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Understanding Diverse Bilingual Learners: The Need for a Transdisciplinary Lens

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Chapter 9
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ABSTRACT

The chapter synthesizes findings from diverse disciplinary perspectives to make the case that we need a new lens to better serve the diversity of bilingual learners. Drawing upon theories and findings from studies by educators, child developmentalists, and neuroscientists, but moving beyond any one disciplinary perspective, the authors aim to create a unity of new knowledge developed of theories from across disciplines. This approach is exactly what is needed to address the complexity of factors surrounding bilingual learners. Taking a transdisciplinary approach will allow us to move closer toward an understanding of the many factors affecting bilingual children and families, and this new knowledge can be applied to promote their educational and lifelong success.

INTRODUCTION

Many years ago, as an undergraduate student, I had the privilege of enrolling in an academic internship course. Though I was studying psychology, I chose to intern at a Head Start preschool, which eventuated in my becoming a co-teacher. I began my experience in the classroom because of my desire to teach young children, but quickly realized that I was the true learner in this experience. Of the 20 young children, five spoke mostly Spanish, and they quickly piqued my intellectual interests. One of the young boys, Eddie, was quite the classroom wanderer. He just never sat still! He seemed to enjoy every area of

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teaching space, even the dramatic play section, mostly inhabited by the girls, and would "disrupt" circle time if he happened to find it more interesting to take up a paint brush. With great curiosity, I watched him one day carefully wrap a doll in a baby blanket, balance his baby in one arm, while pretending to phone his invisible wife, presumably away at work. He was clearly mimicking his own father, an involved family man whom I often talked with during drop-off or pick-up times. This observation was only one of many that I had that caused me to reflect on this young boys' familismo (high value of family; loyalty, reciprocity, and solidarity with family; Gonzales, Germán, & Fabrett, 2012) and other positive cultural characteristics of Mexican American families that can easily go unnoticed in our school systems. Eddie, an emerging Spanish-English bilingual, held incredible assets of linguistic and cultural wealth, as do many young children in immigrant families.

Bilingual learners, also are referred to in research studies and by the U.S. Department of Education National Center for Education Statistics (NCES, 2018) as English Language Learners (ELLs) or children with Limited-English-Proficiency (LEP), have many unique strengths that they bring to the classroom. The present chapter focuses on these assets and the term bilingual learner is used throughout to a) emphasize that bilingual learners are doing much more than just learning English-- they are simultaneously developing a second language, subject area knowledge, and thinking skills; and b) highlight bilingual learners' accomplishments rather than deficits.

It is only when we broaden our views that we learn to see how the many sociocultural facets of a child's life are resources that shape the course of their development. In fact, to truly understand the ways in which we can work together to create positive pathways, it may be necessary to add new lenses, transcending any one vantage point, to understand the many layers that affect educational outcomes of diverse learners.

Taking a transdisciplinary approach is quite different from simply merging two or more interdisciplinary approaches, which can sometimes fail to identify important differences in value and epistemology. Transdisciplinary approaches move from a problem outward without interest in concretizing any one discipline's value system, theory, or research perspective, but rather creating a unity of new knowledge developed of theories from across disciplines. This approach is exactly what is needed to address the complexity of factors surrounding bilingual learners. By aggregating findings from studies by educators, child developmentalists, and neuroscientists, we move closer toward an understanding of the many predictors of bilingual children's development, which can be used to ensure their lifelong and educational success. The present chapter synthesizes findings from diverse disciplinary perspectives to make the case that we need a new lens to better serve the diversity of bilingual learners.

Contemporary theories from developmental science describe the interplay of biological, sociocultural, ecological, and historical factors on development (e.g., Baltes, Lindenberger, & Staudinger, 2006; Lerner, 2006). From developmental science, we learn that to fully understand any aspect of development, it is important to view the individual from a holistic perspective, investigating not only multiple predictors of developmental outcomes, but also the many ways that these predictors interact to produce the outcomes. It also is critical to consider the diversity of bilingual learners from those who are challenged by learning disabilities to those who are gifted and talented, and even those who may be a combination of both.

Educational theories have described the diversity of how emergent bilingual Latino students might display their characteristics of gifted and talented differently than mainstream, middle-class students. Nevertheless, most educators and educational researchers continue to use the framework for gifted and talented established by Renzulli (1999) that focuses on three dimensions in mainstream giftedness: above average ability, creativity, and task commitment. There is limited literature on how gifted and

talented traits manifest in emergent bilingual Latino students; however, Lara-Alecio and Irby (2000) have defined giftedness for emergent bilingual students. They used Renzulli's definition of giftedness but placed emphasis on the socio-cultural-linguistic context. Using this framework, it becomes clear that emergent bilingual gifted students are not only highly capable of performing academically and/or artistically at or above average and demonstrating commitment to those tasks, but they are also growing up in a socially, linguistically, and culturally diverse environment (Esquierdo & Arreguín, 2012). This framework acknowledges that emergent bilingual students' experiences with their home, community, and school environment support the students' performance in academic and/or artistic tasks and applies well in the present chapter.

Neuroscientific findings also apply toward understanding diverse bilingual learners and their educational settings. Most people probably take for granted that they are able to express thoughts and feelings via speech. This ability, to communicate via vocalizations, is present in humans and some non-human animals (e.g., songbirds). Interestingly, human speech and communication behaviors in other species share common mechanisms: (a) an innate ability or predisposition that biases the individual to perceive complex vocalizations, (b) a sensitive or critical period for vocal learning that is present during early developmental stages, and (c) the influence of environmental factors, such as exposure to language and social interactions, that are vital for vocal learning (Doupe & Kuhl, 1999). The remarkable progression from basic, rudimentary vocalizations to the ability to communicate effectively via speech is dependent on physical changes in the brain that involve structural and/or functional changes at the level of individual neurons and their myriad connections with other neurons. This process, that underlies vocal learning, is called neuroplasticity, and there is growing evidence that learning a second language is associated with anatomical changes in the brain (Li, Legault, & Litcofsky, 2014). The phenomenon of neuroplasticity in the context of bilingual speakers raises a number of considerations for educators and researchers. For example, given that learning a second language is associated with neuroplasticity, it is reasonable to propose that environments that expose young learners to multiple languages may facilitate learning and promote brain health.

Collectively these frameworks provide guidance to disentangle the multitude of factors that affect bilingual learners. By synthesizing findings from disciplinarily diverse perspectives, and transcending each to develop a new holistic view, we can better understand diverse bilingual learners.

BACKGROUND

Historic ideas of immigrant assimilation have focused on the processes of how immigrants adopt the cultural patterns of the host society, including the language and dressing style, implying a loss of home traditions (Gordon, 1964). Yet there are alternative perspectives that describe how assimilation also can occur through processes that allow for the keeping of one's native traditions while incorporating elements of new cultures. For example, Linton (2004) describes a movement away from the view that follows dominant language norms and patterns of linguistic assimilation toward one in which the outcome of assimilation into U.S. society is bilingualism, not English monolingualism. It is especially timely to consider these processes given the increasing prevalence of culturally and linguistically diverse learners in U.S. schools.

Prevalence

In 2017, the National Center for Education Statistics reported 13.6 million Latino students were enrolled in U.S. public schools from prekindergarten through grade 12 (NCES, 2017). Additionally, the U.S. Census Bureau projects that by the year 2060 the Latino population will comprise over 28% of the total population, with 119 million residing in the United States (U.S. Census, 2017). Children with Spanish as their first language (L1) are the largest and most rapidly growing population of bilingual learners in PK-12 education in the US. Bilingual learners comprised approximately 21 percent of all school children in 2008 (NCES, 2010). The National Center for Education Statistics reported that in 2014–15 there was a greater percentage of bilingual students in lower grades than in upper grades in U.S. public schools (16.7% of kindergarteners were emergent bilingual students, compared to 7.8% of 6th-graders, 6.5% of 8th-graders and 4.1% 12th-graders; NCES, 2017). However, these numbers from the NCES exclude bilingual students that are not served in a bilingual/English as a Second Language program and also exclude bilingual students that have achieved English proficiency in school, but still remain bilingual. Thus, there may be even more bilingual learners than we have estimated. As these numbers grow, it becomes increasingly critical that researchers identify the best methods of ensuring positive outcomes for bilingual learners.

BILINGUALS AND LEARNING DISABILITIES

Since learning disabilities should not be defined by cultural and environmental factors, it might seem counterintuitive that one cultural group would have such high rates, over and above others. Yet this is the case. Currently there is an overrepresentation of bilingual children in special education programs in the United States, despite the mandate in the Individual with Disabilities Education Act against discriminatory assessment for culturally and linguistically diverse children (Oswald, Coutinho, & Best, 2002). Latino bilingual children in particular are more likely to be identified as having learning disabilities compared to other types of learners. This is especially disconcerting, as they comprise such a large proportion of bilingual learners. This disproportionate representation in special education programs is a significant problem and it is rooted in the sociopolitical and inherited inequalities of the general education system, such as: inequalities in the referral, assessment, and placement process (Sullivan, 2011).

Though children can overcome many challenges, especially because their neural structures are still malleable, there is a need for early identification of disabilities in order to increase the likelihood of long-term success. For most bilingual learners with learning disabilities, though, being identified and provided with services does not occur smoothly or early. Most English-language-proficient children (i.e., children whose performance on English language tasks is not impaired as a consequence of being bilingual learners) with learning disabilities are not identified and provided special education services until second or third grade. One of the reasons is that there is not one single method of identification that differentiates between bilingual learners who have difficulty acquiring language skills and those who have learning disabilities, which results in school districts adopting various identification procedures, many of which are ineffective (Burr, Haas, & Ferriere, 2015). Delayed identification might also result when school districts require there be a significant discrepancy between expected levels of achievement based on IQ and observed levels of achievement, which can take several years to emerge (Wagner, Fran-

cis, & Morris, 2005). As a result, it becomes more difficult for bilingual learners to overcome learning disabilities since they do not start receiving special education services until their mid-elementary years.

BILINGUALS AND GIFTEDNESS

There also is an issue of underrepresentation of bilingual learners in gifted and talented programs, which is of particular concern. At the core of this issue are ambiguous identification assessment practices, especially for bilingual learners. Esquierdo and Arreguín-Anderson (2012) suggest that to rectify this situation, schools will need more than simple adjustments to current school policies and procedures. The restructuring of the gifted and talented program calls for a strong focus on educating and informing teachers, parents, and the community about the specific characteristics and identification process of gifted bilingual learners. Additionally, there needs to be an alignment between the distinctive characteristics of giftedness in bilingual learners and the assessment tools used for identification and services.

Researchers suggest that conservative gifted and talented definitions and educators' deficit thinking about Latino children are major challenges to the initial identification and program retention of bilingual learners in gifted programs (Esquierdo & Arreguin-Anderson, 2012; Ford & Grantham, 2003; Peterson, Rubie-Davies, & Sibley, 2016). Although definitions of giftedness vary by school district within the different states, most heavily depend on measurements of intelligence and academic achievement, excluding creativity, leadership, and the other arts. Additionally, deficit beliefs and low expectations for bilingual learners become an issue in the U.S. public school system where bilingual and other minority students make up more than 40% of the student population while teachers of a minority background comprise 17% of the national teaching force (Boser, 2011). As the population of Latino bilingual learners increases, there will be a greater need to address this academic concern through bilingual and English as a Second Language education teacher training and recruitment. Most importantly, all teachers that serve bilingual learners need to have a deep understanding of how bilingual learners process information and develop academic and linguistic skills.

INSTRUCTIONAL PROGRAMS

Despite bilingual learners' many academic, cultural, and linguistic strengths, educators have identified that it is bilingual learners who have the highest dropout rate (61.1% graduation rate), lowest achievement scores, and highest rates of poverty (NCES, 2015). Yet, a growing body of research in the field of bilingual education has identified how effective bilingual instructional programs can produce positive linguistic, academic, and social outcomes for bilingual learners (Rolstad, Mahoney, & Glass, 2005) and Latino students, in particular (Lindholm-Leary & Hernández, 2011). Thus, it is important to consider how type of bilingual instruction affects long-term outcomes.

Considering the school context when examining outcomes is particularly important because "bilingual children bring to the language learning process a wider set of skills than do monolingual learners" (Uccelli & Páez, 2007, p. 226). Thomas and Collier (2002) reported on an extensive five-year study focused on examining academic achievement in Grades K-12. They found that bilingual learners who did not receive English as a Second Language learner (ESL) services showed large longitudinal decreases in reading and math achievement in comparison to students who received services. Dual language bilingual

education programs were associated with the most positive academic outcomes. Subsequent research also has documented that Latino students in dual language programs achieve at or above monolingual English peers (e.g., Lindholm-Leary & Hernández, 2011).

Dual language programs, in fact, have many advantages. These programs, which are enriched educational programs that use two languages, often abbreviated as L1 and L2(e.g., Spanish and English) for instruction, capitalize on the child's native language to help build their second language. This practice makes sense theoretically considering that theories of development suggest using one's existing knowledge (e.g., L1) as a scaffold to develop further knowledge (e.g., L2). Research assessing the outcomes of the practices also corroborates the usefulness of the practice; children's reading proficiency in their native language is a strong predictor of later English reading performance (Garcia, 2000; Reese, Garnier, Gallimore, & Goldenberg, 2000; Slavin & Cheung, 2005). Yet, dual language programs not only help build a second language, they also prevent the loss of native language proficiency, which can afford bilinguals economic and social capital as well.

POVERTY AND THE DEVELOPING BRAIN

Equally important to considering the macro (environmental) factors of the child's development, are the importance of the developments within the child. For example, drawing on theoretical frameworks in neuroscience, the concepts of neural plasticity, epigenetics, and environmental factors can be considered as they apply to shaping the developing brain (Johnson, Riis, & Noble, 2016). There is a great deal of literature on the relationship between child poverty and brain structure and function, focusing on brain areas that have been identified as critical in higher-order cognitive functioning (i.e., hippocampus, amygdala, prefrontal cortex) and regions that support language and literacy (i.e., cortical areas of the left hemisphere) that can inform practices for bilingual learners. Unfortunately, the reality for many national and local educational institutions, and the families they serve, is a striking lack of resources to overcome the burdens of poverty; and it is not uncommon for rural and disadvantaged communities to acknowledge and accept the attendant hardships of poverty. This perspective, though understandable, has a devastating effect on bilingual children and it raises important questions: how many talented bilingual children are prevented from reaching their full potential due to the effects of poverty, and what can be done to help all children succeed in this type of negative environment? The concept of poverty and brain development is so complex that is can potentially overwhelm educators, researchers, and families. Viewing this problem (i.e., poverty) from a transdisciplinary lens, however, may offer hope for low-socioeconomic communities. That is, instead of considering poverty as a giant problem with a single solution, a transdisciplinary approach allows for breaking down the problem into manageable units that can be investigated using innovative, interdisciplinary research approaches. Indeed, researchers have identified key variables, linked to poverty – such as maternal deprivation, nutritional deprivation, stressors, early life adversity, and environmental toxins – that have a negative impact on brain development and neurocognitive outcomes (Johnson, Riis, & Noble, 2016). Developing specific strategies based on each child's unique environmental exposure profile may help educators better serve the needs of bilingual children who are affected by poverty. Moreover, it is important to consider how concepts from neuroscience can be applied in curricular development for bilingual learners.

Genetic Risk Factors

One way in which neuroscience can inform educators is to consider the genetic risk factors in learning disabilities. Researchers have argued that understanding of genetic risk is a necessary step toward an integrated understanding of children at risk for learning disabilities (Miller & McCardle, 2011). With the recent advances in molecular genetics, it is now possible to move beyond questions of relative heritability, and to directly link behavioral phenotype with specific genotypes. Researchers have identified genotypes related to reading disabilities. For example, Paracchini et al. (2008) have identified a haplotype on chromosome 6p22 defined by three single-nucleotide polymorphisms (SNPs) as associated with dyslexia (a reading disability). Specifically, their data implicated the three-SNP haplotype and its tagging SNP rs2143340 as genetic risk factors for poor reading performance. They tested whether the KIAA0319 gene influences reading skills in the general population using four SNPs that previously showed association with reading disability in the population of 7—9-year-old children in the Avon Longitudinal Study of Parents and Children, a large longitudinal cohort for which reading-related phenotypes were available for 6,000 individuals. Matsson et al. (2011) also recently identified four genes, DYX1C1, ROBO1, DCDC2 and KIAA0319 as candidates for developmental dyslexia. Of specific note, the KIAA0319 gene was implicated again in the development of dyslexia. Thus, it seems likely that the KIAA0319 may be linked to dyslexia. Docherty et al. (2010) also have recently conducted the first genome-wide association study (GWAS) of mathematical disability. Using a sample of 2356 individuals with a variety of mathematical abilities, they identified several candidate genes such as NRCAM. Thus, it would be useful for geneticists to work collaboratively with educators and other practitioners to explore how knowledge of genetic links to reading and math disabilities can be used ethically and practically in identification of bilingual children at risk for learning disabilities.

Neuroimaging

The results of many neuroimaging studies support the hypothesis that both native and second language production involve common mechanisms in language-associated systems in the bilingual brain (Green, 2003). However, although the same brain areas appear to be involved in multilingual processing, individual differences in ability and environment are associated with differences in brain activity. That is, language proficiency, age of second language acquisition, and degree of exposure to a new language are factors that influence the pattern of brain activation that presumably underlies differences in observable behavior and performance. It is notable that low second language proficiency in bilinguals may, in effect, exert increased demands on the cognitive neural systems that support language, compared to other groups with higher levels of proficiency (Perani & Abutalebi, 2005). In support of this, Wartenburger et al. (2003) reported that individuals who acquire a second language late in life show a more extensive pattern of neural activation, including in major cortical and subcortical language areas (e.g., Broca's area), relative to individuals who acquire a second language since birth. Moreover, there is evidence that age of acquisition may have a greater influence on the cerebral systems for grammatical processing compared to semantic processing, whereas language proficiency may have a greater impact on the brain systems for semantic processing (Wartenburger et al., 2003). A transdisciplinary approach – that incorporates neuroscience, developmental psychology, education, and other related areas – holds the key for developing interventions that are informed by evidence-based research on the factors and neural correlates that influence bilingual children.

Neural Substrates of Language (With a Focus on the Bilingual Brain)

The interaction between language and emotion is a powerful force in our daily lives. Individuals are motivated to connect with other people via language, and this need for human connection is particularly important for the development of language as previously noted. The subfield of social neuroscience has made significant progress in elucidating the complex relationship between the brain and emotions: a relationship that serves as a foundation for the formation of social bonds. Although many brain areas are involved in the perception and regulation of emotions, decades of behavioral neuroscience research indicate that there are key brain structures that play an essential role in emotion and motivation. These structures, that include subcortical structures like the amygdala, hippocampus, and hypothalamus, are highly interactive and function within a larger system called the limbic system (LeDoux, 2000). A transdisciplinary perspective allows for the use of these neuroscience concepts in addressing issues that are of great importance for bilingual learners. That is, some researchers are now investigating the link between the limbic system and development of language in children. In fact, there is now evidence that the amygdala, a subcortical structure that is important for emotions and fear responses, is associated with language abilities, and developmental changes in the size and structure of the amygdala appear to correlate with the development of language abilities as children progress from infancy to preschool age (Ortiz-Mantilla, Choe, Flax, Grant, & Benasich, 2010). Imagine using this information to help identify bilingual children in need of additional resources, support, and attention, or gifted children who may go unnoticed by educators. This topic is certainly more complex and requires a serious discussion among community members, educators, and researchers. A transdisciplinary approach – that incorporates neuroscience, developmental psychology, education, and other related areas – holds the key for developing interventions that are informed by evidence-based research on the factors and neural correlates that influence bilingual children.

FUTURE RESEARCH DIRECTIONS

The Need for a New Lens

Collectively research from cross-disciplinary perspectives suggest the need for a transdisciplinary approach to investigating the many predictors of bilingual children's success. It is only through multifaceted investigations of the many factors (e.g., biological, sociocultural, and contextual) that work together to affect learning, that we can achieve an integrated understanding of the processes underlying development among diverse groups of learners. Through these approaches we will not only advance science, but our knowledge can then be applied toward the development of effective educational programs.

Developmental science highlights the need to approach learners holistically. There are factors within the child (e.g., linguistic talents, cultural aptitudes, genetics) that can be explored as they relate to curriculum development, but macro-environmental elements also matter. Teachers and school personnel engaged with bilingual learners might consider how home factors (e.g., poverty, parental education) influence learning, how the community context can be leveraged to help connect lesson plans with real-world examples, and/or how cultural practices can affect educational outcomes. For example, given that many

Latino individuals place great importance on the family, it would be important to consider the potential benefits of inviting family members to be active participants in the child's school experience. How are the things that are most important to the child incorporated into their school lives? Can learners choose to invite grandparents to school events, complete writing assignments about a unique cultural practice, or are these types of experiences devalued (even implicitly when only parents are invited or only standardized writing projects are assigned)? If children are experiencing poverty, how are they being introduced to information that they might be missing? For example, if children do not have parents with high levels of education, what efforts does the school make to introduce them to role models in careers that require education and can set the stage for the pursuit of a broad range of professions?

Educational theories inform of the importance of considering the diversity of bilingual learners, identifying learners with difficulties early, but without making erroneous assumptions about the abilities of bilingual learners, which includes offering the full range of challenging opportunities to them. From research in education, we also have learned that following evidence-based practices produces greater academic success for bilingual students longitudinally. Teachers and school personnel engaged with bilingual learners might consider their practices and timing of identifying children with learning disabilities and gifted and talented learners. Does the school or district use diagnostic measures that have been normed for use with bilinguals? Are there practices within the identification process that make bilinguals more or less likely to be identified for services? For example, if only one linguistically–demanding assessment tool is used to determine a learning disability, this might incorrectly lead to a bilingual learner's incorrect placement into a classroom of children with special needs. Similarly, if processes for the identification of children for Gifted and Talented programs rely too heavily on knowledge outside of the minority language and/or culture, we may miss the inclusion of a gifted bilingual child.

Neuroscience also brings such educationally-pertinent concepts as the consideration of how genetic risk factors, neural imaging, and an understanding of the complex relationship between the brain and emotions can help identify bilingual children's needs and talents early. Teachers and school personnel engaged with bilingual learners might consider the use of genetic testing (with parental consent, of course!) in cases when they are uncertain about a learning disability diagnosis. While these tests are not 100% accurate, they can provide estimates of the likelihood of certain genetic propensities. If identified early, when the brain is relatively plastic, early interventions can have positive and lasting impacts. Neural imagining can be used similarly. Another important concept from neuroscience is the idea of neural plasticity. The brain changes in response to environmental demands and behaviors. Bilingual brains appear to have different neural activation patters in some areas. How can this knowledge be applied in the educational setting? One implication is that if we have a goal of creating bilingual learners, we should start early, when neural plasticity is greatest. Another implication is to consider that bilinguals might process information differently; perhaps the use of standardized approaches to teaching and assessment should be considered with caution, as results for bilingual learners may be different.

By taking a collective approach that incorporates multiple disciplines such as developmental psychology, education, and neuroscience, we can broaden views of diverse bilingual learners. Yet, there are many other disciplinary perspectives that could be invited! Future discussions should consider how knowledge from across disciplines such as rhetoric and composition, sociology, and communication can inform our perspectives. For now, we have developed several recommendations as basic guidance:

RECOMMENDATIONS

- Consider learners holistically; Use resources from families and communities to help learners make connections
- Apply a transdisciplinary approach to the development of educational and research programs that focus on the complex relationship among poverty, brain development, and negative outcomes for bilingual learners
- Challenge deficit-models of bilingual students; consider the cultural and linguistic capital of learners and help encourage the recognition and use of these assets
- Take evidenced-based approaches to teaching and assessment
- Bridge the gap between basic neuroscience research and clinical/educational applications
- Establish meaningful collaborations and resource sharing initiatives among educational institutions, government agencies, and medical/clinical organizations, to make state-of-the-art neuroscience technologies available to low-income communities

CONCLUSION

Collectively research and theories from across the fields of child development, education, and neuroscience provide useful information that applies aptly toward creating positive outcomes for a broad range of bilingual learners. Using transdisciplinary approaches, we can advance theories and expand knowledge that can then be applied toward improving our understanding of children like Eddie, the emerging Spanish-English bilingual with incredible assets of linguistic and cultural wealth, and other children like him. As we broaden our views about bilingual, Latino children, and others of immigrant families, we learn to see how the many sociocultural facets of a child's life can be developed and applied as important resources that promote positive development.

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KEY TERMS AND DEFINITIONS

Critical (Sensitive) Period: A time in the lifespan during which the nervous system is especially sensitive to environmental stimuli.

Dual Language Education Program: An enriching form of bilingual education in which students are taught literacy and content knowledge in two languages.

Dyslexia: A language-based learning disability that can affect an individual's speaking, reading, and/or writing abilities, including the ability to recall information.

Emergent Bilingual: Learners who are in the developing stages of acquiring their native language (L1) and/or a second language (L2), and who have the ability to tap into both languages as resources. This term is used as a way to reject the deficit-oriented terminology of limited English proficient (LEP), English language learner (ELL), English learners (EL) or English as a second language (ESL) students.

English as a Second Language learner (ESL): Learners who are not native English speakers.

English Language Learner (ELL): Learners with a limited proficiency in English.

Genotype: The genetic make-up of an individual.

Gifted and Talented Education/Program: A broad term for special practices, procedures, and theories used in the education of children who have been identified as gifted and/or talented.

Giftedness: The extent to which an individual has an ability that is significantly above the norm for their age; may manifest in one or more domains such as; intellectual, creative, artistic, leadership, or in a specific academic field such as language arts, mathematics or science.

Learning Disability (Specific Learning Disability): A broadly applied term that covers a range of neurologically based disorders in learning related to basic psychological processes: (1) input (auditory and visual perception), (2) integration (sequencing, abstraction, and organization), (3) memory (working, short term, and long term memory), (4) output (expressive language), and (5) motor (fine and gross motor).

Limbic System: Interactive brain areas that comprise a neural network that is involved in the regulation and expression of emotions and emotional behaviors.

Limited English Proficiency (LEP): Individuals who have a limited ability to read, speak, write, or understand English.

Molecular Genetics: The field of biology that studies the structure and function of genes at a molecular level. The study of chromosomes and gene expression of an organism provides insight into heredity, genetic variation, and mutations.

Neural Plasticity (Neuroplasticity): The brain's ability to change at any age. Some changes that occur include the shrinking or thickening of grey matter and the forging or weakening of neural connections.

Phenotype: The observable traits of an individual resulting from the interaction of its genotype with the environment.

Transdisciplinary Approach: A research effort conducted by investigators from different disciplines working jointly to create new conceptual, theoretical, methodological, and translational innovations that integrate and move beyond discipline-specific approaches to address common problems.