2018; Carpente et al., 2022), it is possible to assume that this current investigation was an asset for the sample size as well as for the heterogeneity in study I. Although the author intended that the IMCAP-ND profile should be used with several NDD, the original validation only included autistic children.

In summary, it should be concluded that there was evidence of inter-rater reliability as well as convergent validity with significant results, as it was also previously described by Waldon et al. (2015) with MASA-R, Bergmann et al. (2015) with Music-based Autism Diagnostics (MUSAD) and Gattino et al. (2017) with the Brazilian version of KAtegoriensystem MUsikTHErapie (KAMUTHE), though future studies are necessary to increase the level of validity evidence for the IMCAP-ND outcome measure.

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Ελληνική περίληψη | Greek abstract

Το Ατομικό Μουσικοκεντρικό Προφίλ Αξιολόγησης για Νευροαναπτυξιακές Διαταραχές (IMCAP-ND) προς χρήση στην Πορτογαλία: Μετάφραση και ψυχομετρική τεκμηρίωση

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ΠΕΡΙΛΗΨΗ

Υπάρχει μία γενικότερη ανάγκη για μουσικοκεντρικά εργαλεία αξιολόγησης ως ειδικά μέτρα έκβασης για την αποτελεσματικότητα της μουσικοθεραπείας σε άτομα με νευροαναπτυξιακές διαταραχές (ΝΑΔ), και ειδικότερα με διαταραχές αυτιστικού φάσματος (ΔΑΦ), καθώς η μουσική διευκολύνει τις επικοινωνιακές και κοινωνικές δεξιότητες αυτών των ατόμων και παρέχει μοναδικούς τρόπους για την αξιολόγηση των

συγκεκριμένων δυσκολιών τους. Αυτή η μελέτη διερεύνησε τις αρχικές ψυχομετρικές ιδιότητες της Πορτογαλικής έκδοσης του Ατομικού Μουσικοκεντρικού Προφίλ Αξιολόγησης για Νευροαναπτυξιακές Διαταραχές (IMCAP-ND^{PT}) εξετάζοντας 1) τη μετάφραση και την προσαρμογή, 2) την αξιοπιστία μεταξύ αξιολογητών, 3) την αξιοπιστία εξέτασης-επανεξέτασης και 4) την εγκυρότητα κριτηρίου και τη συγκλίνουσα εγκυρότητα. Το δείγμα της πρώτης μελέτης ήταν 87 παιδιά ηλικίας από 21 έως 91 μηνών, εκ των οποίων τα 30 με νευροτυπική ανάπτυξη και τα 57 με ποικίλες νευροαναπτυξιακές διαταραχές, ενώ στην δεύτερη, τρίτη και τέταρτη μελέτη συμμετείχαν αυτιστικά παιδιά ηλικίας από 26 έως 65 μηνών (n = 10, n = 12 and n = 11, αντίστοιχα). Η μεταφρασμένη και πολιτισμικά προσαρμοσμένη εκδοχή του IMCAP-ND^{PT} κρίθηκε ως επαρκής για τους σκοπούς της. Αυτό το μέτρο έκβασης απέκτησε στατιστική σημαντικότητα κατά τη διαφοροποίηση μεταξύ των ομάδων με και χωρίς παθολογία. Τα αποτελέσματα έδειξαν επίσης μία μέτρια έως ικανοποιητική επαναληψιμότητα στην εξέταση-επανεξέταση (95% CI – CCI = .424 p= .022 κυμαινόμενο σε CCI= .791 p= .000) και σταθερή συμφωνία μεταξύ των παρατηρητών (95% CI – ICC από .924 σε .996 μεμονωμένες μετρήσεις p = .000, (κ) μεταξύ δύο αξιολογητών από .81 ως 1.00 σε 63 από 109 στοιχεία των τριών κλιμάκων, καθώς επίσης και ο συντελεστής γραμμικής συσχέτισης r του Pearson κυμάνθηκε από .7 έως .9, a= .997). Σχετικά με την εγκυρότητα κριτηρίου και την συγκλίνουσα εγκυρότητα, καταγράφηκαν σημαντικές θετικές συσχετίσεις μεταξύ αρκετών στοιχείων και συνόλων της Μουσικής Συναισθηματικής Κλίμακας Αξιολόγησης (Musical Emotional Assessment Rating Scale, MEARS) και της Κλίμακας Μουσικής Γνώσης/Αντίληψης (Musical Cognitive/Perception Scale, MCPS) και των τομέων των Κλιμάκων Νοητικής Ανάπτυξης του Griffiths (Griffiths Mental Development Scales, GMDS), με διακυμάνσεις από .60 έως .90· δεν καταγράφηκαν αρνητικές ή μηδενικές συσχετίσεις. Τα αποτελέσματα έδειξαν ένα αξιοσημείωτο επίπεδο αξιοπιστίας μεταξύ αξιολογητών καθώς και καλή εσωτερική συνέπεια. Συνεπώς, η Πορτογαλική έκδοση του IMCAP-ND δύναται να χρησιμοποιηθεί με μεγαλύτερη σιγουριά στην κλινική πράξη· παρόλα αυτά, συστήνεται σε μελλοντικές μελέτες να χρησιμοποιηθεί μεγαλύτερο δείγμα.

ΛΕΞΕΙΣ ΚΛΕΙΔΙΑ

μουσικοθεραπεία, διαταραχές αυτιστικού φάσματος, νευροαναπτυξιακή διαταραχή, αξιολόγηση, αξιοπιστία, τεκμηρίωση εγκυρότητας