20 Assessing Developmental Learning and Communication Disorders in Hispanic Children: A Neuropsychological Perspective

Mónica Rosselli, Esmeralda Matute, and Alfredo Ardila

According to the *Etymology Dictionary* (2011), the term Hispanic refers to a group of people who trace their origins back to Spain (*Hispania*). In the USA, however, this word is used more generally to refer to people from Iberian or Latin American backgrounds who share common cultural elements, such as surnames, customs, and the Spanish language, which in most Hispanic countries is the official one, though some sectors of those populations may also speak a native language. Thus, it is not uncommon to find significant bilingual populations, for example, Spanish/Quechua or Spanish/Aymara in Peru and Bolivia, Spanish/Guaraní in Paraguay, and Spanish/Nahuatl in Mexico.

The USA is now the second largest Spanish-speaking country in the world, after Mexico (U.S. Census Bureau, State and County Quick Facts, 2011), as it is estimated that 18.7% of the American population is bilingual, and that Hispanics represent approximately 75% of this group (U.S. Census Bureau, 2004). This ethnic group is linguistically diverse, as some members speak Spanish or English almost exclusively (i.e., are virtually monolingual), while the majority speak both languages, though with varying degrees of fluency. In most cases, especially when children are descendants of first-generation immigrants, the primary household language is Spanish, with exposure to English coming in the school setting. There is an enormous variation in the level of proficiency in the two languages among Hispanic children, such that one of the first problems that researchers involved in clinical assessments of this group face consists in deciding which language to use. On some occasions, English is the preferred, or dominant, language, but in others it is Spanish; while often both are used to a similar extent. If the language selected is Spanish, the evaluator faces the additional difficulty of the many idiomatic variations that exist among Spanish speakers in terms of vocabulary, phonology, grammar, and even pragmatics, all of which can deeply affect the ecological validity of their assessments.

M. Rosselli, Ph.D. (✉)
Department of Psychology, Charles E. Schmidt College of Science, Florida Atlantic University, 3200 College Avenue, Davie, FL 33314, USA
e-mail: mrossell@fau.edu

E. Matute, Ph.D.
Neuroscience Institute, University of Guadalajara, Francisco de Quevedo 180, Guadalajara 44130, Mexico
e-mail: ematute@cencar.udg.mx

A. Ardila, Ph.D.
Department of Communication Sciences and Disorders, Florida International University, 11200 SW 8th Street, AHC3-431B, Miami, FL 33199, USA
e-mail: ardilaa@fiu.edu

L.T. Benuto (ed.), *Guide to Psychological Assessment with Hispanics*,
DOI 10.1007/978-1-4614-4412-1_20,

The Hispanic (and Latin American) population in the USA is growing rapidly; indeed, it is estimated that by the year 2050, one-fourth of all North Americans will be Hispanic, while with respect to the younger generations, it is expected that approximately one-third of all people under 19 years of age will be Hispanic by that year (U.S. Census Bureau, 2010).

With the increase in the number of Hispanic children and youths in the USA, schools can predict a corresponding rise in Hispanics with special needs, including individuals who suffer developmental disorders. This, in turn, will require assessment practices that are cross-culturally competent, which entails understanding Hispanic cultures and comprehending the attitudes and beliefs that go hand in hand with such testing. Furthermore, it will become increasingly important to have a broad knowledge of the tests that are available for use with Hispanic children.

Developmental learning and communication disabilities are relatively common disorders during childhood and adolescence. Often, reading, writing, mathematics, and language disorders are included in these two umbrella categories. Perhaps the most widely used classification system for learning and communication developmental disabilities is the one offered by the American Psychiatric Association in its *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-IV-TR*) (APA, 2000), as for all cases of developmental disorders, the *DSM-IV*'s diagnostic criteria include the failure to perform adequately on "individually standardized measures" of reading accuracy or comprehension, mathematical ability, writing skills, and language related to disorders in reading, mathematics, writing, and communication, respectively. Performance on such tests may well be "substantially below that expected given a person's chronological age, measured intelligence, and age-appropriate education." Also, these criteria give strong weight to academic test scores, but fail to define more clearly the underlying cognitive difficulties. Despite such drawbacks, those disabilities are thought to be related to dysfunctions in the way that children perceive, process, organize, integrate, store, or retrieve information. Significantly, certain specific cognitive mechanisms underlying these learning disabilities have been identified. For example, children with reading disorders (dyslexia) frequently present metalinguistic disabilities, low vocabulary size, and defects in their phonological abilities, whereas children with mathematical disorders (dyscalculia) present some combination of primary deficits in the appreciation of magnitudes and working memory. These cognitive deficits can be identified through neuropsychological testing; therefore, including neuropsychological data in assessments of children with learning disorders provides supplementary cognitive information that may facilitate cognitive interventions. While the subgroups of learning difficulties have been classified on the basis of neuropsychological assessments, including low linguistic functioning, limited abstract thinking, low sequencers, and poor body awareness and control, most categorizations of these phenomena are still grounded on the presence of verbal *vs*. nonverbal problems.

This chapter analyzes variables related to the complex assessment of learning and communication disorders in Hispanic children, including characteristics of the Spanish language and the influence of bilingualism. It also reviews the instruments that are available in English and Spanish for carrying out assessments of these children.

Learning Disabilities in Hispanic/Latino Children

Linguistic factors can have an impact on the idiosyncrasies of childhood and developmental disorders. In particular, developmental disorders in both oral (dysphasia, developmental language disorder, or specific language impairment) and written language (dyslexia or reading disorder) are affected by the characteristics of the individual's language. Like every other language in the world, Spanish has particular phonological, lexical, and grammatical characteristics and a writing system also marked by distinctive features.

Due to the size of the Spanish-speaking population worldwide (approximately 500 million people; etymology dictionary), procedures for assessing developmental language impairments have never been unified, a reflection, at least in part, of the great diversity and heterogeneity that characterize the different Spanish-speaking nations (Ardila, 2009).

Several papers have examined the specific characteristics of oral and reading disorders in Spanish populations (e.g., Aguilar-Mediavilla, Sanz-Torrent, & Serra-Ravento, 2007; Anderson & Lockowit, 2009; Davies, Cuetos, & Glez-Seijas, 2007; Jackson-Maldonado, 2011; Jimenez Gonzalez & Hernandez Valle, 2000; Jiménez, Rodríguez, & Ramirez, 2009; Matute & Leal, 2003; Matute, Rosselli, & Ardila, 2010; Serrano & Deflor, 2008). As one might well expect, both commonalities and contrasts can be found among the difficulties described in oral and written languages between Spanish and other languages.

In children who speak Spanish – or other Latin-based languages – certain problems have been identified in relation to developmental language disorders (Bortilini, Caselli, Deevy, & Leonard, 2002; Jackson-Maldonado, 2011; Paradis, 2010). They include an increased use of verbs in the infinitive, a reduced frequency in the use of auxiliary verbs, shorter utterance length, and difficulties in noun-adjective agreement. Hence, it is likely that such difficulties arise from the specific grammatical features of those languages.

The prevalence of dyslexia varies in different languages as a result of the complexity (irregularity) of their respective writing systems (Lindgren, De Renzi, & Richman, 1985; Paulesu et al., 2001). Thus, for instance, studies have shown that dyslexia is less prevalent in Spanish than English (Matute et al., 2010), perhaps due to the transparent nature of the former's writing system. In fact, the transparency/opacity of writing systems has been proposed as a major variable affecting the level of difficulty in learning to read (e.g., Ziegle & Goswami, 2005). A transparent language is one in which there is a straightforward correspondence between phonemes and graphemes; Italian, Spanish, and Russian are examples of transparent languages. It has been estimated that reading skills develop more quickly in Spanish than English due to the differences between the respective orthography systems of these two languages (Goswami, 2002; Ziegle & Goswami, 2005).

However, there are reports indicating that the deficits in phonological processing that underlie dyslexia may also be observed in Spanish-speaking children, despite this language's shallow orthography. Although during the initial school years errors in reading precision and slowness in reading are observed in Spanish-speaking dyslexic children, in older ones, the sole distinguishing characteristic of dyslexia is a decrease in reading speed (Davies et al., 2007; Defior & Serrano, 2011; Goswami et al., 2010; Jimenez Gonzalez & Hernandez Valle, 2000; Jiménez et al., 2009; Matute & Leal, 2003; Serrano & Deflor, 2008).

Given that Hispanic children living in the USA are frequently bilingual, it is important to note that in bilinguals, dyslexia can affect reading ability differently in each language (Karanth, 1992). Furthermore, upon taking into account the transparency of the Spanish reading system that contrasts with the opacity of its English counterpart (Spencer, 2000), it is easy to understand that English is usually the language more acutely affected in Spanish/English bilingual children who experience difficulties in reading.

In addition to linguistic variables, environmental variables can also affect the development of cognitive skills (Molfese & Molfese, 2002; Samuelsson & Lundberg, 2003). Socioeconomic conditions vary greatly from one Spanish-speaking country to another. In Mexico, for example, 44% of the population lives below the poverty line (i.e., income below $2 USD/day), while in the USA, this percentage is only 12% (Wikipedia, 2011). In addition, there is great socioeconomic and educational disparity across ethnic groups in the USA. For example, Hispanic Americans frequently have lower SES and attain lower levels of education than Euro-Americans. For this reason, the number of books and amount of other reading materials may be quite limited in the homes of a significant number of

Hispanic children. Also, on average, students from low-SES settings have fewer opportunities to practice literacy and mathematics at the preschool level than children from more advantaged conditions (Roberts & Bryant, 2011).

Bilingualism and Learning Disorders

Assessing bilingual children represents a special challenge in neuropsychology. First, it is important to bear in mind that such children are often thought to suffer learning difficulties simply because their mastery of both of the languages to which they are exposed may be incomplete (Baker, 2000). Indeed, suspicions of learning impairments are a major reason for referrals to neuropsychological evaluation. Two types of potential misclassifications of bilingual children have been described (Genesee, Paradis, & Crago, 2004): (1) "mistaken identity": due to their slow progress in learning the second language, normally developing bilingual children may be placed in classrooms with pupils who require special education programs, and (2) "missed identity": the problems of bilingual, language-impaired children may easily be overlooked because their slow development is seen simply as a natural consequence of the task of learning a second language and the time required to master it. In both cases, diagnostic errors result from such inappropriate assessments of the child's language and cognitive abilities.

The knowledge of one or both of the languages that a particular bilingual child uses may have be narrower or broader, but insufficient knowledge of either language can result in defective communication, regardless of the specific language selected. Furthermore, comparisons of bilingual children clearly show that there is enormous heterogeneity in their respective degrees of bilingualism, and that specific patterns of bilingualism are dynamic phenomena that can change in accordance with such factors as time, increased schooling, new environmental conditions, etc.

Therefore, selecting the most appropriate language is a major concern when testing bilingual children. Obviously, testing children in the language in which they have lower proficiency will yield inaccurate measurements of both their language use and their general intellectual ability. An inappropriate selection of the testing language often occurs because there are no bilingual professional/technicians capable of carrying out neuropsychological testing in Spanish/English bilingual children. A second area that can prove problematic is the selection of the testing instruments to be used. In this sense, the relative scarcity of instruments developed specifically for evaluating Spanish/English bilingual children (e.g., Systematic Analysis of Language Transcripts, or SALT; Bilingual Spanish/English Version) is an unfortunate reality. Some batteries originally developed for monolingual Spanish children have been used with Spanish/English bilingual populations, for instance, the *Evaluación Neuropsicológica Infantil* (Matute, Rosselli, Ardila, & Ostrosky, 2007; Rosselli, Ardila, Navarrete, & Matute, 2010). The consequences of selecting an inadequate testing language include errors in estimates of participants' language ability *and* their wider intellectual level. Ideally, in any neuropsychological evaluation, children should be allowed to use their best language and cognitive resources. Bilingual subjects should thus be tested by a bilingual evaluator and should be given every opportunity to express themselves in both languages. Bilinguals perform significantly higher when the conditions established leave them free to use both languages than when testing is restricted to the dominant one.

Bilingual children with specific language impairments constitute a particular subtype of the general bilingual population. It is to be expected that in any subgroup of children – bilinguals or monolinguals – a certain percentage will manifest specific defects in language development (Tomblin et al., 1997), but this does not mean that bilingualism is the cause of their impairments. For some time now, clinicians have asked themselves whether bilingualism increases the percentage of children with specific language impairments, and whether using two languages intensifies the verbal difficulties that such population sectors may experience. During one period, the recommendation was that bilingualism be avoided at all cost in children with specific language impairments, but this approach is simply inapplicable when dealing with social bilingualism, because in those circumstances the child is unavoidably exposed to two languages, and so will necessarily achieve some degree of bilingualism. This is the type of situation seen, for instance, in Hispanic children living in Miami. Research carried out over the past decade has demonstrated that this popular belief (i.e., that bilingualism is inconvenient in children with specific language impairments) is, in fact, unfounded (Paradis, 2003). The truth is that those children will present language impairments in both languages, just as they would have presented in only one if they had been exposed to a monolingual environment. Indeed, bilingual children with specific language impairments do not acquire language more slowly than monolingual children with similar impairments. Moreover, despite their language difficulties, such bilingual children are capable of using grammatical code-switching (Gutiérrez-Clellen, Simon-Cereijido, & Leone, 2009).

Cognitive Assessment Tools for Hispanic Children

This section describes the tests that have been developed in various Spanish-speaking countries (including the USA) to evaluate cognitive strengths and deficits in developmental learning and communication disorders in Hispanic children. It begins with a description of tests developed in Spanish based on normative data from Spanish-speaking samples outside the USA, followed by an overview of tests that have been adapted for use in Spanish from earlier English versions using norms obtained from Hispanic children living in the USA and/or children in other Spanish-speaking countries. Table 20.1 lists the tests discussed in this section.

Tests Developed in Spanish and Normed Outside the USA

Neuropsychological Batteries

Evaluación Neuropsicológica Infantil – ENI (Child Neuropsychological Assessment) (Matute et al., 2007)

This battery was developed to assess Spanish-speaking children between 5 and 16 years of age. It includes nine neuropsychological domains: constructional abilities, memory (coding and delayed recall), sensory perception (visual, auditory, and tactile), oral language (repetition, expressive language, receptive language), metalinguistic awareness (awareness of phonemes, words, orthography), spatial abilities, attention, concept formation and reasoning, and executive functions. Descriptions of these tasks and examples of the items included are provided in Table 20.2.

The ENI also contains items that assess three academic areas, reading, writing, and arithmetic, and includes a self-administered questionnaire designed to be answered by the child's parents, or caregiver, which gathers personal data and the reasons for consultations. It also contains a structured questionnaire that inquires into the child's developmental and clinical history. Finally, this battery provides an assessment of soft neurological signs.

The original standardization of the ENI was based on a sample of 789 children (350 boys, 439 girls) from different socioeconomic levels in Manizales, a medium-sized city in Colombia, and two cities in Mexico: Guadalajara and Tijuana. It is important to note that Tijuana is right on the Mexico/US border and that Guadalajara is in the state of Jalisco, an area long characterized by a high rate of migration to the USA. Thus, a significant percentage of Hispanic children in the aforementioned standardization sample have roots in Jalisco (CONAPO, 2011), like many Mexican immigrants in the USA.

Table 20.1 Tests available in Spanish for the assessment of Hispanic children

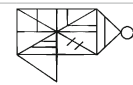
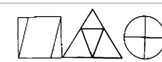
Test name	Original language	Type of assessment	Country of norms	Age range (years)
Evaluación Neuropsicológica Infantil	Spanish	Neuropsychological battery: memory; language; perception; attention; constructional, spatial, conceptual, and executive functions	Mexico, Colombia, USA	6–16
NEUROPSI Atencion y Memoria	Spanish	Memory and attention battery	Mexico	6–85
CUMANIN	Spanish	Screening battery	Spain	3–6
ECOFÓN	Spanish	Phonological awareness	Mexico	7–11
LEE	Spanish	Reading and writing skills		
Batería-R	English	Intelligence index, cognitive abilities, and academic achievement	USA, Mexico, Puerto Rico, Costa Rica, Spain, Argentina, and Peru	2–90
WISC-IV	English	Intelligence IQ, perceptual reasoning index	USA, Mexico, Spain, and Argentina	6–16
Preschool language scale	English and Spanish	Comprehension and expression	USA	2–6
Expressive one-word picture vocabulary test – Spanish-bilingual	English and Spanish	Vocabulary	USA	4–12
Receptive one-word picture vocabulary test – Spanish-bilingual	English and Spanish	Receptive vocabulary	USA	4–12
ROCF	French	Constructional, visual perceptual integration, visuomotor	Mexico and Colombia	4–15

Various types of validity and reliability indexes are reported, and *inter-rater reliability* coefficients for those ENI subtests that require a degree of interpretation were calculated. They ranged from 0.858 for written narrative coherence to 0.987 for complex figure recovery. These high coefficients of inter-rater reliability indicate that the standardized instruction presented in the ENI manual assures a consistent scoring of tests across examiners. *Stability coefficients* were also considered, using a retesting method with an average retest interval of 7.8 months and an average coefficient of 0.508.

The *External Validity* of the ENI was difficult to obtain because there are so few neuropsychological batteries in Spanish. The *Content Validity* of some of the ENI subtests was probed using subtests from the WISC *Escala de Inteligencia Wechsler para Niños* (Wechsler, 1984) and the *Batería Woodcock Psicoeducativa en Español* (Woodcock, 1982). Correlations with the WISC subtests ranged from 0.54 to 0.69 (see the ENI manual for details). These rather low correlations are not unexpected because, in contrast to the WISC, the ENI is not an intelligence test and was not developed under the g-factor theoretical construct. Higher correlations (range: 0.65–0.72) were found between the memory and perceptual subtests of the ENI and the corresponding tasks in the *Batería* (Matute et al., 2007).

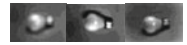
The ENI has been tested in diverse groups of children with neurodevelopmental disorders, such as dyslexia (De los Reyes Aragón et al., 2008), dyscalculia (Rosselli & Matute, 2005; Rosselli, Matute, Pinto, & Ardila, 2006), attention deficit hyperactivity disorder (ADHD, Ramos-Loyo, Michel Taracena, Sánchez-Loyo, Matute, & González-Garrido, 2011), 15q overgrowth syndrome (Gutiérrez-Franco et al., 2010), del(3) (p26) syndrome (Rivera, Domínguez, & Matute, 2006),

Table 20.2 Subtest description of the *Evaluación Neuropsicológica Infantil* (ENI)

Cognitive domain	Area	Subtests	Description	Item example	Scoring
1. Constructional abilities		Stick construction	Make 4 designs using toothpicks		Two points for each figure made correctly
	Graphic abilities	Copying simple figures	Copy 6 simple figures		Two points for each correct design
		Drawing a human figure	Draw a human figure by command		Total body parts (i.e., head + eyes + hair + …)
		Copying a complex figure	Copy a complex geometrical figure		Total number of elements drawn correctly
2. Memory	Verbal coding	Word learning	9–12 word list (animals, fruits, and body parts) in four consecutive trials		Total number of words in the 4 trials
		Story recall	Recall of a story containing 15 story points		Number of story points recalled
	Visual coding	Figure learning	9–12 geometric figures in four consecutive trials		Total number of figures in the 4 trials
	Verbal 30-min delayed recall	Delayed word recall	Free recall	Words are recalled spontaneouly	Total number of words remembered for each recall condition
			Cue recall	Words are recalled by categories (animals, fruits, and body parts)	Total number of words remembered in the three categories
			Recognition	Recognition from a 18/24 word list	Number of words identified
		Delayed story recall	Story points recall of the story presented	Story points are recalled spontaneously	Number of story points recalled
	Visual 30-min delayed recall	Delayed figure recall	Free recall	Figures are recalled spontaneouly	Number of designs drawn spontaneously
			Cue recall	Recall of figures by categories (triangles, squares, and circles)	Total of figures drawn in the three categories
			Recognition	Recognition of figures from among 18/24 figures	Number of figures identified
		Delayed complex figure recall		Complex figure drawn spontaneously	Number of elements drawn

(continued)

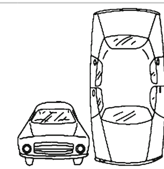
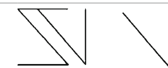
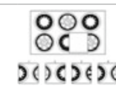
Table 20.2 (continued)

Cognitive domain	Area	Subtests	Description	Item example	Scoring
3. Perceptual abilities	Tactile perception		Recognition of objects placed in each hand out of child's view	Common objects are placed in each hand one by one	Number of objects recognized by each hand
	Visual perception	Superimposed figures	Recognition of 3 overlapping figures		Number of objects identified in the 3 figures
		Blurry images	Recognition of photographs with increasing degrees of clarity		Two points are given when a picture is recognized at the lowest degree of clarity
		Visual closure	Identification of incomplete drawings		Number of drawings identified
		Facial expressions	Recognition of facial expressions		Number of facial expressions identified
		Object integration	Integrate parts to make up an object		Number of correct answers
	Auditory perception	Musical notes	Same or different decision on recorded piano notes	8 pairs of notes are presented	Number of pairs identified as same or different
		Environmental sounds	Identification of environmental sounds presented on a tape recording	E.g., rooster, frog, train, etc.	Number of sounds identified correctly
		Phonemic perception	Decision on similarities and differences of pair of words	E.g., dado-dedo, quiso-guiso	Number of pairs correctly identified as same or different

4. Oral language	Repetition	Repetition	Eight syllables presented orally one by one	E.g., bi, pro, clin	Number of syllables repeated correctly
			Eight words presented orally one by one	E.g., sol, campana	Number of words repeated correctly
			Nonwords presented orally	E.g., bul, fampina	Number of nonwords repeated correctly
			Sentences presented orally		Number of words repeated correctly
	Expression	Naming	Name 15 objects that are presented on a card		
		Narrative coherence	The examiner reads a story, and the child must retell it		Two measures are taken: coherence degree and utterance length
	Comprehension	Images pointing	Point on command to 15 images of objects		Number of objects pointed out correctly
		Oral commands	Follow oral commands given in increasing order of difficulty	E.g., señala un avión azul y un cohe verde	
		Discourse comprehension	Eight questions must be answered about a story presented previously		Number of correct answers
5. Metalinguistic awareness	Phonemic awareness	Phonemic blending	Forming words from oral spelling (using the sound of the letters)	E.g.,/s/a/l/	Number of words formed correctly
		Phoneme counting	Counting the phonemes in words	E.g., brinco	Number of correct answers
	Orthographic awareness	Spelling	Spelling of words		Number of words spelled correctly
	Word awareness	Word counting	Counting the words in sentences		Number of correct answers

(continued)

Table 20.2 (continued)

Cognitive domain	Area	Subtests	Description	Item example	Scoring
6. Spatial abilities	Spatial-verbal abilities	Right-left Comprehension	Understand oral commands that involve distinguishing right and left	A doll is moved on a map	Number of commands followed correctly
		Right-left expression	Describe right and left directions on a map	A doll is moved on a map	Number of commands uttered correctly
		Different angled pictures	Recognition of the angle from which drawings of 2 objects are seen (right, left, front, back, above)		Number of correct answers
	Spatial-nonverbal abilities	Line orientation	Identification of a target line within a group of lines with different spatial orientation		Number of correct answers
		Coordinates	Trace a route using visual directions on a 6 x 6 array of one-cm squares		Number of lines placed correctly
7. Attention	Visual attention	Picture cancellation	Cancellation of large rabbits in an array of small and large ones		Number of rabbits cancelled correctly
		Letter cancellation (paradigm AX)	Select all the "X"s that are followed by the letter "A"		Number of letters cancelled correctly
	Auditory attention	Digits forward	Repetition of oral digits sets of 3–8 digits		Maximum number of digits repeated in a series
		Digits backward	Repeating digits backward, sets of 2–7		Maximum number of digits repeated backward in a series
8. Conceptual formation and reasoning		Verbal reasoning	Similarities between two concepts		Two points are given for each abstract response
		Matrices	Identification of a missing part on a logical array		Number of correct answers
		Arithmetical problems	Word problems		Number of correct answers

9. Executive functions	Fluency	Verbal fluency	Semantic: recall animals and fruits	Number of words correctly uttered in each category
			Phonemic fluency: identify as many words as possible that begin with/m/	Number of correct words
		Graphic fluency	Graphic semantic: draw different meaningful figures	Number of correct designs
			Graphic non-semantic: draw geometric figures with four lines that connect 5 dots in a square in a 35-square matrix	Number of correct designs
	Cognitive flexibility	Sorting cards	Categorize sorting cards based on color, number, and form	Number of correct answers, errors, failure to maintain the set, categories completed, perseverance in responding
	Planning and organizing	Pyramid of Mexico	The child must use three blocks to reproduce the requested constructions as quickly as possible with the minimum number of moves	Total number of correct constructions, constructions performed with the minimum of moves, number of moves in the correct constructions

Table 20.3 Means and standard deviations for the ENI memory subsets in three groups of atypically developed children and a matched control

Subtest	Dyslexia		DD		DD and RD		Control	
	N=20		*N*=13		*N*=17		*N*=20	
	M	SD	*M*	SD	*M*	SD	*M*	SD
Digits forward	5.2	.95	5.3	1.2	5.0	1.2	5.7	.8
Digits backward	3.3	.73	3.6	.27	3.4	.3	5.1	.3
Sentence repetition	4.1	.58	4.9	.9	4.6	1.1	5.8	1.1
Word learning	30.5	6.83	32.5	3.7	30.9	5.1	32.5	4.1
Story recall	7.0	1.7	8.3	1.9	7.1	2.6	9.0	2.3
Naming	9.2	2.9	10.3	1.7	8.9	2.7	10.6	1.3
Visual memory	29.2	7.36	31.0	5.7	26.6	6.3	33.0	6.6

DD developmental dyscalculia, *DD* and *RD* developmental dyscalculia and reading disorder combined

girls with congenital adrenal hyperplasia (Inozemtseva, Matute, & Juárez, 2008), and children born to mothers with gestational diabetes (Bolaños, Ramírez, & Matute, 2007). Table 20.3 compares the performance on seven memory subtests of 20 children with dyslexia, 17 with dyscalculia and dyslexia, 13 with dyscalculia, and 40 controls (adapted from Rosselli, Matute, Pinto, et al., 2006; Medrano, Matute, & Zarabozo, 2007). In this case, all children involved were monolingual Mexicans.

In typical Spanish-speaking pediatric populations, multivariate analyses of the ENI subtests have been conducted that include examining the interaction between scores and sociodemographic variables (Matute et al., in press; Pinto-Dussán, Aguilar-Mejía, & Gómez-Rojas, 2010; Rosselli, Ardila, Matute, & Inozemtseva, 2009). Developmental age and gender patterns have been described in the general profile of the ENI (Ardila, Rosselli, Matute, & Inozemtseva, 2011) and for specific domains, such as memory, language (Inozemtseva et al., 2010), reading (Canet-Juric, Urquijo, Richards, & Burin, 2009; González Reyes, Matute, Inozemtseva, Guajardo-Cárdenas, & Rosselli, 2011; Matute et al., 2008; Rosselli, Matute, & Ardila, 2006), and executive functions (Ardila, Rosselli, Matute, & Guajardo, 2005; Matute, Rosselli, Ardila, & Morales, 2004).

More recently, additional normative data for the ENI were collected from 108 bilingual Hispanics living in the states of Florida and Colorado. That sample was divided into five age groups (5–6, 7–8, 9–10, 11–12, and 13–14 years). Analyses of these data showed that language ability scores were lower in the bilingual Hispanic children compared to the Mexican/Colombian children in the standardization sample, though nonverbal and executive functioning abilities were similar in the two groups. More specifically, differences were evident in expressive language measures and in the metalinguistic awareness domain (Rosselli et al., 2010). A post hoc comparison of this group with a monolingual Spanish-speaking group demonstrated differences in writing skills. Table 20.4 compares the means and standard deviations for this bilingual group (*N*=108) with a group of Mexican/Colombian (*N*=217) monolinguals selected from the standardization sample; the two groups were matched by age and educational level. No children in this sample suffered learning disabilities or neurological or psychiatric disorders. As these scores come from normally developed children from Mexico, Colombia, and the USA, they may prove useful in establishing the gold standard for comparisons of tests applied to monolingual Hispanic children with neurodevelopmental disabilities.

NEUROPSI *Atención y Memoria* (NEUROPSI Attention and Memory) (Ostrosky-Solis et al., 2003)
This test was designed to assess orientation, attention and concentration, immediate and delayed verbal and visual memory, and executive functions, including working memory. The norms were obtained from 950 individuals in Mexico City, aged 6–85. The sample included 199 typically

Table 20.4 Mean test scores and standard deviations (in parenthesis) in typically developed monolingual (Mono) and bilingual (Bi) groups in the different ENI subtests

		Age groups				
		5–6	7–8	9–10	11–12	13–14
Measures		*N*=44/17	*N*=39/24	*N*=40/25	*N*=48/22	*N*=46/13
Constructional abilities						
Stick construction (8)	Mono	2.2 (1.5)	4.1 (1.7)	5.0 (1.3)	5.5 (1.3)	5.4 (1.3)
	Bi	3.4 (1.8)	5.2 (1.9)	5.8 (1.5)	6.5 (1.4)	7.7 (0.4)
Copying simple figure (8)	Mono	5.4 (1.9)	7.7 (2.2)	8.5 (1.9)	9.4 (1.1)	10.0 (1.3)
	Bi	5.8 (2.3)	7.7 (2.3)	9.2 (1.8)	9.7 (2.1)	10.6 (1.9)
Drawing a human figure (20)	Mono	11.2 (1.9)	12.9 (2.9)	13.5 (2.0)	14.1 (2.5)	15.6 (2.5)
	Bi	11.3 (2.7)	13.5 (3.4)	14.0 (2.5)	15.0 (2.4)	15.8 (1.9)
Copying a complex figure (12/15)	Mono	6.5 (2.6)	10.4 (1.6)	12.4 (2.3)	13.7 (1.5)	14.3 (0.7)
	Bi	7.2 (2.9)	8.8 (2.1)	12.1 (2.7)	13.6 (1.7)	13.3 (1.8)
Verbal memory coding						
Word learn (36/48)	Mono	20.6 (6.1)	24.4 (4.8)	30.9 (6.7)	32.6 (6.8)	33.9 (6.1)
	Bi	17.5 (5.2)	20.6 (7.1)	27.5 (6.7)	28.6 (7.5)	31.3 (5.0)
Story recall (15)	Mono	4.2 (2.0)	7.4 (2.5)	8.4 (2.2)	8.9 (2.4)	9.9 (2.1)
	Bi	3.1 (1.9)	5.2 (2.6)	6.2 (2.7)	7.7 (3.1)	9.5 (1.4)
Visual memory coding						
Visual learn (36/48)	Mono	11.9 (5.0)	17.5 (7.5)	28.3 (8.9)	30.5 (10.9)	32.6 (8.3)
	Bi	11.9 (6.8)	18.2 (5.8)	27.0 (7.6)	29.4 (5.7)	32.5 (6.1)
Verbal memory recall						
Free recall (12)	Mono	4.8 (2.2)	6.6 (1.4)	9.0 (1.9)	9.2 (2.2)	9.7 (2.1)
	Bi	3.7 (2.1)	5.2 (2.7)	7.9 (2.6)	8.0 (3.0)	8.6 (1.7)
Cue recall (12)	Mono	4.6 (2.5)	6.5 (1.9)	8.7 (2.1)	9.2 (2.4)	10.0 (2.0)
	Bi	3.9 (2.2)	5.3 (1.9)	7.8 (2.6)	8.0 (2.9)	9.0 (1.3)
Recognition (18/24)	Mono	15.2 (3.0)	16.8 (1.3)	23.1 (1.2)	22.7 (2.0)	23.3 (1.4)
	Bi	14.8 (2.4)	16.9 (1.4)	22.0 (1.9)	21.9 (2.7)	22.3 (1.2)
Story recall (15)	Mono	3.4 (2.2)	6.5 (2.7)	8.3 (2.3)	8.6 (2.3)	9.1 (2.3)
	Bi	2.7 (1.7)	4.2 (2.4)	5.8 (2.5)	7.0 (3.7)	9.0 (2.4)
Visual memory recall						
Free recall (12)	Mono	3.3 (2.1)	6.1 (2.0)	9.0 (2.4)	9.4 (2.5)	9.8 (2.3)
	Bi	4.0 (2.1)	5.7 (1.7)	7.7 (2.3)	8.7 (2.2)	9.7 (2.4)
Cue recall (12)	Mono	3.8 (2.3)	6.0 (2.2)	9.3 (2.0)	9.6 (2.5)	10.0 (2.2)
	Bi	3.8 (2.4)	5.8 (1.9)	8.0 (3.7)	9.2 (1.5)	10.3 (1.8)
Recognition (18/24)	Mono	15.8 (2.7)	17.2 (1.6)	23.5 (1.4)	23.2 (1.6)	23.5 (1.1)
	Bi	16.4 (2.0)	18.2 (2.3)	23.0(1.7)	23.7 (0.6)	23.6 (0.6)
Complex figure (12/15)	Mono	3.5 (2.91)	8.1 (2.72)	9.1 (3.24)	10.8 (2.45)	11.7 (1.91)
	Bi	4.5 (3.40)	6.9 (3.21)	8.7 (2.96)	10.7 (2.65)	12.1 (2.06)
Visual perception						
Superimposed figures (16)	Mono	7.2 (2.4)	9.9 (2.7)	12.2 (1.8)	12.6 (1.8)	13.7 (1.9)
	Bi	7.9 (2.2)	10.0 (2.0)	11.0 (1.9)	12.1 (2.4)	14.0 (1.4)
Blurry images (10)	Mono	5.4 (1.4)	6.0 (1.3)	6.5 (1.2)	7.2 (1.5)	7.7 (1.5)
	Bi	6.4 (1.4)	6.7 (1.0)	8.0 (1.4)	7.5 (1.5)	8.0 (1.5)
Visual closure (8)	Mono	2.4 (1.4)	3.8 (1.4)	5.1 (1.5)	5.2 (1.5)	5.7 (1.6)
	Bi	3.5 (1.2)	4.6 (1.5)	4.9 (1.4)	5.9 (1.1)	6.0 (1.4)

(continued)

Table 20.4 (continued)

Measures		Age groups 5–6 N = 44/17	7–8 N = 39/24	9–10 N = 40/25	11–12 N = 48/22	13–14 N = 46/13
Facial expressions (8)	Mono	6.0 (1.3)	6.8 (1.1)	7.3 (0.8)	7.3 (0.9)	7.2 (0.9)
	Bi	6.1 (1.2)	6.7 (1.2)	7.0 (1.2)	7.1 (1.0)	7.3 (1.1)
Object integration (8)	Mono	2.5 (1.4)	3.6 (1.4)	4.1 (1.5)	4.7 (1.6)	4.6 (1.7)
	Bi	2.2 (1.3)	3.2 (2.0)	3.8 (1.9)	4.7 (1.3)	5.7 (1.4)
Auditory perception						
Musical notes (8)	Mono	4.4 (1.6)	4.3 (1.7)	5.1 (1.8)	5.7 (1.9)	5.9 (1.6)
	Bi	4.7 (2.3)	4.9 (1.6)	6.3 (1.6)	6.1 (1.8)	5.9 (1.8)
Environmental sounds (8)	Mono	4.3 (1.4)	5.2 (1.3)	6.0 (1.1)	6.1 (1.2)	6.5 (1.0)
	Bi	3.7 (1.5)	5.3 (1.2)	5.6 (1.3)	6.3 (0.8)	6.8 (1.1)
Phonemic perception (20)	Mono	17.3 (3.3)	18.8 (1.6)	19.3 (1.1)	19.3 (0.9)	19.5 (0.7)
	Bi	16.5 (4.3)	18.3 (1.5)	18.6 (1.2)	17.9 (4.4)	18.2 (3.7)
Oral language						
Repetition						
Syllables (8)	Mono	6.2 (1.6)	6.9 (1.1)	7.5 (0.8)	7.2 (1.0)	7.4 (0.8)
	Bi	6.4 (1.9)	7.2 (1.2)	7.3 (0.85)	7.5 (0.6)	7.6 (0.4)
Words (8)	Mono	6.2 (1.2)	6.9 (1.4)	7.3 (0.8)	7.1 (1.2)	7.3 (0.8)
	Bi	6.9 (0.9)	7.1 (1.0)	7.5 (0.8)	7.3 (1.1)	7.9 (0.2)
Nonwords (8)	Mono	6.2 (1.2)	6.9 (1.4)	7.3 (0.8)	7.1 (1.2)	7.3 (0.8)
	Bi	6.9 (0.9)	7.1 (1.0)	7.5 (0.8)	7.3 (1.1)	7.9 (0.2)
Sentences (8)	Mono	3.8 (1.1)	4.8 (1.2)	5.8 (1.2)	6.1 (1.0)	6.4 (1.2)
	Bi	3.3 (1.3)	3.6 (0.6)	4.3 (1.1)	4.5 (1.2)	6.5 (1.3)
Expression						
Naming (15)	Mono	7.0 (2.7)	8.8 (3.4)	11.1 (2.8)	11.7 (2.2)	12.3 (1.6)
	Bi	8.4 (2.4)	9.5 (3.1)	11.1 (2.7)	11.9 (1.7)	13.6 (1.1)
Narrative coherence (7)	Mono	1.6 (1.0)	3.1 (1.1)	4.2 (1.5)	4.7 (1.3)	5.1 (1.0)
	Bi	1.6 (1.3)	3.1 (2.4)	3.3 (1.4)	4.5 (2.0)	6.0 (1.0)
Utterance length ++	Mono	27.1 (27.4)	90.7 (76.4)	133.8 (61.6)	141.9 (59.6)	154.8 (2.2)
	Bi	20.9 (20.4)	57.1 (55.8)	66.2 (48.6)	87.3 (60.5)	116.8 (42.9)
Comprehension						
Image pointing (15)	Mono	13.5 (2.1)	14.5 (1.4)	15.0 (0.0)	14.9 (0.3)	14.9 (0.2)
	Bi	13.0 (1.8)	13.95 (1.1)	14.5 (0.8)	14.8 (0.4)	14.9 (0.2)
Following oral commands (10)	Mono	7.7 (1.5)	9.0 (0.9)	9.4 (0.6)	9.5 (0.6)	9.7 (0.4)
	Bi	7.9 (1.0)	8.3 (0.8)	9.0 (0.8)	9.5 (0.5)	9.9 (0.1)
Discourse comprehension (8)	Mono	3.1 (1.2)	4.2 (1.4)	5.3 (1.6)	5.7 (1.4)	6.4 (1.2)
	Bi	2.5 (1.6)	3.0 (1.5)	4.0 (1.0)	5.0 (2.0)	6.3 (1.1)
Metalinguistic awareness+						
Phonemic blending (8)	Mono	0.8 (1.6)	2.9 (2.5)	3.7 (2.3)	4.7 (2.5)	5.1 (2.3)
	Bi	2.3 (2.1)	3.3 (2.4)	4.3 (1.8)	4.5 (2.1)	5.7 (2.0)
Spelling ++ (8)	Mono	1.0 (1.7)	5.0 (1.6)	6.0 (1.5)	6.6 (1.1)	7.3 (0.7)
	Bi	2.2 (2.1)	3.4 (1.8)	4.5 (1.3)	5.3 (1.6)	6.8 (1.4)
Phoneme counting (8)	Mono	1.5 (2.3)	5.8 (1.8)	6.6 (1.4)	6.6 (1.6)	7.1(1.0)
	Bi	2.5 (2.6)	3.7 (3.0)	5.5 (2.4)	6.2 (2.3)	7.4 (1.6)
Word counting (8)	Mono	1.5 (2.1)	5.1 (2.1)	6.0 (1.7)	6.1 (1.4)	7.0 (1.0)
	Bi	1.8 (2.2)	4.0 (2.3)	5.4 (1.5)	6.5 (2.0)	7.1 (1.1)

(continued)

Table 20.4 (continued)

		Age groups				
		5–6	7–8	9–10	11–12	13–14
Measures		*N*=44/17	*N*=39/24	*N*=40/25	*N*=48/22	*N*=46/13
Verbal spatial abilities						
Right-left comprehension (8)	Mono	4.2 (2.2)	6.1 (1.6)	6.7 (1.2)	6.5 (1.5)	6.7 (1.0)
	Bi	2.7 (1.6)	3.9 (2.5)	5.2 (1.8)	6.0 (1.9)	7.6 (0.4)
Right-left expression (8)	Mono	3.3 (2.0)	5.9 (1.8)	6.9 (1.0)	6.8 (1.6)	7.2 (0.6)
	Bi	2.5 (1.8)	3.9 (2.4)	5.3 (2.6)	6.2 (2.2)	7.9 (0.2)
Nonverbal spatial abilities						
Different angled pictures (8)	Mono	4.6 (2.4)	5.9 (2.1)	6.4 (2.3)	6.8 (1.6)	7.3 (1.6)
	Bi	4.0 (2.7)	5.0 (2.6)	6.6 (1.9)	6.8 (1.9)	7.6 (1.1)
Line orientation (8)	Mono	3.4 (2.2)	5.7 (1.4)	7.0 (1.3)	7.3 (0.9)	7.6 (0.6)
	Bi	2.4 (2.6)	5.8 (2.1)	6.0 (2.5)	7.2 (1.0)	7.9 (0.2)
Nonverbal attention						
Picture cancellation (44)	Mono	10.4 (4.7)	16.6 (5.5)	24.0 (6.5)	28.3 (8.4)	34.0 (6.9)
	Bi	12.7 (5.6)	17.2 (4.8)	23.2 (7.4)	26.6 (12.6)	32.4 (13.3)
Letter cancellation (82)	Mono	11.1 (5.6)	17.3 (6.2)	26.3 (7.1)	31.8 (7.0)	40.9 (8.2)
	Bi	10.8 (6.9)	19.1 (5.4)	31.4 (19.3)	29.8 (14.8)	38.9 (19.5)
Verbal attention						
Digits forward (8)	Mono	4.1 (1.3)	5.1 (0.9)	5.6 (1.1)	5.8 (0.9)	6.1 (1.1)
	Bi	3.7 (1.7)	3.8 (1.0)	4.0 (1.8)	4.6 (1.0)	5.0 (2.3)
Digits backward (7)	Mono	1.8 (1.2)	3.3 (0.9)	3.9 (0.9)	3.9 (0.9)	4.4 (1.3)
	Bi	2.3 (1.2)	2.8 (0.7)	3.3 (1.6)	3.5 (1.2)	3.7 (2.6)
Concept formation						
Similarities (16)	Mono	3.9 (2.2)	5.7 (2.5)	7.6 (2.1)	8.5 (2.5)	10.3 (2.3)
	Bi	3.4 (2.5)	5.3 (2.3)	6.6 (3.3)	9.1 (2.6)	12.1 (1.5)
Matrices (8)	Mono	1.9 (1.7)	3.5 (1.74)	4.6 (2.1)	5.2 (2.3)	5.6 (1.61)
	Bi	1.91 (1.3)	2.5 (1.9)	4.2 (2.7)	5.4 (2.0)	7.1 (0.8)
Arithmetical problems (8)	Mono	1.1 (1.0)	3.3 (1.2)	4.6 (1.4)	5.1 (1.3)	5.5 (1.1)
	Bi	0.8 (0.8)	2.9 (1.2)	4.0 (1.5)	5.0 (1.2)	7.7 (0.9)
Executive functioning						
Verbal fluency						
Semantic fluency (fruits)	Mono	7.0 (2.7)	9.3 (2.2)	11.4 (3.0)	13.2 (2.7)	14.5 (2.2)
	Bi	5.8 (2.4)	6.3 (2.8)	8.2 (2.7)	9.4 (2.3)	13.2 (2.9)
Semantic fluency (animals)	Mono	9.3 (3.5)	12.8 (4.2)	15.6 (3.9)	16.2 (4.4)	19.4 (3.7)
	Bi	9.0 (3.6)	10.4 (3.9)	13.0 (3.8)	13.9 (4.4)	17.0 (3.2)
Phonemic fluency	Mono	2.5 (2.2)	6.1 (3.1)	7.5 (3.3)	9.5 (2.8)	11.4 (3.0)
	Bi	3.7 (2.1)	4.8 (2.7)	5.9 (1.8)	8.1 (4.7)	10.0 (3.9)
Nonverbal fluency						
Graphic semantic fluency (35)	Mono	9.0 (3.5)	11.4 (4.5)	17.1 (6.2)	17.9 (6.7)	21.7 (5.9)
	Bi	7.6 (4.3)	10.0 (4.0)	10.2 (3.8)	12.5 (8.3)	15.5 (4.8)
Graphic non-semantic (35)	Mono	3.3 (2.8)	5.5 (3.9)	10.4 (5.4)	11.4 (5.5)	13.4 (5.8)
	Bi	3.0 (2.9)	5.6 (3.7)	6.8 (4.7)	10.1 (5.7)	10.8 (5.4)
Cognitive flexibility						
Card-sorting errors	Mono	25.8 (5.6)	16.9 (8.9)	15.0 (7.8)	11.4 (7.3)	11.0 (6.4)
	Bi	23.6 (7.2)	16.3 (7.7)	16.3 (10.6)	10.0 (6.3)	8.3 (3.5)

(continued)

Table 20.4 (continued)

Measures		Age groups 5–6	7–8	9–10	11–12	13–14
		N = 44/17	*N* = 39/24	*N* = 40/25	*N* = 48/22	*N* = 46/13
Card-sorting categories	Mono	1.1 (0.7)	2.2 (0.9)	2.2 (0.8)	2.5 (0.7)	2.5 (0.5)
	Bi	1.6 (0.8)	2.1 (0.9)	1.9 (0.9)	2.7 (0.5)	2.8 (0.6)
Pyramid of Mexico correct	Mono	8.2 (2.7)	9.9 (2.3)	10.7 (0.6)	10.7 (0.5)	10.6 (0.6)
	Bi	8.2 (3.2)	9.3 (2.3)	10.0 (2.3)	10.6 (0.5)	10.7 (0.4)

Maximum scores when appropriate are indicated in parenthesis adjacent to the name of the corresponding measure

developed children divided into five age groups: 6–7, 8–9, 10–11, 12–13, and 14–15 years (Ostrosky-Solis et al., 2007). The manual includes standard scores for each age group – mean = 100, standard deviation of 15 – for three domains: (1) attention and executive function, (2) memory, and (3) attention and memory. Additionally, scaled scores are provided for each task with a mean of 10 and a standard deviation of 3. The profile that can be generated shows strong and weak areas. Table 20.5 presents the means and standard deviations for the different subtests of the NEUROPSI Attention and Memory battery across three age groups (adapted from Ostrosky-Solis et al., 2007). These data are especially useful when testing monolingual Spanish children.

Factor analysis revealed a total of 6 factors: Factor I included the category formation test, visual search, semantic and phonological verbal fluency, and design fluency; Factor II contained the following tasks: logic memory, immediate and delayed recall, immediate and delayed recall of verbal paired associates, and motor functions; Factor III involved word list encoding, word list free recall, word list cue recall, and a word list recognition trial; Factor IV utilized items that assess time orientation, digit detection, mental control, and immediate and delayed faces recall; Factor V employed digit forward span, digit backward span, spatial forward span, and spatial backward span; and, finally, Factor VI focused on place and person orientation. With regard to age effects on children, the age ranges at which the highest performance level was reached varied across factors: the first areas to mature were related to memory functions (Factors II and III), at 6–7 or 8–9 years. The highest performance for functions tested in Factors IV and V was attained at 10–11 years. The last area to reach the highest performance level was related to Factor I, at 14–15 years (Ostrosky-Solis et al., 2007).

The validity of the NEUROPSI Attention and Memory in screening for attention problems was tested in 61 6–10-year-old children previously diagnosed with ADHD (Flores, 2009). This attention and memory battery has also been used to assess children/adolescents with cerebral palsy ranging in age from 5 to 18. Significant variations in attention/memory scores appeared in children with different subtypes of cerebral palsy: those with the athetosis type performed better, followed by the mixed group and, finally, the spastic group, which underperformed the other two (Ramírez-Flores & Ostrosky-Solís, 2009).

Cuestionario de Madurez Neuropsicológica Infantil – CUMANIN **(Child Neuropsychological Maturity Questionnaire – Portellano Pérez, Mateos Mateos, Martínez Arias, Tapia Pavón, & Granados García-Tenorio, 2000)**

CUMANIN was developed to assess neuropsychological development in children aged 3–6.5 years (36–78 months). Tasks are grouped in 13 scales: gross and fine motor skills, repetition, expressive language, receptive language, spatial abilities, visuoperception, visual memory, rhythm, verbal fluency, attention, laterality (hand, eye, foot), reading, and spelling. The last two are used only with children over 61 months. CUMANIN was developed in Spain and normed on a sample of 803 Spanish children, 51% males and 49% females. Preliminary studies with special populations have been con-

Table 20.5 Means and (standard deviations) for the NEUROPSI Attention and Memory subsets in three groups of typically developed Mexican children (Maximum scores are in parenthesis)

		6–9	10–13	14–15
		$n=68$	$n=80$	$n=25$
Orientation	Time (4)	3.2(0.9)	3.2(0.9)	3.9(0.3)
	Place (2)	1.8(0.45)	2.0(0.15)	2.0(0.0)
	Person (1)	1(0.0)	1.0(0.0)	1.0(0.0)
Attention and concentrations	Digit forward span (9)	4.65(0.85)	5.5(0.9)	5.8(1.0)
	Digit detection (10)	5.1(1.6)	8.85(1.15)	9.3(0.9)
	Mental control (3)	1.05(1.3)	1.55(1.25)	1.7(1.3)
	Spatial forward span (9)	4.8(0.9)	5.5(0.9)	5.8(1.0)
	Visual search (24)	11.55(4.4)	15.65(3.85)	18.0(3.2)
Executive functions	Category formation test (25)	13.5(4.45)	16.5(4.2)	17.6(5.6)
	Semantic verbal fluency	14.6(4.5)	17.5(3.45)	19.7(4.3)
	Phonological verbal fluency	8.1(2.5)	11.35(3.25)	15.0(6.0)
	Design fluency (35)	8.0(3.6)	12.35(4.45)	15.7(6.3)
	Motor functions (20)	17.4(2.15)	18.65(1.25)	19.1(1.1)
	Stroop (time)	67.7(21.7)	47.35(11.95)	36.8(15.0)
	Stroop (correct)	32.4(4.15)	34.5(1.6)	35.1(1.6)
Working memory	Digit backward span (8)	3.05(0.8)	3.75(0.85)	3.9(0.9)
	Spatial backward span (8)	4.05(0.9)	5.0(0.85)	5.4(1.0)
Immediate memory	Word list (12)	5.95(1.55)	7.0(1.4)	7.5(1.6)
	Verbal paired associates (12)	7.05(2.25)	8.6(2.0)	8.2(1.5)
	Logical memory (16)	6.85(2.7)	9.1(2.15)	9.9(2.6)
	Rey-Osterreith Complex Figure (36)	27.8(5.0)	31.5(4.15)	34.4(2.8)
	Faces (4)	2.61(1.0)	3.45(0.8)	3.6(0.7)
Delayed memory	Word list (free recall) (12)	6.35(1.95)	7.85(1.8)	8.1(2.2)
	Word list (cued recall) (12)	6.35(1.8)	8.05(1.75)	8.2(1.9)
	Word list (recognition) (12)	9.7(1.8)	10.65(1.55)	10.2(2.2)
	Verbal paired associates (12)	8.45(2.45)	10.15(1.95)	10.2(1.8)
	Logical memory (16)	6.3(2.6)	8.6(2.1)	9.6(2.5)
	Rey-Osterreith Complex Figure (36)	16.9(5.9)	20.2(5.65)	24.6(5.4)
	Faces (2)	0.9(1.05)	1.3(1.0)	1.4(0.8)

ducted with low-birth-weight children, youngsters with Down's syndrome, and learning-disabled children, all in Spain. This instrument was also adapted for use in Chile with a sample of 243 infants aged 36–72 months at private and public educational institutions (Urzua, Ramos, Alday, & Alquinta, 2010) and a group of two hundred and sixty-one 43–78-month-old urban children in Lima, Peru (Guerrero Leiva, 2011).

Reading and Writing Tests

Evaluación de la conciencia fonológica (ECOFÓN – Phonological Awareness Assessment)

ECOFÓN was designed to assess phonological awareness in Spanish-speaking children aged 7–11 in the second to sixth grades of elementary school (Matute, Montiel, Hernández-Ramírez, & Gutiérrez-Bugarín, 2006). This test is sensitive to reading disabilities and involves three phonological levels and ten tasks. The syllabic awareness level comprises two tasks: syllabic segmentation in words and syllabic counting in words, whereas the intra-syllabic level includes two tasks: rhyme detection in words and initial phoneme detection in words. Finally, six tasks are included at the phonemic level: phoneme suppression within a word, phonemic decoding in words, phonemic decoding in nonwords, phoneme substitution in words, phoneme blending in words, and phonemic blending in nonwords.

This metalinguistic awareness test was standardized using a sample of 119 children (50% males) from private and public schools in Guadalajara, Mexico. All children had scores ≥50 on the Raven Matrices. Reliability was verified by analyzing test-retest stability. Norms are provided according to age or school grade. ECOFÓN has been shown to be useful in detecting children with reading difficulties, as the performances achieved on this battery and in reading tests correlated significantly (Montiel & Matute, 2007).

LEE. Test de Lectura y Escritura en Español (LEE. Spanish Reading and Writing Test) (Defior et al., 2006)

The aim of LEE is to assess reading and writing abilities in relation to expected achievement levels according to school grade. A qualitative analysis makes it possible to detect the error type, attain a precise diagnosis, and develop therapy programs. Nine tests are included: phonemic segmentation, reading letters, reading words, reading pseudowords, word and phrase comprehension, prosody, text comprehension, writing words, and writing pseudowords. Norms were obtained from a representative sample of 400 schoolchildren enrolled in the first to fourth grades of primary school at public and private institutions in Buenos Aires, Argentina, and Granada, Spain. Norms are provided separately for each country. Two types of validity were considered: (1) convergent and (2) discriminating. The test showed appropriate internal consistency according to the split and test-retest stability methods.

Tests Translated to Spanish and Normed Outside the USA

Test Batteries

Batería Woodcock-Muñoz-Revisada (Batería-R) (Woodcock & Munoz, 1998)

The Batería-R is the Spanish version of the Woodcock-Johnson Psychoeducational Battery-Revised (WJ-R) and is composed of the *Batería Woodcock-Munoz pruebas de habilidad cognitiva-revisada* (Batería-R COG – cognitive battery) and the *Batería Woodcock-Munoz pruebas de aprovechamiento-revisada* (Batería-R APR –achievement battery). The cognitive battery includes 21 memory tests for names, memory for sentences, visual matching, incomplete words, visual closure, picture vocabulary, analysis-synthesis, visual auditory learning, memory for words, cross out, sound blending, picture recognition, oral vocabulary, concept formation, delayed recall for names, delayed recall-visual-auditory learning, numbers reversed, sound patterns, spatial relations, listening comprehension, and verbal analogies. The achievement battery includes eighteen subtests: letter-word identification, passage comprehension, calculation, applied problems, dictation, writing samples, science, social studies, humanities, word attack, reading vocabulary, quantitative concepts, proofreading, writing fluency, punctuation, spelling, usage, and handwriting.

The cognitive items are clustered in 4 groups: broad cognitive ability, cognitive factors, scholastic aptitude, and oral language. Cognitive ability represents the Horn–Cattell theory of intelligence (g) and measures different domains of general intelligence, such as fluid reasoning (Gf), comprehensive knowledge (Gc), visual processing (Gv), auditory processing (Ga), processing speed (Gs), long-term retrieval (Glr), and, finally, short-term retrieval (Gsm). The achievement battery is clustered into basic and broad reading, reading comprehension, mathematical abilities (basic and reasoning), writing abilities, general knowledge, and skills. Woodcock and Munoz-Sandoval (2001) suggest that the Batería-R can provide useful information for neuropsychological assessments as it evaluates aspects of different processes, running from basic (i.e., attention) to more complex ones (i.e., reasoning to problem solving).

Norms are based on 6,359 English speakers aged 24 months to 90 years and subsequently recalibrated on 2,000 Spanish speakers in six countries (Mexico, Puerto Rico, Costa Rica, Spain, Argentina, Peru) and five US states (Arizona, California, Florida, New York, Texas). Norms on the Batería-R were "equated" with the WJ-R through item response theory. Specifically, where subtest items had nonverbal content, norms from the WJ-R were used, whereas when subtests used verbal prompts and required verbal responses, items were translated from English to Spanish by native Spanish speakers from several countries, all of whom adopted an iterative cross-checking process until a consensus was reached. The new items that emerged in Spanish were integrated into the item difficulty rankings of the existing English items.

All items (those translated from English plus new items developed in Spanish) were recalibrated with a sample of 2,000 Spanish-speaking individuals. The external validity of the cognitive battery in English has shown a high correlation (0.64) with the WAIS-R Full-Scale IQ, though external validity with the WISC or any one of the Spanish versions of this intelligence test has been reported.

Both strengths and weaknesses have been observed in the Batería-R. The major strength is that it is one of the most comprehensive, adequately validated, and normed intelligence test available for use with Spanish speakers in several Latin America countries and the USA (Schrauf & Navarro, 2005). However, questions have been raised as to just how suitable the Batería-R norms (obtained largely outside the USA) are for Hispanic-American children, many of whom are better characterized as bilingual. The high number of verbal subtests compared to the low number of nonverbal tasks in the Batería-R is another limitation on the cognitive assessment of children with learning disabilities, especially those affected by visuospatial defects. The final weakness of this battery is the lack of validation of its nonverbal tests in the Spanish sample, which was based on the erroneous assumption that visuospatial and nonverbal tests are culturally and educationally fair or at least fairer than verbal tests, a supposition that has since been refuted (see Rosselli & Ardila, 2003 for a review).

Wechsler Intelligence Scale for Children (WISC-IV, Wechsler, 2004)

This battery aims to assess intellectual abilities in children and adolescents aged 6–16. It provides a full IQ score plus scores on four indexes: verbal comprehension, perceptual reasoning, working memory, and processing speed. Compared to the WISC-III, it places less emphasis on crystallized knowledge (Information is now a supplemental test to the full IQ score) by accentuating the contribution of fluid reasoning (matrix reasoning, picture concepts), working memory (letter-number sequencing), and processing speed (coding and symbol search). Whereas the WISC-IV FSIQ is comprised of subtests that encompass these four index scores, the earlier WISC-III FSIQ included only one measure of processing speed and one of working memory. Also, the WISC-IV maintains ten subtests from the WISC-III while adding five additional ones (picture concepts, letters and numbers, symbol search, word reasoning, cancellation). The WISC-FSIQ scores allow the evaluator to assign the child's scores to intellectual groups that range from very high (gifted) to very low (mentally retarded). Also, pattern analyses have helped clinicians characterize the cognitive profiles of children with developmental disorders.

The WISC-IV Spanish edition was translated from English and adapted to Spanish taking into consideration cultural issues. A panel of scholars that included native Spanish speakers worked together to minimize the dialectic and regional differences that exist among the various Hispanic nations that were to be included in the standardization sample. The resulting scores were equated to the WISC-IV norms so that Hispanic children could be measured and compared to English norms.

The original WISC-IV in Spanish was standardized on a nationally stratified sample of 851 children selected on the basis of data from the 2000 US Census to represent the Hispanic population in the USA in terms of age, sex, gender, parental education, parental race/ethnicity, geographic area, and disability status. The WISC-IV Spanish norms were developed on the basis of 500 of those individuals and obtained from the four major geographic regions identified in the aforementioned census (northeast, south, midwest, west). Puerto Rico was included in the South region. Norms for the

WISC-IV are available for Mexican (Wechsler, 2007), Argentinean (Wechsler, 2010), and Spanish (Wechsler, 2005) children. The Mexican standardization was performed on a sample of 1,234 children and adolescents from urban and rural areas in 11 states. The norms of the Argentinean WISC-IV are from a sample group based in Buenos Aires. Finally, the Spanish standardization (in Spain) was conducted with a sample of 1,590 children and adolescents representative of that country's population.

Few studies have addressed the use of the WISC-IV in learning disabilities. Recently, for example, De Clercq-Quaegebeur et al. (2010) found that the working memory index of the WISC-IV in French is deficient in tests on children with dyslexia compared to the other three indexes (verbal comprehension, perceptual reasoning, and processing speed). Those authors found marked deficiencies in the digit span and letter-number sequence tasks and, though to a lesser degree, also in coding. San Miguel Montes, Allen, Puente, and Neblina (2010), meanwhile, found that the WISC-IV Spanish letter-number sequencing subtest successfully distinguished 35 Puerto Rican children with neurological dysfunction – including nine with different types of learning disabilities – from a normal control group. These results suggest that the inclusion of a WM index in IQ tests has made this assessment tool more suitable for the evaluation of learning disabilities, although additional research is required.

Language

Preschool Language Scale – Fourth Edition Spanish – PLS-4 (Zimmerman, Steiner, & Pond, 2002)

The Preschool Language Scale – Fourth Edition Spanish – PLS-4 is an individually administered test used to identify monolingual or bilingual Spanish-speaking children who have a language disorder or delay (Zimmerman et al., 2002). It is not a translation of the English version; instead, the test tasks and sub-items of both versions were codeveloped. PLS-4 Spanish is composed of two scales: auditory comprehension and expressive communication, together with a total language score. The test includes three supplemental assessments: a language sample checklist, the articulation screener, and the caregiver questionnaire.

The sample was formed according to the Hispanic population as it is portrayed in the US Census. The PLS-4 Spanish standardization sample included 1,188 children (613 female, 575 male), aged 2 days to 6 years and 11 months. The caregiver's education level was used as an SES indicator. Four groups based on years of schooling were considered: (1) 0–11 years, (2) 12 years (diploma or GED), (3) 1–3 years of college or technical school, and (4) 4 years or more of college. The sample included children from different countries of origin according to the Spanish dialect spoken in their households; 81.2% were from Mexico. Also, 61 children in the sample reported previously identified developmental conditions or having received earlier diagnoses. Exposure to Spanish was also considered during sample selection. The reliability of PLS-4 Spanish was estimated using test-retest reliability, internal consistency, and inter-rater reliability.

Expressive One-Word Picture Vocabulary Test – Spanish-Bilingual Edition (Brownell, 2001a)

The Expressive One-Word Picture Vocabulary Test – Spanish-Bilingual Edition (EOWPVT-SBE) provides an assessment of an individual's combined Spanish and English speaking vocabulary. This test is individually administered. The standardization edition was applied to 1,150 bilingual individuals in testing conducted in 50 cities in 17 states across the USA. The demographic criteria for inclusion required potential subjects to speak at least some Spanish and be aged 4–12 years. Standard scores, confidence intervals, percentile ranks, and age equivalents are provided. Three types of validity were considered: (1) content validity, (2) criterion-related validity, and (3) construct validity. Standard scores from 105 children who had been identified as receiving special education or speech-language services were examined. Only the articulation disorder group showed no differences in performance when compared to the entire sample.

Table 20.6 Comparison of the performance of two groups of Latin American children on the ROCF

Colombian sample (Ardila & Rosselli, 2003)			Mexican sample (Galindo & Cortes, 2003)		
Age group	Copy	Immediate recall ratio	Age group	Copy	3-min recall ratio
5–6	14.5 (7.9)	8.4 (6.2) 57%	–	–	–
7–8	22.0 (8.8)	13.9 (7.3) 63%	8–9	17.6 (3.2)	10.6 (4.0) 60%
9–10	24.6 (6.1)	17.0 (6.3) 70%	10–12	21.4 (5.0)	12.0 (4.4) 56%
11–12	27.9 (4.7)	19.4 (5.2) 69%	13–15	22.9 (4.1)	14.3 (4.9) 62%

The ratio memory score equals memory/copy

Receptive One-Word Picture Vocabulary Test – Spanish-Bilingual Edition (Brownell, 2001b)

The Receptive One-Word Picture Vocabulary Test – Spanish-Bilingual Edition (ROWPVT-SBE) is also administered individually. It is intended for use with children who speak Spanish and English at varying levels of proficiency. The ROWPVT-SBE is an adaptation of the Receptive One-Word Picture Vocabulary Test (ROWPVT; Brownell, 2000). The EOWPVT-SBE and ROWPVT-SBE were co-normed. Standard scores, confidence intervals, percentile ranks, and age equivalents are all given. Three types of validity were considered: (1) content validity, (2) criterion-related validity, and (3) construct validity. Reliability was analyzed by considering internal consistency and temporal stability. As with the EOWPVT-SBE, the ROWPVT-SBE was also tested on four exceptional groups: (1) mentally retarded, (2) expressive/receptive language disorder, (3) learning disabled, and (4) articulation disorder. Only the latter group showed no differences when compared to a group of typical children.

Nonverbal Test with Norms for Spanish-Speaking Children

Rey-Osterrieth Complex Figure (ROCF)

This test is one of the most common neuropsychology instruments used to assess constructional abilities, visual perceptual organization, and visual memory. The test includes two complex figures: the standard complex figure with 18 perceptual units and a maximum score of 36 and a simpler complex figure that has only nine perceptual units and a maximum score of 18. The standard ROCF is commonly used with adults and children over 8, whereas the second is appropriate for younger children, ages 4–8 (Galindo & Cortes, 2003). Normative data for Spanish-speaking children are available for both types of tests.

Galindo and Cortes (2003) administered the standard ROCF to 2,250 Mexican children ranging in age from 8 to 15 years (50% females). The administration procedure was of the standard "copy everything you see on the card" type, with a 3-min immediate recall: "on this blank paper draw everything you can remember from the figure you just copied." Rosselli and Ardila (2003) followed a similar procedure to obtain norms from a sample of 233 Colombian children aged 5–12. No gender effects were seen. A summary of the results from these two studies appears in Table 20.6. The results from the Colombia sample are higher than those reported for the Mexican group, a finding that may be due to the fact that half of the Colombian sample came from a high SES group, whereas the Mexican sample was probably a more homogeneous mid-SES group. The means and standard deviations by age range and SES group are presented in Ardila and Rosselli (2003).

Norms for the Spanish population on the simpler version of ROCF are available in Rey (1997). Also, Galindo and Cortes (2003) provide norms for this ROCF for younger children in a sample of 750 Mexicans aged 4–8 years. The means for copying/memory the figure at ages 4, 5, 6, 7, and 8 are 5.8/3.63 (sd = 2.9/2.13), 8.6/6.4 (sd = 2.2/2.3), 9.9/7.2 (sd = 2.2/2.4), 11.3/8.2 (1.9/2.3), and 11.8/8.8 (sd = 1.7/2.2), respectively.

Recommendations

Neuropsychological assessment of Hispanic children with possible learning and communication disorders is complex and requires not just a solid background in the neurometrics of cognitive developmental disorders, but also an understanding of cross-cultural issues of assessment. Tests should be selected on the basis of the children's cultural background. Tests developed in Spanish are best employed to assess monolingual Hispanic children or those who recently immigrated to the USA but whose preferred language is still Spanish. Bilingual children should be assessed by a bilingual examiner, and responses in both languages should be accepted when calculating verbal scores; also, whenever available, norms determined for bilingual populations should be used. Tests in Spanish that are simple translations of earlier English instruments must be interpreted with great care, since the act of translating by no means rules out cultural bias (Table 20.7). Finally, it is important to note that Hispanic children with emerging bilingualism and blended cultural backgrounds are usually not included in norm samples and, therefore, tend not to be represented in most US standardizations.

Table 20.7 Other tests available in Spanish. Most of them are English translations

Global cognitive assessment
AMPE-F Aptitudes Mentales Primarias Equivalente. Secadas, F. (1989). Madrid: TEA Ediciones
BTI Batería TEA Inicial. García, J.E. Arribas, D. Uriel, E. J. (2006). Madrid: TEA Ediciones
DAS Escala de Aptitudes Diferenciadas Elliot (1990)
Escala de Alexander. ALEXANDER, W.P. (1978). Madrid: TEA Ediciones
K-ABC Batería de evaluación de Kaufman para niños. Kaufman, A. y Kaufman, N. (1997). Madrid: TEA Ediciones
MSCA Escalas McCarthy de Aptitudes y Psicomotricidad para niños. McCarthy, D. (1996). Madrid: TEA Ediciones
Intelligence
K-BIT Test breve de inteligencia de Kaufman, 4 a 90 años. Kaufman, A. y Kaufman N. (1990) Madrid: TEA Ediciones
TIG Test de inteligencia general (S. dominós) Formas 1 y 2 (10 y 14)C/U. Cordero, A. (1994) Madrid: Estudios TEA
Laterality
HPL Test de homogeneidad y preferencia lateral de 4–10 años. Gómez Castro, J. L. y Ortega López, M. J. Madrid: TEA Ediciones
Language
ITPA Test Illinois de aptitudes psicolingüísticas. Kirk S.A., McCarthy J.J., Kirk W.K. (1989) 2da. Edicion. Madrid: TEA Ediciones
BLOC, Batería del Lenguaje Objetivo y Criterial. Puyuelo, M., Wiig, E., Renom, J. y Solanas, A. (1997). Barcelona: Masson, S.A
CDI – Inventarios MacArthur-Bates del Desarrollo de Habilidades Comunicativas. Jackson-Maldonado D., Thal, D. J., Fenson, L., Marchman, V. A., Newton, T. et al., (2005). México: Manual Moderno
Attention
AGL, Atención Global Local. Blanca, M.J., Zalabardo, C., Rando,B., López-Montiel D., y Luna R. (2005). Madrid: TEA Ediciones
Escala de Connners. Conner, K. (1997) New York: Multi-Health Systems, Inc.
EDAH Evaluación del trastornos por déficit de atención con hiperactividad. Farré-Riba, A. y Narbona, J. (2003) Madrid: TEA Ediciones
Smith, A. (2002). *SDMT Test de símbolos y dígitos*. Madrid, España, TEA Ediciones S.A. (Spain norms)
Reading and writing
EDAF Evaluación de la discriminación auditiva y fonológica. Brancal, M., Ferrer, A., Alcantud, F. y Quiroga, M. (1998) Barcelona: Lebón
ECL Evaluación de la comprensión lectora de 6 a 9 años. Cruz, M. V. (1999) Madrid: TEA Ediciones
PROLEC Batería de Evaluación de los Procesos Lectores de los Niños de Educación Primaria. Cuetos, F., Rodríguez, B., y Ruano, E.(1996). Madrid, Spain: TEA Ediciones

(continued)

Table 20.7 (continued)

TALE Test de análisis de la lectoescritura. Cervera, M. y Toro, J. (1980). Madrid: Visor Libros
Learning
ACRA, Estrategias de Aprendizaje. Román, J.M. y Gallego S. (1994) Madrid: TEA Ediciones
TAVECI, Test de Aprendizaje Verbal España-Complutense Infantil. Benedet MJ, Alejandre M.A., y Pamos de la Hoz A. (2001) Madrid: TEA Ediciones
Razonamiento no verbal/Coordinación visomotora
Test Guestáltico Visomotor. Bender L. (1998) México: Paidós
Test de matrices progresivas. Infantil. Raven J.C. (1997) Buenos Aires: Paidós
Porteus, S.D. (2001). *Laberintos de Porteus*. Madrid, España, TEA Ediciones S.A. (Spain norms)
Smith, A. (2002). *SDMT Test de símbolos y dígitos*. Madrid, España, TEA Ediciones S.A. (Spain norms)
Memoria
MAI Memoria auditiva inmediata 7–13 años. Cordero A. (1997) Madrid: TEA Ediciones
MY Test de memoria nivel I, II, III 7–8 años 8–10 años 14–18 años. Yuste, C. (1994) 4ta. Edicion, Madrid: TEA Ediciones

References

Aguilar-Mediavilla, E., Sanz-Torrent, M., & Serra-Ravento, M. (2007). Influence of phonology on morpho-syntax in Romance languages in children with specific language impairment (SLI). *International Journal of Language & Communication Disorders, 42*, 325–347.

American Psychiatric Association. (2000). *Diagnostic and statistical manual of mental disorders* (text rev.). Washington, DC: Author.

Anderson, R., & Lockowit, A. (2009). How do children ascribe gender to nouns? A study of Spanish-speaking children with and without specific language impairment. *Clinical Linguistics & Phonetics, 23*, 489–506.

Ardila, A. (2009). Características de la Población Hispanohablante: Sociedad, Lengua y Cultura. *Glosas. Academia Norteamericana de la Lengua Española, 9*, 2–20.

Ardila, A., & Rosselli, M. (2003). Education effects on ROCF performance. In J. A. Knight & E. Kaplan (Eds.), *The handbook of Rey-Osterrieth complex figure usage: Clinical and research applications*. Lutz, FL: Psychological Assessment Resources.

Ardila, A., Rosselli, M., Matute, E., & Guajardo, S. (2005). The influence of parents' education on the development of their children's executive functions. *Developmental Neuropsychology, 28*, 539–560.

Ardila, A., Rosselli, M., Matute, E., & Inozemtseva, O. (2011). Gender differences in cognitive development. *Developmental Psychology, 47*(4), 984–990.

Baker, C. (2000). *The care and education of young bilinguals: An introduction for professionals*. Clevedon, UK: Multilingual Matters.

Bolaños, M. L., Ramírez, M. L., & Matute, E. (2007). Características neuropsicológicas de niños escolares nacidos de madres con diabetes gestacional. *Revista Neuropsicología, Neuropsiquiatría y Neurociencias, 7*(1–2), 107–123.

Bortilini, U., Caselli, M. C., Deevy, P., & Leonard, L. (2002). Specific language impairment in Italian: The first steps in the search for a clinical marker. *International Journal of Language & Communication Disorders, 37*, 77–93.

Brownell, R. (2000). *Receptive one-word picture vocabulary test* (3rd ed.). Novato, CA: Academic Therapy Publications.

Brownell, R. (2001a). *Expressive one-word picture vocabulary test – Spanish-bilingual version*. Novato, CA: Academic Therapy Publications.

Brownell, R. (2001b). *Receptive one-word picture vocabulary test – Spanish-bilingual edition*. Novato, CA: Academic Therapy Publications.

Canet-Juric, L., Urquijo, S., Richards, M. M., & Burin, D. (2009). Predictores cognitivos de niveles de comprensión lectora médiante análisis discriminante. *Journal of Psychological Research, 2*, 99–111.

CONAPO. (2011). www.conapo.gob.mx/index.php?option=com_content&view=article&id=324&Itemid=251. Accessed September 23, 2011.

Davies, R., Cuetos, F., & Glez-Seijas, R. M. (2007). Reading development and dyslexia in a transparent orthography: A survey of Spanish children. *Annals of Dyslexia, 57*, 179–198.

De Clercq-Quaegebeur, M., Casalis, S., Lemaitre, M. P., Bourgois, B., Getto, M., & Vallée, L. (2010). Neuropsychological profile on the WISC-IV of French children with dyslexia. *Journal of Learning Disabilities, 43*(6), 563–574.

De los Reyes Aragón, C., Lewis Harb, S., Mendoza Rebolledo, C., Neira Meza, D., León Jacobus, A., & Peña Ortiz, D. (2008). Estudio de prevalencia de dificultades de lectura en niños escolarizados de 7 años de Barranquilla (Colombia). *Psicología desde el Caribe, 22*, 37–49.

Defior, S., Fonseca, L., Gottheil, B., Aldrey, A., Rosa, G., Pujals, M., et al. (2006). *LEE. Test de Lectura y Escritura en Español*. Buenos Aires, Argentina: Paidós.

Defior, S. & Serrano, F. (2007). Dislexia en español: bases para su diagnóstico y tratamiento. In: E. Matute, S. Guajardo (Coords.). Dislexia: Definición e intervención en hispanohablantes. Guadalajara, México: Universidad de Guadalajara. pp. 73–88.

Etymology Dictionary. www.ethnologue.com. Accessed September 20, 2011.

Flores, L. (2009). Características de comorbilidad en los diferentes subtipos de trastorno por deficit de atención con hiperactividad. *Psicothema, 21*(1), 592–597.

Galindo, G., & Cortes, J. F. (2003). The ROCF and the complex figure for children in Spanish speaking populations. In J. A. Knight & E. Kaplan (Eds.), *The handbook of Rey-Osterrieth complex figure usage: Clinical and research applications*. Lutz, FL: Psychological Assessment Resources.

Genesee, F., Paradis, J., & Crago, M. B. (2004). *Dual language development and disorders: A handbook on bilingualism and second language learning*. Baltimore: Brookes.

González Reyes, A. L., Matute, E., Inozemtseva, O., Guajardo-Cárdenas, S., & Rosselli, M. (2011). Influencia de la edad en medidas usuales relacionadas con tareas de lectura en escolares hispanohablantes. *Revista de Neuropsicología, Neuropsiquiatría y Neurociencia, 11*(1), 51–65.

Goswami, U. (2002). Phonology, reading development, and dyslexia: A cross-linguistic perspective. *Annals of Dyslexia, 52*, 141–163.

Goswami, U., Wang, S., Cruz, A., Fosker, T., Mead, N., & Huss, M. (2010). Language-universal sensory deficits in developmental dyslexia: English, Spanish, and Chinese. *Journal of Cognitive Neuroscience, 23*, 325–337.

Guerrero Leiva, M. K. (2011) Adaptación del cuestionario de madurez neuropsicológica infantil-CUMANIN en una población urbana de Lima. *Revista Psicológica Herdiana*, 66–75. Retrieved July 12, 2012 from http://www.upch.edu.pe/fapsi/rph/NUMERO/Guerrero.pdf.

Gutiérrez-Clellen, V. F., Simon-Cereijido, G., & Leone, A. E. (2009). Code-switching in bilingual children with specific language impairment. *International Journal of Bilingualism, 13*, 91–109.

Gutiérrez-Franco, M. A., Madriaga-Campos, M. L., Vásquez-Velásquez, A. I., Matute, E., Guevara-Yañez, R., & Rivera, H. (2010). A girl with the 15q overgrowth syndrome and dup (15) (q24q26.3) including telomeric sequences. *The Korean Journal of Laboratory Medicine, 30*, 501–507.

Inozemtseva, O., Matute, E., González Reyes, A. L., Guajardo Cárdenas, S., Rosselli, M., & Ruíz Sánchez, E. A. (2010). Influencia de la edad en la ejecución de tareas relacionadas con el lenguaje en escolares. *Revista de Neuropsicología, Neuropsiquiatría y Neurociencia, 10*(1), 9–21.

Inozemtseva, O., Matute, E., & Juárez, J. (2008). Learning disabilities spectrum and sexual dimorphic abilities in congenital adrenal hyperplasic girls. *Child Neurology, 23*(8), 862–869.

Jackson-Maldonado, D. (2011). La identificación del trastorno específico de lenguaje en niño hispano-hablantes por medio de pruebas formales e informales. *Neuropsicología, Neuropsiquiatría y Neurociencias, 11*(1), 33–50.

Jimenez Gonzalez, J. E., & Hernandez Valle, I. (2000). Word identification and reading disorders in the Spanish language. *Journal of Learning Disabilities, 33*, 44–60.

Jiménez, J. E., Rodríguez, C., & Ramírez, G. (2009). Spanish developmental dyslexia: Prevalence, cognitive profile, and home literacy experiences. *Journal of Experimental Child Psychology, 103*, 167–185.

Karanth, P. (1992). Developmental dyslexia in bilingual-biliterates. *Reading and Writing, 4*, 297–306.

Lindgren, S. D., De Renzi, E., & Richman, L. C. (1985). Cross-national comparisons of developmental dyslexia in Italy and the United States. *Child Development, 56*, 1404–1417.

Matute, E., Chamorro, Y., Inozemtseva, O., Barrios, O., Rosselli, M., & Ardila, A. (2008). Efecto de la edad en una tarea de planificación y organización (‘pirámide de México’) en escolares. *Revista de Neurologia, 47*(2), 61–70.

Matute, E., & Leal, F. (2003). Los llamados “errores ortográficos” en niños hispanohablantes con problemas del aprendizaje de la lectoescritura. In *Introducción al estudio del español desde una perspectiva multidisciplinaria* (pp. 549–570). Guadalajara, México: Universidad de Guadalajara.

Matute, E., Montiel, T., Hernández-Ramírez, C., & Gutiérrez-Bugarín, M. (2006). *ECOFÓN Evaluación de la conciencia fonológica (Phonological awareness assessment)*. Guadalajara, México: Universidad de Guadalajara.

Matute, E., Montiel, T., Pinto, N., Rosselli, M., Ardila, A., & Zarabozo, D. (2012). Comparing cognitive performance in illiterate and literate children. *International Review of Education,* 1–19.

Matute, E., Rosselli, M., & Ardila, A. (2010). Trastorno de la lectura. In M. Rosselli, E. Matute, & A. Ardila (Eds.), *Neuropsicología del desarrollo infantil* (pp. 161–180). Mexico City, Mexico: Manual Moderno.

Matute, E., Rosselli, M., Ardila, A., & Morales, G. (2004). Verbal and nonverbal fluency in Spanish-speaking children. *Developmental Neuropsychology, 26*(2), 647–660.

Matute, E., Rosselli, M., Ardila, A., & Ostrosky, F. (2007). *ENI: Evaluación Neuropsicológica Infantil*. Mexico City, Mexico: Manual Moderno.

Medrano, A. P., Matute, E., Zarabozo. D. (2007). Características neuropsicológicas de niños hispanohablantes con trastorno de la lectura. In: E. Matute, S. Guajardo (Coords.). Dislexia: Definición e intervención en hispanohablantes. Guadalajara, México: Universidad de Guadalajara. pp. 73–88.

Molfese, V., & Molfese, D. (2002). Environmental and social influences on reading skills as indexed by brain and behavioral responses. *Annals of Dyslexia, 52*, 121–140.

Montiel, T., & Matute, E. (2007). Relación entre conciencia fonológica y aprendizaje de la lectura en escolares. *Revista Neuropsicología, Neuropsiquiatría y Neurociencias, 7*, 19–20.

Ostrosky-Solis, F., Gomez-Perez, M. E., Matute, E., Rosselli, M., Ardila, A., & Pineda, D. (2003). *Neuropsi Atención y Memoria (NEUROPSI attention and memory)*. Mexico City, Mexico: American Book Store S.A. de C.V.

Ostrosky-Solis, F., Gomez-Perez, E. M., Matute, E., Rosselli, M., Ardila, A., & Pineda, D. (2007). Neuropsi attention and memory: A neuropsychological test battery in Spanish with norms by age and educational level. *Applied Neuropsychology, 14*(3), 156–170.

Paradis, J. (2003). Bilingual children with specific language impairment: Theoretical and applied issues. *Applied PsychoLinguistics, 28*, 551–564.

Paradis, J. (2010). The interface between bilingual development and specific language impairment. *Applied PsychoLinguistics, 31*, 227–252.

Paulesu, E., Démonet, J. F., Fazio, F., McCrory, E., Chanoine, V., Brunswick, N., et al. (2001). Dyslexia: Cultural diversity and biological unity. *Science, 291*, 2165–2167.

Pinto-Dussán, M. C., Aguilar-Mejía, O. M., & Gómez-Rojas, J. D. (2010). Estrés psicológico como possible factor de riesgo prenatal para el desarrollo de dificultades cognoscitivas: Caracterización neuropsicológica de una muestra Colombiana. *Universitas Psychologica, 9*(3), 749–759.

Portellano Pérez, J. A., Mateos Mateos, R., Martínez Arias, R., Tapia Pavón, A., & Granados García-Tenorio, M. J. (2000). *Cuestionario de Madurez Neuropsicológica Infantil – CUMANIN*. Madrid, Spain: TEA Ediciones, S.A.

Ramírez-Flores, M., & Ostrosky-Solís, F. (2009). Atención y memoria en pacientes con parálisis cerebral infantil. *Revista Neuropsicología, Neuropsiquiatría y Neurociencias, 9*(1), 55–64.

Ramos-Loyo, J., Michel Taracena, A., Sánchez-Loyo, L. M., Matute, E., & González-Garrido, A. A. (2011). Relación entre el funcionamiento ejecutivo en pruebas neuropsicológicas y en el contexto social en niños con TDAH. *Revista de Neuropsicología, Neuropsiquiatría y Neurociencia, 11*(1), 1–16.

Rey, A. (1997). *Test de copia de una figura compleja. Adaptación Española*. Madrid, Spain: TEA.

Rivera, H., Domínguez, M. A., & Matute, E. (2006). Follow-up of an intelligent odd-mannered teenager with del(3)(p26). *Genetic Counseling, 17*(4), 401–405.

Roberts, G., & Bryant, D. (2011). Early mathematics achievement trajectories: English-language learner and native English-speaker estimates, using the early childhood longitudinal survey. *Developmental Psychology, 47*(4), 916–930.

Rosselli, M., & Ardila, A. (2003). The impact of culture and education on non-verbal neuropsychological measurements: A critical review. *Brain and Cognition, 52*, 326–333.

Rosselli, M., Ardila, A., Matute, E., & Inozemtseva, O. (2009). Gender differences and cognitive correlates of mathematical skills in school-aged children. *Child Neuropsychology, 15*, 216–231.

Rosselli, M., Ardila, A., Navarrete, G., & Matute, E. (2010). Performance of Spanish/English bilingual children on a Spanish-Language neuropsychological battery: Preliminary normative data. *Archives of Clinical Neuropsychology, 25*, 218–235.

Rosselli, M., & Matute, E. (2005). Neuropsychologie de la dyscalculie développementale: Derniers résultats de recherche en Amérique du Nord. In A. Van Hout & C. Meljac (Eds.), *Troubles du calcul et dyscalculies chez l'enfant* (pp. 175–185). Paris: Masson.

Rosselli, M., Matute, E., & Ardila, A. (2006). Predictores neuropsicológicos de la lectura en español. *Revista de Neurologia, 42*(4), 202–210.

Rosselli, M., Matute, E., Pinto, N., & Ardila, A. (2006). Memory abilities in children with subtypes of dyscalculia. *Developmental Neuropsychology, 30*(3), 801–818.

Samuelsson, S., & Lundberg, I. (2003). The impact of environmental factors on components of reading and dyslexia. *Annals of Dyslexia, 53*, 2001–2217.

San Miguel Montes, L. E., Allen, D. N., Puente, A. E., & Neblina, C. (2010). Validity of the WISC–IV Spanish for a clinically referred sample of Hispanic children. *Psychological Assessment, 22*, 465–469.

Schrauf, R. W., & Navarro, E. (2005). Using existing tests and scales in the field. *Field Methods, 17*, 373–393.

Serrano, F., & Deflor, D. (2008). Dyslexia speed problems in a transparent orthography. *Annals of Dyslexia, 58*, 81–95.

Spencer, K. (2000). Is English a dyslexic language? *Dyslexia, 6*(2), 152–162.

Tomblin, J. B., Records, N. L., Buckwalter, P., Zhang, X., Smith, E., & O'Brien, M. (1997). Prevalence of specific language impairment in kindergarten children. *Journal of Speech and Hearing Research, 40*(6), 1245–1260.

United States Census Bureau. (2004). *United States population*. Washington, DC: US Census Bureau.

United States Census Bureau. (2010). *United States population*. Washington, DC: US Census Bureau.

Urzua, A., Ramos, M., Alday, C., & Alquinta, A. (2010). Madurez neuropsicológica en preescolares: Propiedades psicométricas del test CUMANIN. *Terapia psicológica, 28*(1), 13–25.

U.S. Census Bureau, State. (2011). State and County QuickFacts. Retrieved, September 20, 2011, from http://quickfacts.census.gov/qfd/states/12000.html.

Wechsler, D. (1984). *WISC-RM Escala de inteligencia revisada para nivel escolar*. Mexico City, Mexico: Manual Moderno. (Adaptado y estandarizado para México por Gómez Palacio MM, Padilla ER, Roll S).

Wechsler, D. (2004). *WISC-IV, Escala de Inteligencia Wechsler para niños*. San Antonio, TX: Harcourt Assessment Inc.

Wechsler, D. (2005). *WISC-IV, Escala de Inteligencia Wechsler para niños Spanish version*. San Antonio, TX: Harcourt Assessment Inc.

Wechsler, D. (2007). *WISC-IV Escala Wechsler de inteligencia para niños-IV: Manual de aplicación* (G. Padilla Sierra, Trans.). Mexico City, Mexico: Editorial El Manual Moderno.

Wechsler, D. (2010). *Wechsler Intelligence Scale for Children 4ª ed. (WISC-IV). Manual Técnico de Interpretación* (M. E. Brenlla, A. Taborda, & C. Barbenza, Trans.). Buenos Aires, Argentina: Paidos. (Edic. Orig.: Harcourt Assessment)

Wikipedia. (2011). *Poverty in Mexico*. Retrieved September 21, 2011, from http://en.wikipedia.org/wiki/Poverty_in_Mexico

Woodcock, R. W. (1982). *Bateria Woodcock Psicoeducativa en Español*. Chicago: Riverside Publishing.

Woodcock, R. W., & Munoz, A. F. (1998). *Batería Woodcock-Muñoz-Revisada (Batería-R)*. Chicago: Riverside Publishing.

Woodcock, R. W., & Munoz-Sandoval, A. F. (2001). The Bateria-R in neuropsychological assessment. In M. O. Ponton & J. L. Carrion (Eds.), *Neuropsychology and the Hispanic patient*. Mahwah, NJ: LEA.

Ziegle, J. C., & Goswami, U. (2005). Reading acquisition, developmental dyslexia and skilled reading across languages: A psycholinguistic grain size theory. *Psychological Bulletin, 131*, 3–29.

Zimmerman, I. L., Steiner, V. G., & Pond, R. E. (2002). *Preschool language scale, Fourth edition Spanish*. San Antonio, TX: The Psychological Corporation.