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Assessment Measures for Specific Language Impairment in Brazil: A Systematic Review

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Abstract

Specific Language Impairment (SLI) is defined as an unexpected failure in linguistic abilities during a child's early years of development. Children with SLI do not present significant impairment in nonverbal intellectual outcomes and do not lack normal environmental exposure to language. Brazilian and worldwide researchers have sought to understand the cultural implications of SLI in the Brazilian Portuguese language. Standardized and validated measures must be used in empirical studies. The present study systematically reviewed the instruments used to assess linguistic abilities in quantitative SLI research in Brazil. Three databases were chosen: Medline, SciELO, and Google Scholar. From a total of 828 articles retrieved, only 10 met the inclusion criteria. Seven standardized assessment measures were identified. However, only two of these reported psychometric properties using adequate normative data. No normalized instrument measured the entire spectrum of linguistic abilities. We discuss the results from the perspective of SLI theories and evidence in Brazil and worldwide.

Keywords: specific language impairment, assessment, standardization, systematic review

1. Introduction

Specific Language Impairment (SLI) has an estimated prevalence of 7-8% in children in kindergarten and the first years of primary education (Tomblin, Zhang, Buckwater, & O'Brien, 2003). For most of these children, language difficulties persist throughout their school years and even into adulthood (Snowling, Bishop, & Stothard, 2000). In later grades, children with SLI are identified as having learning disabilities based on performance during the last years of school when children are continuously evaluated. Specific Language Impairment results in deficiencies in academic learning, especially reading and writing (Leonard, 1998).

Children with SLI fail to learn language at the expected rate. Other cognitive functions, such as attention and perception, sensory functions, environmental exposure to language, and intellectual outcomes remain intact (Leonard, 1998; Wener & Archibald, 2011). Scientific evidence suggests the presence of hereditability in SLI (Tomblin & Buckwater, 1998). Approximately 40-70% of children who exhibit early language delay will continue to have impaired language skills beyond the age of five (Snowling et al., 2000). Of those with enduring SLI, 70% will continue to have language difficulties throughout adulthood (Johnson et al., 1999).

Hallmark deficits identified for English speaking children with SLI include difficulty with verb tense and agreement, nonword repetition, and sentence repetition (Conti-Ramsden, Botting, & Faragher, 2001). Nevertheless, considerable heterogeneity has been observed across individuals with SLI, an observation that has made it all the more difficult to determine the underlying nature of SLI. Friedman and Novogrodsky (2008) proposed that SLI could present four diverse subtypes depending on which components of language were impaired—syntax, phonology, pragmatics, or the lexicon. Empirical data also supported these authors' proposition. Children with syntactic SLI fail to understand Wh questions—who and which—while children with lexical SLI and pragmatic SLI succeed (Friedman & Novogrodsky, 2011). Also, syntactic SLI appears to need specific rehabilitation programs due to its singularity (Levy & Friedman, 2009). Thus, to adequately identify

children with SLI, measures tapping a broad range of language abilities are needed.

The early identification of children with SLI is essential for maximizing their cognitive potential. When specifically designed interventions are implemented in a timely fashion, these children's language abilities can be improved, thus reducing the probability of presenting deficits in academic learning (Camarata, Nelson, & Camarata, 1994; Ebbels, 2007). According to Young (1996), investments in early childhood interventions have a significant impact on developmental outcomes within 2 years. Such interventions reduce public spending on academic reinforcement in later years and improve overall ratings in intelligence and school enrollment. As a result, the importance of understanding and providing adequate interventions for SLI is crucial for both child language development and public policy. Instruments that accurately identify language impairments are tremendously relevant for researchers in Brazil and all Latin America.

Adequate assessment allows more precise conclusions to be drawn. Netto et al. (2011) highlighted the relevance of assessment measures in language. According to these authors, Brazil and Latin America lack standardized instruments to measure several factors involved in linguistics, including motor control—articulation and face movement, auditory perception, pragmatics, syntax, language semiotics, vocabulary, and fluency. The present study attempted to fill this gap in the literature by reviewing standardized tests used in Brazil for language performance and its implications in an attempt to help Brazilian and worldwide researchers to correctly diagnose and measure SLI in children speaking Brazilian Portuguese.

1.1 Identifying SLI

The diagnostic criteria for SLI appear in the World Health Organization's International Statistical Classification of Diseases (ICD-10; World Health Organization, 1993). Six criteria must be met for a child to be considered to have SLI: (1) standardized language test score markedly below the appropriate level relative to mental age, (2) nonverbal intelligence within normal limits, (3) no compromised hearing, (4) intact articulation with no structural or functional anomalies, (5) no symptoms of impaired reciprocal social interaction, and (6) no diagnosis of Autism Spectrum Disorder or other pathology that may account for the language delay (World Health Organization, 1993). In many research studies (e.g., Alloway & Archibald, 2008; Archibald, Joanisse, & Edmunds, 2011; Conti-Ramsden et al., 2001; Dawes & Bishop, 2009; Tomblin & Buckwater, 1998), a cut off of more than 1 SD below the mean on a standardized language test has been employed to identify children with SLI.

Identifying children with SLI is challenging. For English speakers, one of the gold standard tests for identifying SLI is the Clinical Evaluation of Language Fundamentals, 4th edition (CELF-IV; Semel, Wiig, & Secord, 2003). However, the CELF-IV is not yet standardized for the Brazilian culture and language. Other instruments, such as Andrade, Befi-Lopes, Fernandes, and Wertzner (2000)'s Language Test for Children (the ABFW), were created in Brazil to compensate for the lack of adequate language assessment tools. The objective of the present study was to systematically review quantitative research with Brazilian samples of children with SLI, with a focus on studies that used standardized language measures.

2. Method

2.1 Identifying SLI

To identify SLI assessment articles in Brazil, an online search was performed using the Medline, SciELO, and Google Scholar databases. We searched for articles published from 1993 to March 5, 2013. We limited the review to two languages: English and Brazilian Portuguese. Three key terms (and synonyms) were used in the search: Specific Language Impairment (also Developmental Dysphasia, Developmental Language Impairment), Assessment, and Brazil. For all of the databases, a specific combination of search terms was used: Specific Language Impairment OR Developmental Dysphasia OR Developmental Language Impairment AND Brazil (with/without Assessment).

Several authors have discussed the use of Google Scholar in systematic reviews. Cecchino (2010) suggested that this tool presents higher retrieval than other databases. The present study also found this evidence. However, precision and full-text retrieval are compromised when using Google Scholar. Anders and Evans (2010) recommended the use of Medline because it is significantly more precise. It does not include the search results that are not from the targeted field and has better full-text retrieval, in which approximately 8% of the results in Medline are full-text articles compared with only 0.5% in Google Scholar.

Higher retrieval is a problem for researcherswhen proper care is not taken to refine the results. Gehanno, Rollin, and Darmoni (2013) found that Google Scholar retrieved more information than the Cochrane Library database, as suggested previously by Cecchino (2010). Nonetheless, 100% of the studies retrieved by the Cochrane

database were also retrieved by Google Scholar. This indicates the need to carefully examine literature searches in Google Scholar, but it is still an interesting and useful database.

2.2 Inclusion and Exclusion Criteria

The search yielded a large number of publications that were further refined using the article title, abstract, and inclusion and exclusion criteria. Case studies and reviews of any kind were excluded. If a quantitative study used no standardized instruments, thenit was also excluded. After the articles were examined with regard to the exclusion criteria, all of the remaining articles were included, even if they did not have an empirical design (i.e., no control group or experimental group) because of the rarity of SLI studies in Brazil.

3. Results

A total of 828 articles were retrieved from the primary search. After the first refinement using the articles' titles and abstracts, 22 articles remained. We also excluded dissertations and theses because they are unpublished material yielding a total of 10 published articles. Medline retrieved one articlein the final result. SciELO had nine of the 10 articles including the one retrieved by Medline. Google Scholar retrieved 10 of the 10 articles. Table 1 presents the authors, years, measures, standardization of the instruments, and brief descriptions of the studies' samples and results.

Table 1. Authors, year of publication, measures, assessed constructs, Brazilian standardization, age range of the sample, and results

Authors	Year	Measures	Constructs Evaluated	Standardized in Brazil?	Sample's Age Range	Sample Size	Results
Hage, Joaquim, Carvalho, Padovani, & Guerreiro	2004	Escala de Desenvolvimento Comportamental de Gesell e Amatruda (EDCGA)	Global Development: Adaptative Behavior, Gross Motor, Fine Motor, Linguistics and Persona-Social	No	3- to 6-year old	75 participants - 50 control children with typical development and 25 children diagnosed with SLI	Children wih SLI performed as well as typically developing children on both motor assessments. However, SLI children presented worse performance in linguistics, adaptative behavior and personal-social evaluations. It is suggested that SLI impairment in language is probably influencing the poor performance in the other two aspects of those children's development.
Hage, Cendes, Montenegro, Adramides, Guimarães, & Guerreiro	2006	Peabody Picture Vocabulary Test (PPVT)	Vocabulary and Lexical Ability	No	4- to 14-year old	17 participants - all children with SLI	Children with SLI presented abnormal Magnetic Ressonance Images (MRI). Overall, SLI children had perisylvian polymicrogyria - malformation of brain's language network due to excessive small convolutions on the cortex. Probably the perisylvian polymicrogyria is involved with SLI's impairment in syntatic, expressive and receptive language.
		Wechsler Intelligence Scale for Children - III (WISC-III)	Global Inteligence	Yes			
		Wechsler Preschool and Primary Scale of Inteligence (WPPSI)	Global Inteligence	No			
Nicolielo, Fernandes, Garcia, & Hage	2008	School Performance Test (TDE)	Writting, Reading and Arithmetics	Yes	7- to 12-year old	20 participants - all children with SLI where 14 were boys and 6 were girls	Arithmetics and short-term memory are positively associated. On the other hand, the phonological processing seems to be more strongly related to writting and reading skills.
		Phonological Ability Profile	Phonological and Audiological Processing	No			
		Illinois Psycholinguistic Abilities Test (IPAT)	Phonological Short-Term Memory	No			
Gahyva, & Hage	2010	Audiological Discrimination Test	Auditory Perception	Yes	4- to 8-year old	4 participants on intervention group - children with SLI - and 4 participans on control group - children with typical development	Children with SLI presented improvement on phonological performance after a different intervention for each child based on receptive and expressive processing. The consciousness of structural and functional aspects of the language, lexical representation and planning of the movement were the trained aspects.
		Phonological Ability Profile	Phonological and Audiological Processing	No			
		ABFW - Language Test for Children	Phonology, Pragmatics, Vocabulary and Fluency	Yes			
		Illinois Psycholinguistic Abilities Test (IPAT)	Phonological Short-Term Memory	No			
		ABFW - Language Test for Children	Phonology, Pragmatics, Vocabulary and Fluency	Yes			
Bomfim	2010	MABILIN - Linguistic Abilities Evaluation Modules	Morphosyntax, Syntax and Lexics in Expressive and Receptive Abilities	No	5- to 9-year old	34 participants - 19 control children with typical development and 15 children with SLI	SLI children presents learning impairments and more difficulty to foresee a character's action from a false belief attribution than typically developing children. Thus, SLI is also affected regarding the Theory of Mind.
		Theory of Mind Test	Foresee Characters Attributes and Mental States	No			
Nicolielo, & Hage	2011	ABFW - Language Test for Children	Phonology, Pragmatics, Vocabulary and Fluency	Yes	7- to 10-year old	40 participants - 20 children with SLI and 20 children with typical language development	SLI children present impairment in phonological processing and it probaly leads to reading and writting poor performance on those subjects.
		Phonologic Working Memory Test	Verbal Short-Term Memory	No			
		Rapid Automatized Naming (RAN)	Lexical Ability	Yes			
		Phonological Ability Profile	Phonological and Audiological Processing	No			
		TALE - Reading and Writting Analysis Test	Reading and Writing	Yes			
Gonzalez, Cáceres, Bento-Gaz, & Befi-Lopes	2011	ABFW - Language Test for Children	Phonology, Pragmatics, Vocabulary and Fluency	Yes	7- to 10-year old	40 participants - 20 children with SLI and 20 children with typical language development	Children with SLI presents less use of conjunctions than typically developing children. Also, SLI children are less proactive regarding narrative than control group.
		Language Evaluation Manual from the Audiology Service of the Health School Center Samuel B. Pessoa	Length Utterance and Phonological Performance	No			
Befi-Lopes, Cáceres, & Esteves	2012	Test of Early Language Development (TELD-3)	Receptive and Expressive Abilities, Semantics, Syntax and Language Morphology	No	2- to 8-year old	46 participants - all children with SLI and all male	The sample presented both expressive and receptive impairment, however expression was more compromised than reception. Nevertheless, TELD-3 proved a satisfactory assessment for language-impaired children.
		ABFW - Language Test for Children	Phonology, Pragmatics, Vocabulary and Fluency	Yes			
Rocha-Muniz, Befi-Lopes, & Schochat	2012	Raven's Coloured Progressive Matrices	Nonverbal Inteligence	Yes	6- to 12-year old	57 participants - 18 children with typical development; 18 children with Auditory Processing Disorder (APD) and 21 children with SLI	Children with APD and SLI revealed impairment encoding the speech acoustic features. Both gourps had a greater difficulty distinguishing stimuli based on timing cues, however children with SLI had additional difficulty of distinguishing speech harmonics.
		ABFW - Language Test for Children	Phonology, Pragmatics, Vocabulary and Fluency	Yes			
		Receptive Vocabulary	Receptive Ability	No			
		Mean Length of Utterance (MLU)	Morphosyntax - Mean Number of Words and Morphemes	Yes			

Instruments used for language assessment were separated from global intelligence measures, short-term memory, theory of mind, and other instruments unrelated to aspects of linguistics. The frequency of use of each language assessment is depicted in Table 2. The ABFW (Andrade et al., 2000) was the most used instrument, which was found in 60% of the articles. The second most widely employed assessment was the Brazilian-translated version of the Illinois Psycholinguistic Ability Test (IPAT; Bogossian & Santos, 1977), which was found in 20% of the publications. All of the other measures were used only once.

Table 2. Instruments and number of studies that used them

Instrument	Number of studies using N (%)
ABFW and Phonological Ability Profile	6 (60%)
Illinois Psycholinguistic Abilities Test (IPAT)	2 (20%)
Test of Early Language Development (TELD-3)	1 (10%)
Peabody Picture Vocabulary Test (PPVT)	1 (10%)
School Performance Test (TDE)	1 (10%)
MABILIN	1 (10%)
Phonologic Working Memory Test	1 (10%)
Rapid Automatized Naming (RAN)	1 (10%)
TALE - Reading and Writting Analysis Test	1 (10%)
Receptive Vocabulary	1 (10%)
Audiological Discrimination Test	1 (10%)
Mean Length of Utterance (MLU)	1 (10%)
Language Evaluation Manual ASHSC Samuel Pessoa	1 (10%)

Among the included measures, only a few have been standardized in Brazil including: the (1) Auditory Discrimination Test (Serrano, 2012), (2) Rapid Automatized Naming (RAN) test (Ferreira, Capellini, Ciasca, & Tonelotto, 2003), (3) Teste de Análise da Leitura e da Escrita (TALE—Reading and Writing Analysis Test; Anderle, 2005), (4) Mean Length of Utterance (MLU) test (Araujo & Befi-Lopes, 2007), (5) ABFW—Language Test for Children (Andrade et al., 2000), (6) Phonological Ability Profile test (Wertzner, 2000), (7) Teste de Desempenho Escolar (TDE; School Performance Test; Stein, 1994), and (8) Test of Early Language Development Third Edition (TELD-3; Hresko, Reid, & Hammil, 1999).

3.1 Standardized Measures

Standardization is essentially a common procedure used to administer and score an instrument and develop normative data (Cohen & Swerdlik, 2009). An adequate assessment should be presented the same way every time by following the same order and instructions. Standardized instructions and order specify the manner in which a test is presented to any test-taker.   Such procedures ensure that performance differences do not arise due to differences in the instructions, context, or cues provided. Normative data are the foundation of test interpretation and valid data relies on the use of standardization. The normative data are used to place individual scores into the context of the scores obtained by the standardization sample. The normative sample supposedly represents the population's norms relative to the aimed construct (Cronbach, 1971).

Having a standardized instrument allows viewing a single person from the perspective of the population to which he belongs. The importance of a standardized measure for SLI cannot be understated, especially given the variability in language abilities inherent in the population at large. In this study, seven instruments were identifiedas standardized by the literature. We will attempt to understand the standardization criteria and validation processes employed, and clarify each measure according to its construct.

Auditory Discrimination Test (Serrano, 2012). This digital instrument is used to determine whether children can accurately discriminate specific sounds in Brazilian Portuguese. The evaluated construct is basically auditory perception. For this instrument, information regarding the normative sample data and validation procedures are available only in unpublished material. Cutoff points are presented, however, supporting psychometric analyses are not reported. Regardless, the test is important to the present review given its focus on Brazilian Portuguese. As a test of auditory discrimination, however, this assessment will be sensitive to several language impairments. Research shows that not all children with SLI will have an auditory perception deficit, or will continue to show

such a deficit even if present in early stages of development (Rosen, 2003). As such, the Auditory Discrimination Test cannot be considered sufficient to identify SLI.

<u>Rapid Automatized Naming test (Ferreira et al., 2003).</u> The validation and standardization of the Brazilian Portuguese version of the RAN test was conducted in a sample of 80 children who ranged from 6 to 10 years of age. This instrument is composed of five subtests: naming colors, digits, letters, animals and objects. Each subtest has five stimuli that are presented twice in random order. The child is asked to name the stimuli as fast and accurately as possible. At the beginning of the test, the child is warned that time will be counted by a chronometer. The RAN test assesses rapid lexical retrieval and inhibition in children. A more impaired lexicon is associated with more difficulty and slower naming of stimuli. Children with SLI perform poorly on the RAN test (Nicolielo & Hage, 2011), but this test has low specificity for SLI because children with other learning disabilities also present impairment in this task (Ferreira et al., 2003).

<u>Reading and Writing Analysis Test (Anderle, 2005).</u> The Brazilian-adapted version of this instrument is derived from the original version in Spanish (Toro & Cervera, 1990). Cross-cultural adaptation and validation were performed by Anderle (2005) in a sample of 1,945 children with typical development. The TALE presents normative data for children from 7 to 10 years of age and measures letters, syllables, word and text reading, comprehension, dictated words, and free writing. Children with SLI perform poorly on the TALE, likely attributable to different causes of language impairment (Nicolielo & Hage, 2011). Nonetheless, its specificity for SLI is questionable because other children with learning disabilities, such as dyslexia (De Lima, 2012), also perform poorly on the TALE.

<u>Mean Length Utterance test (Araujo & Befi-Lopes, 2007).</u> This measure is used to assess grammatical performance in Brazilian Portuguese in children from 2 to 4 years of age. The validation and standardization studies presented an unselected sample of 60 children. The purpose of this instrument is to evaluate the way a child uses morphemes and the average length of utterances. The test also assesses the number of grammatical morphemes, content words (e.g., nouns and verbs), pronouns, prepositions, and conjunctions. Based on MLU results, Befi-Lopes and Rondon (2010) reported that Brazilian children with SLI used disyllabic words more frequently in spontaneous speech than polysyllabic words. The specificity of MLU as a measure to evaluate SLI, however, is unclear. For example, Scarborough, Rescola, Tager-Flusberg, Fowler, and Sudhalter (1991), examined the utility of the MLU test in identifying language impairments in early language delay, fragile X syndrome, down syndrome and autism before 3 years of age. Their findings suggested that MLUs become less associated with grammatical performance as language proficiency increases. According to these authors, in 1- to 3-year-olds during the early stages of language development, the MLU test alone does not provide an accurate estimate of syntactic and morphological forms of language.

<u>ABFW—Language Test for Children (Andrade et al., 2000).</u> This is the most common measure for assessing several aspects of the Brazilian Portuguese language acquisition profile in children. The instrument is composed of four subscales—Phonology, Vocabulary, Pragmatics, and Expressive Fluency. The phonology subscale assesses the child's proficiency in producing sound patterns, and how she uses phonology to speak individual words in Brazilian Portuguese; the vocabulary subscale here is considered the lexicon—group of words that a person can accurately receive, understand and express; the pragmatics subscale measures the ability to accurately use words and expressions in a certain context or culture; and the expressive fluency subscale evaluates the ability to communicate and concatenate ideas during speech using adequate grammatical and syntactical structures. The age range for the ABFW is 3 to 12years. No background information about sampling and psychometric properties is provided in the articles or reviewed material. Regardless, the norms are published in the instrument's manual. Much evidence supports the use of the ABFW as a useful measure for SLI. Befi-Lopes and Rondon (2010), Gahyva and Hage (2010), Nicolielo and Hage (2011), Gonzales, Cáceres, Bento-Gaz, and Befi-Lopes (2012), Befi-Lopes, Cáceres, and Esteves (2012), and Rocha-Muniz, Befi-Lopes, and Schochat (2012) successfully used the ABFW to detect impairments in children with SLI and found solid evidence to support its validity.

<u>Phonological Ability Profile (Wertzner, 2000).</u> This measure is used to independently assess phonology, but it is an integral part of the ABFW—Language Test for Children. In this test, two different tasks are required. In the repetition task, the child repeats, one by one, a list of 39 words in Brazilian Portuguese. In the naming task, 34 figures are presented and the child needs to give each a name—there is no time limit in this task. According to the child's response, several phonological competencies are judged by the experimenter: segmentation, addition, subtraction, rimes, sequential rimes, and syllabic reversibility. This Phonology Ability Profile is listed as a unique instrument here because several studies used it solely, without using the entire ABFW test (e.g., Nicolielo, Fernandes, Garcia, & Hage,2008; Gomes, Gomes, & Ferreira, 2012).

School Performance Test (TDE; Stein, 1994). This instrument is used to evaluate children's performance in elementary school in Brazil. No age range is specified for the TDE, only the relative school year. The norms were developed by Stein (1994), but new norms for the first to sixth school years were provided by a recent study (Oliveira-Ferreira et al., 2012). The norms presented by Stein (1994) were obtained from 538 students from the first to eighth elementary school year. Oliveira-Ferreira et al. (2012) included 1,034 children in their normative sample. This instrument proposes to the evaluate reading, writing, and arithmetic. Nicolielo et al. (2008) demonstrated that children with SLI perform poorly in reading and writing tasks on the TDE. Oliveira-Ferreira et al. (2012) suggested that the TDE identifies children with learning disabilities. Thus, developmental disorders other than SLI are identified by this instrument because its norms are related to the school grade of the subject and not specifically to any language impairment.

Test of Early Language Development, Third Edition (Hresko et al., 1999). The TELD-3 is a standardized instrument used to assess expressive and receptive language in children from 2- to 7-years-old. It presents two equivalent forms—A and B—each one divided in two subscales measuring expressive language with 39 items and receptive language with 37 items. Those items assess semantic, morphosyntactical and pragmatic factors of language. The two forms enable the researcher or examiner to evaluate and re-evaluate language of a child over short periods of time without test-retest issues. The raw score is converted into three coefficients: expressive language coefficient, receptive language coefficient, and a speech language coefficient considered the global linguistic ability of the children. What is interesting in TELD-3 is that a "linguistic age" for each child is also calculated from the raw score to indicate true language development. In Brazil, Giusti and Befi-Lopes (2008) performed the translation of the instrument using back-translation and content validity techniques with specialist judges in early child language development. In a further study, Befi-Lopes et al. (2012) conducted a convergent validity study using the ABFW—Language Test for Children as gold standard to the TELD-3. Regardless, there was no intention in either study to build norms for the Brazilian population and we did not find any study of psychometric properties of the TELD-3 in Brazil.

4. Discussion

The objective of this systematic review was to identify the most common standardized measures used in empirical studies with Brazilian children with SLI and its implications. To meet this goal, we used three different databases, Medline, SciELO, and Google Scholar, giving special attention to the material retrieved from Google Scholar because of its lack of search specificity. A total of 10 articles were found based on the established criteria. This indicates that SLI studies in Brazil are still incipient. Nonetheless, the extant Brazilian studies are important assets and make interesting contributions to the field.

Among the most common assessment measures, only eight were standardized. This number could be reduced to seven if we consider the Phonological Ability Test as an integral part of the ABFW—Language Test for Children. Based on these seven measures, we discuss the most adequate instruments for assessing SLI in an attempt to help Brazilian and worldwide researchers correctly diagnose and measure SLI.

4.1 Standardization and Adequate Sample Size

Among the eight standardized instruments, only two hadan adequate sample size to provide reliable normative data. The study that utilized the TALE (Anderle, 2005) had 1,945 participants, ranging in age from 7 to 10 years. The two studies that utilized the TDE (Stein, 1994; Oliveira-Ferreira et al., 2012) had 538 and 1,034 participants, respectively, but these instruments mainly assess reading and writing. Several studies in Brazil (Nicolielo & Hage, 2011; Rocha-Muniz et al., 2012) and other countries (Levy & Friedmann, 2009) provided evidence that reading and writing are compromised in SLI. However, this evidence actually supports the idea that language impairment leads to poor performance in reading and writing. The pivotal factor in SLI is overall language impairment (Leonard, 1998). This includes the ability to communicate using complex and well-structured sentences. If someone cannot present expressive communication at his age-adequate level, then other tasks, such as reading and writing, are likely to be consequently impaired (Nicolielo & Hage, 2011). The main concern about using the TALE and TDE in SLI studies is that these instruments do not evaluate expressive and receptive communication, only a part of this ability (i.e., read and write like children their own age). They are good measures for assessing learning disabilities, but they do not cover the entire set of linguistic abilities and are not specific to SLI. The only instruments for detecting learning disabilities in Brazil with normative data from adequate samples do not evaluate language itself but rather reading and writing, which are indirect measures of language. The first conclusion that can be made from the present study is that Brazil needs instruments to measure language. Such instruments need to be based on careful and dedicated studies of their psychometric properties, with adequate sample sizes and sampling techniques to generate normative data.

Cohen and Swerdlik (2009) suggested that a normative sample should be representative of the socioeconomic characteristics of the population. Cochran (1977) proposed several methods for sampling that allow psychometric researchers to build study samples based on adequate techniques. One of the most important suggestions made by these authors is that a representative sample should enable statistical analyses to evaluate the psychometric properties of the studied instrument. Hair, Anderson, Tatham, and Black (2011) suggested that for several statistical techniques, such as factor analysis, regression and multivariate modeling, the researcher should have a sample with at least 100 participants. To guarantee variance, they recommended 400 participants in quantitative studies. The Brazilian psychometric properties of classic psychological measurements, such as the Wechsler Intelligence Scale for Children, 3rd edition (WISC-III; Wechsler, 1991), were studied in a sample of 801 children (Figueiredo, Mattos, Pasquali, & Freire, 2008). Nevertheless, few psychometric studies have used very large samples. For example, Filgueiras, Pires, Maisonnette, and Landeira-Fernandez (2013) studied the psychometric properties of a screening assessment in 45,640 children in Brazil. A greater sample size allows researchers to more closely approximate normative data for a population (Cochran, 1977).

4.2 Standardized Measures without Normative Data

Other measures can be divided according to their evaluation focus. The Auditory Discrimination Test (Serrano, 2012) is essential for SLI because it rules out a difficulty in discriminating sounds as accounting for the child's language learning difficulties. It is a screening test in which the child must understand and discriminate several common sounds in Brazilian Portuguese. If someone presents impairment in this assessment, then the problem is likely with auditory perception. Regardless, it still unclear the role of auditory perception in SLI. For example, Rosen (2003) suggested that children with SLI also presented with impairment in auditory perception and processing. On the other hand, Gahyva and Hage (2008) used auditory perception as one of many criteria to differentiate SLI from other possible language impairments such as Auditory Processing Disorder (APD). Other studies also supported this idea. Ferguson, Hall, Riley, and Moore (2011) suggested that children with SLI and APD may be differentially diagnosed based on their referral route rather than by notable differences in behaviors.

Despite not knowing normative characteristics in the Auditory Discrimination Test, audiologists use it quite often, with good ecological validity (Gahyva & Hage, 2008). There are other known measures used to assess auditory perception that are standardized for Brazilian samples. For example, the Boston University Speech Sound Discrimination Picture Test (Mota, Keske-Soares, & Vieira, 2000) has been used in several studies in Brazil (e.g., Santos-Carvalho, Mota, Keske-Soares, & Attoni, 2010). Therefore, with regard to auditory discrimination measures, Brazil seems to have adequate instruments.

The RAN test (Ferreira et al., 2003) assesses rapid lexical retrieval in SLI. The ability to associate a picture with a name is the core of a lexicon. The vocabulary of a child is a pivotal part of language. It allows associations between signifiers and the signified—the linguistic sign (Cunha, 2008). A richer vocabulary allows the individual to more easily represent an abstract world of ideas and express these ideas to other people. Evidence from SLI groups suggests that their lexicon is at least partially impaired. Nicolielo and Hage (2011) found that children with SLI have difficulty in naming tasks, such as the RAN test. The problem of naming is not specific to a single group of categories (Sheng & McGregor, 2010). Friedmann and Novogrodsky (2008) were so convinced of lexical impairment in at least some children with SLI that they suggested a subtype for this category, namely lexical SLI (LeSLI). Further evidence shows abnormal brain activity in LeSLI during naming tasks (Guibert et al., 2011). Despite being a good instrument, other language measures have a more complete set of tests that assess naming ability and the lexicon (e.g., the ABFW). If researchers want to specifically measure naming ability, then the RAN test is recommended. However, if researchers want to evaluate language overall, then the RAN test is not entirely satisfactory.

The MLU test (Araujo & Befi-Lopes, 2007) is a classic measure that evaluates the speaker's proficiency in a given language. Since early studies of language (e.g., Cazden, 1968), the MLU test has been quite sensitive to assessing language development across ages. These studies have been further supported in the literature, building a solid argument for the use of the MLU test to assess language development in early ages (Miller & Chapman, 1981). However, some contradictions may be found in the literature. For example, the MLU test was not found to be a good predictor of grammatical development (Klee & Fitzgerald, 1985). Araujo and Befi-Lopes (2007) used the MLU test as a morphosyntax measure. Rocha-Muniz et al. (2012) found that children with SLI presented poor performance in MLU tasks. This likely happened because of problems with expressive communication and sentence construction, the foundation of syntax. Chomsky (1995) suggested that syntax is an integral part of grammar. We are able to infer, based on evidence from MLU studies and Chomsky's proposition, that the MLU test assesses one specific factor of grammatical development (i.e., syntax) but not the entire set of

factors that compose it. Nonetheless, the MLU test is a very interesting instrument that evaluates syntax in SLI by measuring words and morphemes during speech (Rocha-Muniz et al., 2012). However, the MLU test suffers from the same drawbacks of the RAN test in SLI studies. Measures such as the ABFW already assess syntax. Therefore, the MLU test may be redundant for some research, depending on the study's design. The MLU test is adequate if used in the early stages of language development (i.e., from 1 to 3 years of age; Cazden, 1968; Miller & Chapman, 1981) to measure syntax and not grammatical development.

The ABFW—Language Test for Children (Andrade et al., 2000) and its integral part, the Phonological Ability Profile (Wertzner, 2000), comprises a complete set of language assessments that evaluate phonology (i.e., the organization of linguistic sound-structures in phonemes and morphemes), expressive fluency (i.e., the ability to expressively communicate concatenating ideas fluently), vocabulary (i.e., the group of words, linguistic signs in this case, that a person is able to use and understand), and pragmatics (i.e., the given use of a word in different social and cultural contexts). This is the most widely used instrument in empirical SLI studies with Brazilian children. In the present study, we found that 60% of empirical articles used the ABFW to measure aspects of language. Despite not having good normative samples, this instrument appears to have good validity. Nicolielo et al. (2008) used only the Phonological Ability Profile (i.e., one part of the ABFW that assesses phonology) and found that the phonological profile is associated with reading and writing skills in children with SLI. The authors suggested a hierarchical relationship between phonology proficiency, which comes first, and reading and writing skills (i.e., consequences of the phonological profile).

Gahyva and Hage (2010) used the ABFW—Language Test for Children and found the benefits of an intervention in children with SLI when the trained factor was the child's awareness of language and its rules. Befi-Lopes and Rondon (2010) also found that children with SLI use disyllabic words more frequently than polysyllabic words, using solely the ABFW to assess language and delineate the SLI sample's characteristics. Nicolielo and Hage (2011) reaffirmed previous findings from Nicolielo et al. (2008), showing that phonological processing in children with SLI leads to poor performance in reading and writing. Gonzales et al. (2012) used the ABFW to determine the impact of SLI on children's volition to communicate expressively. Befi-Lopes et al. (2012) used the ABFW as a gold standard to validate the Brazilian version of the TELD-3 (Hresko et al., 1999) in a sample of children with SLI. Finally, Rocha-Muniz et al. (2012) used the ABFW to differentiate children with SLI, Auditory Processing Disorder (APD), and controls.

One theory that supports the use of the ABFW—Language Test for Children in SLI studies is the model proposed by Friedmann and Novogrodsky (2008) cited earlier. According to their proposition, SLI presents four subtypes: syntactic (SySLI), phonological (PhoSLI), pragmatic (PraSLI), and lexical (LeSLI). Based on their SLI findings (e.g., Friedmann & Novogrodsky, 2007, 2011; Levy & Friedmann, 2009), predominantly with SySLI, each subtype has a central impairment in different linguistic factors. Interestingly, the ABFW presents four subtests (i.e., Phonology, Vocabulary, Expressive Fluency, and Pragmatics) that largely correspond with Friedmann and Novogrodsky's (2008) theory and subtypes.

Phonology and pragmatics are evaluated in the ABFW using the Phonological Ability Profile (Wertzner, 2000) and pragmatic subtest, respectively. Thus, associating PhoSLI and poor performance in the Phonological Ability Profile appears to be appropriate, as well as associating PraSLI with poor performance in the respective ABFW subtest. Syntax is the ordered structure of a phrase or sentence in a specific language (Chomsky, 1995). Children with SySLI present difficulty organizing sentences in free speech, an ability that is also compromised in expressive fluency tasks (Friedmann & Novogrodsky, 2007). Because of this association, the ABFW expressive fluency subtest seems tobe a good measure of SySLI in Brazil. Finally, with regard to LeSLI, the lexicon can be defined as the repertoire of words that a person has in a specific language (Chomsky, 1995). By measuring a child's vocabulary, we may also assess his lexicon. Therefore, the ABFW vocabulary subtest is likely a good measure for LeSLI studies in Brazilian samples. Although these studies support the idea of using the ABFW to measure the children linguistic abilities, it is still unclear whether the ABFW has a four-factor structure as proposed by Friedman and Novodrodsky (2008).

Furthermore, the ABFW—Language Test for Children is sensitive to the detection of language impairment. The studies cited above provide further evidence of the adequacy of the ABFW in evaluating children with SLI. Nonetheless, standardization and validation studies with larger samples are still required to understand the psychometric and factorial properties of the latent traits measured because the ABFW appears to be the most widely used measure in SLI studies in Brazil.

The TELD-3 (Hresko et al., 1999) in its Brazilian-translated version (Giusti & Befi-Lopes, 2008) presents good convergent validity with the ABFW—Language Test for Children in a sample of children with SLI (Befi-Lopes

et al., 2012). The standardization of this test in Brazil refers only to its translation and adaptation to Brazilian context—using almost the same procedures as its original version. To our knowledge, just one study with SLI uses the TELD-3 in Brazil (Befi-Lopes et al., 2012). Undoubtedly, the lack of information in Brazil about the empirical results of TELD-3 regarding psychometric properties and normalization is a problem. Nonetheless, it may still be an accurate tool to assess SLI in the early years. The instrument proposes both receptive and expressive standardized coefficients (Hresko et al., 1999). Despite evidence questioning the dichotomy of diagnosing expressive and receptive language disorders as dissociated impairments (Leonard, 2009), psycholinguistic evidence investigating expressive and receptive language disorders is still needed. Regardless, TELD-3 is a valuable asset to speech language pathologists, audiologists and other professionals whose work focuses on language impairment.

4.3 No Standardized Measures in Brazi

Although there are several Brazilian language assessment measures, there is a lack of standardized and normative studies employing representative samples. If Brazilian or worldwide researchers lack validated and standardized instruments to extensively evaluate language, then we can suggest other measures for future standardization that may help SLI studies in Brazil. We focus on two instruments for their wide-ranging ability to evaluate linguistic abilities: the IPAT and MABILIN.

The Brazilian-translated version of the IPAT (Bogossian & Santos, 1977) measures several psychological and linguistic abilities, including semantics, phonology, grammar, comprehension, spelling, and the short-term memory of nonwords. It is used to assess a wide range of ages, from 5 to 12years, and is an adequate measure for SLI studies (Nicolielo et al., 2008; Gahyva & Hage, 2010). However, a few issues about the Brazilian-translated version of the IPAT should be mentioned. The first is the year of publication of the Brazilian-adapted version (Bogossian & Santos, 1977). Thirty-six years have elapsed between its cross-cultural adaptation and research conducted in 2013. According to Turner, DeMers, Fox, and Reed (2001) one of the requirements for choosing a measure for psychological assessment is regularly updating normative data. The Brazilian version of the IPAT, to our knowledge, does not have any up-to-date research that defines recent normative data, thus suggesting that itsuse may not be recommended. Another issue is the short-term memory subscale. Children with SLI present poor performance in short-term memory tests with regards to phonology (Archibald & Gathercole, 2006). However, one hypothesis is that SLI is associated with impairment in specifically the phonological loop subcomponent of working memory and not all of working memory (Alloway & Archibald, 2008; Archibald, 2006; Archibald et al., 2011). The memory subtests of the IPAT would be insufficient to discriminate short-term and working memory deficits across domains. Based on the two aforementioned issues, we do not recommend using the Brazilian-adapted version of the IPAT to study language in SLI, but we concede that it is a good instrument for other clinical uses (Nicolielo et al., 2008).

Finally, the MABILIN (Corrêa, 2000) is a picture-based test that evaluates phonology, syntax, pragmatics, and the lexicon, in which the child must answer several types of questions based on a presented picture. The first sample for its pilot study had 300 children, ranging in age from 7 to 10 years. However, the psychometric evidence from this pilot study is still uncertain because the analyses are not specified and thus further clarification about statistics used to determinate cutoff points and percentiles is needed. The instrument was developed by the author by focusing basically on the SLI diagnosis (Corrêa, 2000; Ribeiro, 2012). The recommendation of studies that used the MABILIN is that it cannot be the only measure for SLI diagnosis (Bomfim, 2010 & Ribeiro, 2012). However, strong evidence indicates that the MABILIN is suitable for SLI studies. Corrêa and Augusto (2011) found that 9.3% of a sample of 300 children had syntax impairment. According to these authors, the children with syntax impairment also presented several symptoms of SLI, including reading and writing impairment, and linguistic difficulty in expressive communication. The MABILIN requires further studies of its psychometric properties and standardization, but its validity and suitability for assessing language are undeniable.

5. Conclusions

Language assessment measures in Brazil are not rare, but only two instruments that measure reading and writing have been standardized with normative data. In SLI studies, standardized language assessment is pivotal for evaluating the four linguistic components: pragmatics, the lexicon, phonology, and syntax/grammar. The ABFW, TELD-3 and MABILIN are valuable assets for Brazilian researchers. For cross-cultural studies, we recommend the Brazilian-translated version of the IPAT but acknowledge its limitations. All of these instruments comprise batteries of tests that allow the extensive measurement of aspects of language in Brazil. However, if a researcher wants to draw definitive conclusions, then the experimental design should incorporate a control group because

none of these measures have normative data. The present study indicates that Brazil needs more studies of psychometric properties and standardization to enable more precise and rigorous scientific research in linguistics.

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