

Chapter 2

Dual-Language Learner Development

Introduction

Although much has been theorized in the field of education about how children learn a first and a second language, during the past 25 years there has been an explosion of knowledge about what actually occurs in the brain during language acquisition. This has been made possible through advances in medical technology which allow neuroscientists to track the activity of neurons as the brain processes speech, reading, writing, and math. As noted neuroscientist Stanislas Dehaene (2009) says, “Today, the brain’s black box is cracked open and a true science of reading is coming into being” (p. 1). The black box is also cracked open for a science of math, writing, and language acquisition. It is important to note, though, that new discoveries about the brain and other aspects of the nervous system are being made daily. In the future, there will doubtless be breakthroughs in the hypothetical paradigms that exist today, forcing the formation of new paradigms to better explain what is happening as the individual speaks and reads. Before we investigate how the brain learns a second language, we explore the topic of how it learns a first language.

How Do Neuroscientists Study What Is Happening in the Brain as Students Learn Oral and Written Language?

There are various methods that are used to study the workings of the brain.

- *Electroencephalography (EEG)* involves recording electrical activity along the scalp. EEG measures voltage fluctuations resulting from ionic current flows within the neurons of the brain.
- *Magnetoencephalography (MEG)* is a neuroimaging technique for mapping brain activity by recording magnetic fields created by electrical currents taking place naturally in the brain, using very sensitive magnetometers.

- *Positron emission tomography (PET scans)* uses nuclear medicine imaging to generate three-dimensional, color images of the functional processing within the brain.
- *Functional magnetic resonance imaging (fMRI)* measures and localizes brain activity by detecting related changes in blood flow.
- *Magnetic source imaging (MSI)* gives information about both the location and the time course of activation of neurons in the brain.

Through these means, neuroscientists can track and localize neuronal activity as the brain initially sees letters, words, phrases, and sentences, processes their auditory and visual aspects, determines their meaning, and formulates a response.

What Is Brain Plasticity?

Brain plasticity, or neuroplasticity, is the brain's ability to reorganize its neural pathways in response to our experiences and what we learn from them. The brain is constantly changing in response to new information and skills that are being learned. It reorganizes and adapts in response to the experiences of the individual. It was once thought that individuals with learning disabilities would have them for life and the most that could be done was to learn to compensate for them. The following rather gloomy statement made by a noted expert in 2001 about the trajectory of learning disabilities illustrates this early philosophy:

Learning disabilities are neurologically based and must be seen as a lifetime disability. The child with a learning disability will become an adolescent with a learning disability, who will become an adult with a learning disability. Learning disabilities are also life disabilities. The same areas of neurological dysfunction that interfere with learning interfere with life skills, sports, activities, family and peer relationships. At this time, treatment involves remediation and teaching compensatory strategies along with appropriate accommodations (Silver, 2001, p. 4)

In the past, students who struggled to read text might be given “talking books” so they could access the text without reading it themselves. Although this kind of technology can be useful in some cases, neuroscientists have learned that with an explicit, systematic reading program of sufficient intensity and duration, it is possible for the dyslexic brain to actually be trained to reorganize neuronal networks so that it “normalizes” and gains access to the areas that the typical reading brain uses (Shaywitz, 2003; Simos et al., 2007). Like muscles in the body that need to be exercised and trained to accomplish new skills, the brain must also be given opportunities to practice skills, such as reading, in order to form and strengthen those new neuronal connections. Taking away the opportunity to practice reading, then, may be a disservice to a student because it takes away the possibility of forming those neuronal connections.

What Are the Different Aspects of Oral and Written Language That the Brain Must Process?

The brain must break down different elements of oral and written language in order to process them in the appropriate regions. Here are aspects of language that are important to understanding the challenges in learning to speak and write in a second language:

- Phonemes are the smallest unit of speech that can be used to make one word different from another. The phonemes in “cat” are /k/ /a/ /t/. The phonemes in “cap” are /k/ /a/ /p/. Those little sounds—/t/ and /p/—are all our brains need to hear to bring up the image of a kitty cat versus a cap that we wear on our heads.
- Morphemes are the smallest units of meaning, or the smallest contrasting units of language which bring about a change of meaning. A morpheme may appear as a prefix, a base, a suffix, or it may be inflectional. For example, “tele” is from the Greek and means “far” or “far off.” It is a common prefix (telescope, television, telegraphy). A common base is “port,” from the Latin meaning “door, gate, or passage” (transportation, portage, portable). A common suffix is “ism,” meaning practice or belief (racism, Marxism). Common inflectional morphemes are “s” and “ed.” The addition of the /s/ as a sound in speech or as a letter in writing is all it takes to let you know if we are talking about one feline or more than one feline.
- Graphemes are the visual symbols (letters or combinations of letters, such as digraphs) that are used in writing. They are the letters or letter combinations that represent phonemes. For example, the grapheme for the /k/ sound in English can be c (as in cat), k (as in kitty), ch (as in choir), ck (as in check), or even que (as in plaque).
- Syntax refers to the rules that govern the way that words are put together in phrases, clauses, or sentences so that they convey a shared meaning. In English we commonly form a sentence using subject, then verb, and then object. An example is “The cat chases the mouse.” But we can also say, “The mouse is chased by the cat.” Both of these sentences follow syntactical rules that must be learned in order to make sense of sentences in English.
- Semantics refers to the meaning or interpretation of words within phrases, clauses, or sentences. There is a very different meaning between “Will the cat chase the mouse?” and “I saw Will, the cat, chase the mouse.”
- Pragmatics refers to the appropriate use of language in different settings and contexts. For example, a father might say to his child, “Eat your vegetables” when both are at home at the dinner table. But it would not be appropriate for the same man to say “Eat your vegetables” to an adult who is sitting beside him at a dinner party.

When the brain gets the auditory input from a person’s speech, it must pull apart or analyze the sentence as to phonemes, morphemes, syntax, semantics, and pragmatics.

Once it has processed these elements, it must synthesize them so that it has a coherent understanding of what was said and so that it can make a response, if needed. When the brain gets the visual input of a word, phrase, or sentence in writing, it must similarly analyze it and then synthesize what has been pulled apart in order to understand what has been read. The brain does this processing at lightning speed resulting in, for most people, fluid understanding and expression of oral and written language.

Oral Language: How Does the Brain Learn to Speak and Understand a First Language?

The brain appears to be hard-wired for oral language. Humans do not typically need to attend classes to learn to speak and understand oral speech, as they do to read and write. They just need to be exposed to a language for a sufficient amount of time. As Shaywitz (2003) puts it, “Through neural circuitry deep within our brains, a genetically determined phonological module automatically assembles the phonemes into words for the speaker and disassembles the spoken word back into its underlying phonemes for the listener” (p. 45). This process is natural and instinctive, and it happens over the first years of a child’s life.

Before babies are born, they are already becoming attuned to the rhythm of their native language (Mehler et al., 2002). They perceive differing phonemes a few days after birth (Eimas, Siqueland, Jusczyk, & Vigorito, 1971) and the infant’s speech areas in the brain, mainly in the left hemisphere, become attuned to the native language (Kuhl, 2004). The planum temporale is an area in the brain that is critical for speech decoding. During childhood, this region learns to process relevant speech sounds in the child’s native language while ignoring speech sounds that do not occur in that language. When babies are born, they have the capacity to make any sound—about 150 phonemes—that are present in all of the world’s languages (Sousa, 2011). The sounds in the child’s native language will be reinforced by parents and others, but the child will not be exposed to all the sounds that are necessary for speaking other languages. By the end of the first year, a sort of “linguistic deafness” in the planum temporale and nearby regions of the brain results because certain sounds that the infant makes spontaneously have not been reinforced by attention from caregivers (Dehaene, 2009). For example, native speakers of Japanese cannot typically distinguish between /r/ and /l/, since these sounds are not used to discriminate words in Japanese.

As toddlers approach their third birthday, they are learning 10–20 new words a day and, by 5 or 6 years of age, children have a vocabulary of several thousand words (Dehaene, 2009). Before the age of 5, there are already vast differences between the vocabularies of children in different socioeconomic groups. A study conducted in Kansas City by Hart and Risley (2003) found that the average number of words in the expressive vocabulary of 3-year-olds in the lowest socioeconomic

group (welfare) was 525; the “middle-lower” group of toddlers had an average of 749 words, and children in the “upper” group had 1116 words in their vocabulary. Even children who have been living in the USA and speaking English since birth come to school with enormous differences in vocabulary.

How Does the Bilingual Brain Differ from the Monolingual Brain?

Children who are brought up in a bilingual home from birth (simultaneous bilinguals) have an advantage, obviously, in learning to understand both languages and speak both without an accent. Neuronal circuits go through distinct periods of heightened plasticity in many regions of the developing brain of children and adolescents (Levelt & Hübener, 2012), making it advantageous to learn additional languages while young. Further, researchers have shown that children and younger teens who grow up speaking two languages show activity in the same language areas of the brain, whereas areas are spatially separate when a second language is learned during late adolescence and adulthood (Bloch et al., 2009). However, plasticity is present in the adult brain, even at the phonemic level. For example, researchers have shown that adults whose first language is Japanese are able to learn to distinguish the English *l* and *r* sounds with computer-enhanced learning (Ingvalson, Holt, & McClelland, 2012).

When the brain is charged with learning anything new, it must develop new neuronal circuits. When learning a new language, in addition to learning a set of phonemes that may differ from the first language, the brain must learn morphemes, vocabulary, syntax, and semantics that may differ—sometimes markedly—from the native language. There is evidence that words that relate to each other are physically closer among neurons making up a semantic network than are unrelated words (Lavigne & Darmon, 2008). Words *within* these networks can activate each other very quickly but it takes longer for words *between* networks to activate each other (Chouinard & Goodale, 2010). This implies that, until words in the second language are associated with those in the first, it takes the brain longer to activate meaning and associate the equivalent vocabulary in both languages. Kovelman, Baker, and Petitto (2008) conducted an fMRI study which compared 10 monolinguals, who spoke only English from birth, and 11 simultaneous bilinguals, who spoke both English and Spanish from birth. They found that both groups processed the individual languages in similar areas of the brain when speaking only one language, mainly in left-hemisphere language regions. But when the bilingual participants were in a bilingual mode requiring rapid switching between the two languages, they showed increased activity in both left and right hemispheres.

By necessity, the bilingual brain takes increased advantage of the neural environment for language and cognitive processing that is provided in the brain (Sousa, 2011). The bilingual brain differs from the monolingual brain not only in the way it functions

but also in its anatomical structure. In addition to the increased activity in the right hemisphere while individuals are in the bilingual mode, the *corpus callosum*—a cable of nerves that connects the two hemispheres—is larger and more densely populated in the bilingual brain as compared to the brain of a monolingual (Coggins, Kennedy, & Armstrong, 2004). The corpus callosum is the passageway that allows communication between the right and left hemispheres. The two hemispheres of bilinguals have increased opportunities and capacities to communicate with each other. In many ways the bilingual brain is actually a better brain because of this increased engagement and flexibility.

How Does Learning English as a Second Language Interact with the Student's First Language?

To understand the impact learning English has on the student's first language, we must understand the concepts of *positive* and *negative transfer*. When the individual is in the process of learning new knowledge or skills, the brain searches neuronal connections that comprise what we call *long-term memory* for similarities between what is being learned and what has already been learned (Lardiere, 2009). If the brain finds similarities, positive transfer can occur—the new learning can be mapped onto the existing connections, making it easier to acquire the knowledge and remember it. Some languages share similarities in phonemes, morphemes, graphemes, syntax, and semantics with English, making them a better fit as the brain searches established neuronal connections. Spanish and French share many similarities with English, in terms of phonemes, morphemes, and graphemes. For example, the English word *drama* is virtually identical to the Spanish in sound, meaning, and spelling. The French *drame* is not identical but is very similar in sound, meaning, and spelling. So positive transfer can occur in the brain when a Spanish or French speaker is acquiring the word *drama* in English.

As an example of negative transfer, the same word can be used. One aspect of Spanish and French that does not occur in English is the gender of nouns. In English, we need to only know the meaning and usage of the word *a* when referring to any drama and *the* when referring to a specific drama. In French and Spanish, the speaker must learn the gender of each noun in order to use the articles that precede the nouns correctly in speech. In French, *drame* is masculine (*un drame* or *le drame*), whereas in Spanish, *drama* is feminine (*una drama* or *la drama*). So there is negative transfer between Spanish and French in terms of the articles that must precede this noun.

Besides considering the likelihood of positive and negative transfer between the first and second languages, we must also consider the learner's age at acquisition of the second language. It is ideal for both first and second languages to be as fully developed as possible. This does not always happen and the development of the first

language can atrophy when a second language becomes dominant at an early age. Younger immigrants are more likely to lose their first language than are older immigrants (Anderson, 2001).

Before children enter school, they learn their language from their parents and others who live in their homes. The vocabulary that young children learn in their homes is closely associated with the socioeconomic status (SES) of their parents (Hart & Risley, 2003; Sousa, 2011). The National Center for Children in Poverty (2016) reports that over 24 % of US children have at least one foreign-born parent and that immigrant families are disproportionately likely to suffer the effects of poverty and other difficulties that place the children at risk. It should not be assumed, though, that immigrant families are less likely to have rich vocabulary and literacy compared to native-born children. Indeed, Geva and Wiener (2015) point out that in some instances groups of immigrants may be better educated than groups of native-born families.

For English learners, the richness of their vocabulary in the first language is a factor in determining their ease in learning vocabulary in English (Sousa, 2011). There is evidence that the brain stores related words together, such that activating vocabulary items in the same category happens in the same area of the brain (Chouinard & Goodale, 2010). The brains of children who already have a vocabulary word or a concept stored in memory are primed for the storage of related vocabulary and concepts, even if they are in a different language. Children who are learning English are at an advantage when they come with a large vocabulary and the ability to understand complex communication in their native language. English learners can be either simultaneous or sequential bilinguals. Simultaneous bilinguals learn two languages from birth; sequential bilinguals learn a first language and later learn a second language. PET scans have shown that, for simultaneous bilinguals, language is activated in the same area of the brain but children who learn a second language later in life have language areas of activation in the brain that are spatially separated (Bloch et al., 2009; Hernandez & Li, 2007).

The home and community of English learners play roles in the degree to which they will acquire the second language. When children have opportunities to socialize with peers and others who speak English, they are able to acquire more practice in communicating in English. But if they are unlikely to interact with English speakers in their homes and communities, they miss out on English exposure and practice. Similarly, if English learners mainly interact with peers who speak their native tongue at school, they miss out on opportunities to gain vocabulary and fluency in English. In the USA, there are times when an immigrant child's neighborhood school does not offer an ESL program and the district wants to bus the child to a school that has an ESL program. However, parents of these children are sometimes resistant. They may want their children to attend their neighborhood school. Also, they may want their children to be educated wholly in English and may be fearful that sending their children to an ESL program may mean that there will be less direct exposure to English.

Is There a Difference Between Language Learned at Home, in the Community, and at School?

The use of particular vocabulary is dependent upon the setting. For example, the vocabulary we use at a restaurant or grocery store involves knowledge and concepts related to food. Much of the vocabulary and the specific meanings of words used at work are dependent upon the individual's type of job or profession. An architect may talk about an "acute angle" and a doctor may talk about an "acute pain." A high school student may learn the meaning of a "narrative" in English class but is unlikely to use that term in casual conversation. In terms of English learners, Cummins (1984) pointed out a distinction between Basic Interpersonal Communicative Skills (BICS) and Cognitive Academic Language Proficiency (CALP). BICS is a social language that children use on the playground, cafeteria, and halls. CALP is learned in the various classrooms and subjects in school and is typically what is assessed by school psychologists in the tests of achievement and mental ability that they administer (McCloskey & Athanasiou, 2000).

What Behaviors Will Educators See in English Learners as Their Skills Develop?

The behaviors that characterize English language development will vary depending upon an assortment of factors. For example, imagine that you are going to evaluate two English learners: Malek is a third grader from Saudi Arabia; his family moved to Canada a year ago. Ana is also a third grader and her family moved to the USA from the Dominican Republic 3 years ago. Malek's father speaks fluent English but, in the home, only Arabic is spoken and read. Ana's parents started learning English when they moved to the USA; they mainly speak Spanish in the home but encourage their children to speak and read in English as much as possible. They have many books in Spanish and in English in the home. Malek's father is a computer scientist who encourages Malek's interest in mathematics, how things are built, and how things work. Ana's parents both worked in education in their home country and both work as educators in the USA. According to Kohnert (2010), practitioners must consider several factors that differentiate Malek and Ana: (a) The two children may well have uneven proficiency or distributed skills within and across linguistic domains, depending upon the extent to which they have experiences in speaking, listening, reading, and writing in English and in their first languages. (b) School psychologists should recognize the variable presence and nature of cross-language associations; for example, Spanish and English share a multitude of cognates whereas the cognates shared by English and Arabic are more limited. (c) Since every learner is different, educators must realize that there will be individual differences in language performance between Ana and Malek even in response to relatively similar circumstances. Despite the complexities and individual differences

observed in the behaviors of English learners, there are some behaviors that educators will typically see in their language development.

Recent immigrants to a country may initially gravitate toward other students in their classrooms and schools who speak their first language. As they begin to learn English, there may be a “silent period” (Krashen, 1981), wherein the student is learning receptively but is producing little expressive language. During this silent period, students may be practicing “private speech”—repeating what others say and quietly rehearsing by themselves before making tentative forays into using English socially and expressively (Saville-Troike, 1988). Students may also try to communicate using nonverbal cues, such as pointing and gesturing.

English learners use very basic English vocabulary and grammar as they start attempting to communicate in English. In order to communicate, they begin to develop an *interlanguage*, which is composed of elements of the child’s first language and of English. At this point, children may rely heavily on certain forms of verbs, such as *ing* verbs like *reading* or *writing*: “I riding the bus.” They may use certain words to signify plurals, such as *many dog* or *many chair*, without realizing that they must also add the morpheme *s* to *dog* and *chair*. They may say “I not see you” before they use the correct grammar: “I don’t see you.”

When babies and toddlers learn their native language, they make similar mistakes as they acquire the language. For example, they may say “No want milk” or “Me no want milk.” Even though adults understand the child’s initial statement, they will typically respond with a sentence or phrase which implicitly corrects the toddler’s grammar: “You don’t want milk?” The adult does not say to the toddler, “The correct way to say that is “I don’t want milk.” There is research to suggest, however, that many English learners do not notice such implicit corrections and the teacher must explicitly make the distinction clear (Han & Kim, 2008; Lyster & Ranta, 1997).

For adolescents coming into an English-speaking middle or high school, the challenges are particularly daunting. Although these students may successfully learn social, nonacademic language fairly quickly, their academic language—the language specific to academic subjects that is learned in the classroom—may lag behind significantly (Gold & Maxwell-Jolly, 2006). Students who enter English-speaking schools with high-quality education from their home country and who receive high-quality instruction in their new language have a better basis for learning English and gaining academic skills than students who come with interrupted schooling and poor academic skills from their country of origin (Dutro & Kinsella, 2010).

According to Dutro and Kinsella (2010), educators should expect that adolescent newcomers will start out with minimal receptive and expression English language skills. Within the first year, students should be able to use basic English but will make many errors. They are likely to understand high-frequency words and everyday comments that are related to communicating their basic needs. It will be difficult for them to understand the vocabulary and concepts that their teachers intend to teach them. If these students are tested, it should be done in their native language, if at all possible. After the first year, typical English learners will begin to show increased understanding of oral and written English. They will respond with basic

vocabulary to visual prompts, use everyday expressions, and be able to speak and write simple sentences in present and past tenses. With structured support, they can produce writing that includes the main idea and basic descriptions. They will continue to make basic errors in speech.

In the next stage, students will show comprehension of familiar topics and they will begin to be able to have more sustained conversations on more varied topics. Their vocabularies become more detailed and wide ranging. They may continue to misuse the past tense of verbs (“We leaved the school”) and have difficulty with conditional verb forms (“I give you a call if I decide to come”). After this stage, language use progresses substantially but students may engage in circumlocution—avoiding language that they recognize but that has not yet been internalized. When a language is internalized, it is spoken automatically without deliberate thought as to the proper form of verbs that should be used in sentences.

School psychologists and other educators who assess and intervene with English learners with little to no English must realize that, without significant scaffolding, these students are missing out on much content in the regular education classroom, especially during the first couple of years of schooling in English. The first year in the English-speaking country is the best time to test immigrant children’s academic achievement using standardized tests in their native tongue, if such tests are available. After that, enough language loss in the child’s first language may occur so that the child no longer fits the norming sample of tests that were normed on monolingual children in the first language. Also, as will be detailed in Chapter 5, we should not assume that a child who has typical reading skills in one language will not encounter difficulties in a language with a more complex orthography. When testing recent immigrants in English, we should expect standardized achievement scores to be low, with the possible exception of math calculation (provided that the notations and symbols are similar in the first language to those in English). We can also expect that if we administer a test in English, verbal subtests on tests of mental ability will result in low scores for immigrants in their first year of schooling in English. However, it is not necessary or even legal to avoid assessing these children until they have gained a certain level of fluency in English. If these children have a language-based learning disability, it will impact their ability to learn English just as it impacts their ability to learn other academic skills. In the following chapters, we will explore better and more valid assessment practices to use with students who do not fit the norming samples of standardized tests.

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