Designing Education for Twice-Exceptional Learners

by

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Abstract

Gifted and talented students with coexisting learning disabilities, also known as twice-exceptional, are increasingly recognized in U.S. schools. This increasing awareness needs to be met with improved legal protection, better methods for identification and optimized teaching strategies for the unique needs of these students. For this thesis, literature from a range of disciplines including education, cognitive science, and psychology regarding twice-exceptionality is examined, with a specific focus on gifted students with language-based learning disabilities like dyslexia, along with commonly comorbid factors such as ADHD and anxiety. The challenges of these students are also modeled using human centered design tools. Personas of archetypal twice-exceptional students are presented to create empathy for them and awareness of their unmet needs. Design frameworks are examined that aim to improve education universally for all students. Research strongly suggests that twice-exceptional students are under-identified and underserved in our schools and that comprehensive, individualized teaching strategies are necessary in order for them to reach their full potential. Teaching methods are outlined that simultaneously highlight strengths and accommodate the challenges of this important group of gifted learners.

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Chapter 1: Introduction

The term twice-exceptional (2E) describes the paradox of being an intellectually gifted student who also has a learning disability (Nielsen, et al., n.d.). This contradiction in terms, being exceptionally able and disabled, might seem to be a rare occurrence, however, the incidence of learning disabilities in the gifted population is at least as high as the incidence in the general population (10-15%) and some preliminary investigations suggest that the risk of learning disorders increases as a function of IQ (Silverman, 2002).

Recognition of this group has been hindered by the common perception that giftedness equates with academic success. A bright child who is slow to learn to read or fails to memorize math facts or has difficulty paying attention at school is not likely to be regarded as gifted. Poor performance in any area, particularly by a student who has been identified as intelligent, is often attributed to lack of effort, lack of discipline or inattentiveness. Such a student is likely to be labeled an “underachiever” and blamed instead of helped. A major cause of underachievement in the gifted is often undetected learning disabilities (Silverman, 2003).

This thesis will explore ways we might support and encourage 2E students. Different learning disabilities, as outlined by the Individuals with Disabilities Education Act (IDEA) will be examined with a particular focus on gifted and talented who are also dyslexic. Dyslexics think differently, are intuitive, excel at problem solving, seeing the big picture and simplifying (Shaywitz, 2003). These students are all around us, particularly in academic programs that require visual-spatial cognitive skills such as design, engineering and physics. MIT Media Lab co-founder Nicolas Negroponte, who is himself dyslexic, called dyslexia “The MIT disease” because of its prevalence among students and faculty (West, 2004). This thesis will explore ways we might support and encourage 2E students.
Chapter 2: Biography

I include a biography, as it relates to twice-exceptional learning, because the topic is deeply personal and has shaped who I am. I grew up in San Mateo, California in the 70’s and 80’s, a pleasant, quiet suburb prior to its Silicon Valley metamorphosis. I was fortunate to be raised in a family that values education. My family is full of teachers, lawyers and engineers. All four of my grandparents graduated from prestigious universities. My grandfathers and parents all hold graduate degrees. My mom is a former teacher, guidance counselor, PTA president and benevolent tiger mom. My dad was equally engaged in the lives of myself and my two younger brothers, coaching our soccer teams and giving sage advice on everything from schoolwork to teenage ennui. Eighty-years-old and long-retired, he still spends his time taking college courses for the sheer joy of it. Despite this incredibly supportive scaffolding, I often felt uncomfortable in school.

I was a typical nerdy product of the late 70’s. I loved all things Star Wars, building balsa wood airplanes, playing Dungeons & Dragons and exploring the neighborhood on my Schwinn Stingray. I was straight out of Stranger Things central casting. My career aspirations were to play wide receiver for the Oakland Raiders, work on the next Star Wars sequel and become an aerospace engineer.

I went to the local public elementary school. My academic record was checkered with frustratingly variable grades. My 1975 1st grade report card from our local public school shows that I made “accelerated progress” in math and oral communication while my written communication was rated “slower progress” in relation to my grade level. The teacher’s note says that I still “need to work at a faster pace” and that I was “easily distracted at times”. By 2nd grade my teacher reported that I had made “satisfactory progress” in all subjects but noted cryptically “Still some reversals: 2, 6” without elaborating. Apparently I went to 3rd grade but there is no evidence to that effect. I do remember getting in trouble a lot for walking around during class and lacking focus.

My parents sent me to parochial school from 4th to 8th grade. I wasn’t particularly happy about this but in hind sight it seems like it was a wise choice. California passed Proposition 13 around that time which capped property taxes and dramatically reduced public school funding with devastating results. My report cards from middle school didn’t survive but my vintage SRA Standard Achievement Test reports are interesting. I excelled at math and science, consistently scoring in the 99th percentile. My language arts scores were respectable but consistently more than one and a half standard deviations lower than the STEM scores. I struggled mightily at rote memorization tasks. Spelling and math fact tests generated great anxiety in me. Each school year I would fly under the radar with variable grades until achievement tests results came back at which point my teachers would scrutinize my perceived underachievement and lack of focus. School was generally boring
for me. My mind was constantly multithreading, thinking about something interesting to me while simultaneously trying to appear engaged in my class work. My school was quite good by 70's-era Catholic school standards but the curriculum was pretty basic. They did not offer algebra in 8th grade so my math teacher Ms. Bourdelais, a retired nun from South Boston, gave me an old algebra book and let me sit in the corner and self-teach during class.

This dynamic continued after I started at the local public high school. Starting in 8th grade I started taking the SAT test yearly as part of the local gifted and talented program. My standardized test scores remained consistent. My math scores were off the chart; my verbal scores were consistently lower but good enough not to raise any suspicions. Freshman year I skipped algebra and did reasonably well in geometry where I could easily visualize 2D and 3D spatial problems. Despite my interest in science, I struggled with freshman biology which largely consisted of memorizing the internal organs of lampreys and such. I was comically inept at learning German. Sophomore year there was uncertainty as to whether or not I should be in the AP English class since my relatively high reading comprehension skills were inconsistent with my basic writing mechanics. I took the SAT again and my math score as a 15-year-old sophomore would have put me in the 98th percentile of college-bound high school seniors. That same year I failed trigonometry. When I tentatively approached my trig teacher to talk about my struggles in his class, he told me I needed to pay attention and stop flirting with the girl I sat next to in class. While that was fair criticism (she was the prettiest girl in school), it didn’t capture my real problem which was an inability to memorize the formulas. I retook trig in summer school. Dejected by this experience and not wanting to jeopardize my all-important GPA, I never took another math (or science, or physics) class again. My prospects of becoming an aerospace engineer seemed about as likely as getting drafted by the Oakland Raiders. I had a difficult time understanding my cognitive abilities beyond being “right-brained”.

My academic life was easier as an undergraduate at UCLA. I studied Design and steered clear of any classes that required rote memorization or phonological skills (other than my foreign language requirement; passing French was a harrowing experience). After graduation I got an entry-level job as production assistant at Industrial Light and Magic. ILM was an exciting place to be at that time. They had just wrapped Jurassic Park, a seminal moment in computer graphics history and I got to be a player in the celluloid to digital paradigm shift. I took advantage of my afterhours access to Silicon Graphics workstations and the self-learning abilities I acquired by necessity in middle-school to teach myself coding, computer networking, animation and physics simulation. I became the first person to progress from production assistant to technical director, a job previously reserved for people with graduate degrees in computer science. I found fulfillment being in a place where there was no ceiling on achievement and points were not deducted for poor spelling. And I got to work on a Star Wars sequel.

I joke with friends that I'm dealing with my mid-life crisis by getting an engineering degree at MIT instead of buying a sports car. There is a grain of truth there. I am checking off some unrealized educational goals. My first graduate school class was Kerry Cahoy’s Satellite
Engineering 16.851. I sheepishly mentioned to Prof. Cahoy after she agreed to let me take the class that I hadn’t taken a math or science class since my sophomore year in high school. Fortunately, in my experience, students at MIT are judged by what they can do and not what they can’t do. I hope that someday that will be true in elementary schools and high schools as well. Kerry livestreamed the class from her laptop for students offsite at Lincoln Labs. The recordings of these livestreams provided an accidental, nearly effortless accommodation for me. I was able to review and dissect the lectures (which were often over my head during class) before the exams and fill in the holes in my knowledge base. This made me wonder why all schools don’t routinely record lessons as an accommodation to students with learning disabilities and was the partial inspiration for my thesis topic.

Taking that class let me realize one of my pre-trigonometry dreams, aerospace engineering. I studied under a brilliant woman who discovers exoplanets in her spare time, and worked with classmates who are astronaut candidates, fighter pilots and satellite engineers. The Oakland Raiders have not yet contacted me for a tryout so my third childhood aspiration is yet to be fulfilled.

I suspect that I have some mixture of comorbid learning differences. I have never been tested to find out. I have no regrets about my education. Because of my incredibly supportive parents, a few outstanding teachers, luck and perseverance, things have worked out well for me. I consider being “right-brained” a gift. But I also recognize the fact that, for far too many kids, calling their learning differences a gift is pandering at best and cruel at worst.

Learning differences are often genetic. I have two amazing kids who have learning profiles that are, in some ways, similar to mine. Seeing their struggles in school has been eye-opening. As my wife Valerie and I learn more in our attempts to advocate for them, the mysteries of this “right-brained” profile are slowly being revealed. As poet Philip Schultz said when his son was diagnosed with dyslexia, “It feels as if I’m meeting myself for the first time.”
Chapter 3: The Twice-Exceptional Paradox

...failure to help the gifted child reach his potential is a societal tragedy, the extent of which is difficult to measure but which is surely great. How can we measure the sonata unwritten, the curative drug undiscovered, the absence of political insight? They are the difference between what we are and what we could be as a society.

–James J. Gallagher

3.1 Defining the Scope of 2E

James J. Gallagher was a driving force in the fight for inclusive education for both gifted and disabled students. He was the chief architect of the Individualized Education Program, and co-creator of IDEA and the Marland Report, three foundational pillars of support for 2E students. The term twice-exceptional was coined by Gallagher in 2004, referring to children who are both gifted and have physical or cognitive disabilities (Coleman, et al., 2005). In this thesis the term “disability” refers generally to qualifying learning disabilities under IDEA, including those in the categories of Specific Learning Disabilities (SLD) (e.g. dyslexia) and “Other Health Impairment” (e.g. Attention-Deficit/Hyperactivity Disorder or ADHD). It is important to note, however, that there are many other disabling factors that fall outside this definition, including physical disabilities, social and environmental factors. The model of twice-exceptionality is still evolving. Figure 3-1 illustrates the connection between disability and giftedness.

Both terms, gifted and disabled, are comprised of an array of diverse subcategories. Consequently, the mind of a twice-exceptional student is a complex matrix of different cognitive abilities. The opposite ways that people tend to view each of these characteristics reinforces the paradox. To wit: when we think about gifted students we tend to think about their exceptional abilities and what they can do that is considered superior relative to their peers (Ronksley-Pavia, 2015). In contrast when we think about students with disabilities we think about what they can’t do. Those with a disability are viewed from a standpoint of being identified as “a ‘burden’ to society, an assumption reinforced as normative by prevalent biomedical and economic paradigms” (Lero, 2012).

This contradiction often causes 2E kids to be under-identified and taught in a suboptimal manner. When intelligence and underlying learning disabilities are combined, one or both of them may mask the other. Giftedness facilitates compensation. When there is less efficiency in a particular part of the brain that normally controls a function, compensation enables another part of the brain to take over that function. The more brain power, the greater the
potential for compensation. This compensation can prevent accurate diagnosis and recognition of disabilities. Learning disabilities can depress IQ scores significantly, preventing twice-exceptional children from qualifying for gifted programs. Compensation is unstable and fails to operate when a person is fatigued, ill, or under stress. Early identification and intervention, assistive technology and compensation strategies are keys to success for twice-exceptional children. Detection and amelioration of disabilities can dramatically improve quality of life. Gifted children with learning disabilities can be highly successful with recognitions and intervention” (Silverman, 2003).

Figure 3.1 The Twice-Exceptional Model [inspired by Ronksley-Pavia, 2015]

3.2 The Prevalence of 2E Students

How many twice-exceptional students are there? No one really knows. Twice-exceptional individuals are found within every socioeconomic, cultural, racial and ethnic population and are present in most school classrooms. Regrettably, no federal agency or organization collects these student statistics resulting in a lack of available empirical prevalence data (Ralabate, 2006). The Marland Report to Congress estimates that 5-7% of school children are gifted and, “... capable of high performance and in need of services or activities not normally provided by the school” (Marland, 1971). In 2014 there were 6.5 million students in 98,271 public elementary and secondary schools that received services under IDEA (National Center for Educational Statistics, 2017). With the addition of private school students, it is reasonable to assume that there are at least 430,000 2E students in the United States and that each
school has multiple 2E students with unique educational needs. Note that these numbers are based on students receiving services. According to Sally Shaywitz, Co-Director of the Yale Center for Dyslexia & Creativity, there is scientific evidence that dyslexia alone affects as much as 20% of the population, a vast number of which are undiagnosed (Shaywitz, et al., 2016). Regarding the distribution of learning disabilities, the 2Excel Project found that a total of 14% of gifted students showed some form of twice exceptionality. Of those 3% of gifted students showed specific learning disabilities (e.g. dyslexia), 7% ADHD characteristics, 3% emotional behavioral disorders and 1% Autism Spectrum Disorders (Rogers, 2011). Further complicating things, these impairments are often co-occurring because language, reading and math make use of many of the same cognitive capabilities (Seidenberg, 2017).
Chapter 4: Learning Disabilities

4.1 Qualifying Learning Disabilities under IDEA

In the United States, services for disabled students are provided to those that qualify under federal law so, for practical purposes, U.S. educators tend to use those legal standards to define learning differences. IDEA qualifying disabilities include those in the categories of Specific Learning Disabilities (SLD), Autism and “Other Health Impairment.”

The largest percentage of disabled students (approximately 50%) are found in the SLD category (National Association for Gifted Children, 2013). SLDs affect a student’s ability to read, write, listen, speak, reason or do math. Dyslexia, dysgraphia, dyscalculia and auditory processing disorder are examples of SLDs. Dyslexics comprise approximately 80% of the SLD population (Shaywitz, et al., 2016).

Despite the fact that is the most prevalent, the most studied and a highly specific disorder in which the causative agent and evidence-based treatment are both known and validated (Shaywitz, et al., 2016) - “dyslexia is not a special education disability category in and of itself” under IDEA. (Colorado Dept. of Ed., 2012).

Autism is a developmental disability that mainly affects a student’s social and communication skills. The umbrella term “Other Health Impairment” category covers conditions that limit a child’s strength, energy or alertness such as ADHD. Students with learning differences that do not fall into one or more of the above categories can sometimes acquire services under Section 504 of the Rehabilitation Act of 1973. Under 504, colleges and universities are also required to make reasonable accommodations to make their programs accessible for qualified students with disabilities (Connor, 2012).

4.2 The Right to a Free and Appropriate Education

An inclusive educational system, one that is designed to teach the full spectrum of human neurodiversity, should be more than an aspiration. It is required by law, though imperfectly achieved. According to the U.S. Department of Education, all school-age children (grades K-12) in the United States who are individuals with disabilities as defined by IDEA are entitled to a “free appropriate public education” (FAPE) from schools that that receive federal financial assistance. (U.S. Dept. of Education, 2016) (Americans With Disabilities Act, 1990)

FAPE requires schools to provide special education to match the specific needs of the disabled student. Special education services must be provided for free and in the “Least Restrictive Environment” (LRE) meaning that, whenever possible, disabled students must be taught alongside their non-disabled peers. This means that specific accommodations must be made to help them participate in the general education curriculum. Examples of
accommodations include delivering curriculum in video or digital media form as opposed to printed instructions, outlining lesson plans, providing video recordings of lectures, using typefaces designed for ease of reading, providing multisensory instruction and creating optimal lighting or acoustic environments in the classroom. Note that these "accommodations" are also teaching best practices that benefit non-disabled students as well.

Figure 4.1 Americans with Disabilities Act, IDEA 2004 and Section 504

4.3 IEPs and 504 Plans

IDEA 2004 requires public schools to develop an Individualized Education Program (IEP) for every student with a disability who is found to meet the federal and state requirements for special education. The IEP is a plan or program developed to ensure that the student receives specialized instruction and related services. IEP refers both to the program and to the written document that describes it. (U.S. Dept. of Education, n.d.)
The 504 Plan is a plan developed to ensure that a child who has a disability identified under the law and is attending an elementary or secondary educational institution receives accommodations that will ensure their academic success and access to the learning environment. 504 plans are intended for students who do not require specialized instruction. (U.S. Dept. of Education(3), 2018)
Chapter 5: Gifted and Talented

5.1 Federal Definitions of "Gifted & Talented"

In 1972 The U.S. Department of Health, Education, and Welfare issued the Marland Report and brought giftedness to the educational forefront; yet there were no legal mandates associated with it. Subsequently the US government has defined "Gifted & Talented" students as those "... who give evidence of high achievement capability in areas such as intellectual, creative, artistic, or leadership capacity, or in specific academic fields, and who need services or activities not ordinarily provided by the school in order to fully develop those capabilities (No Child Left Behind, 2001).

The U.S. Department of Education has defined both “gifted” and “learning disabled” but has not addressed how they intersect. Because gifted education is not regulated or funded on a national level, each state (or each school district if not regulated by the state) can create its own definition of giftedness and determine the identification process used to decide which students will receive services (Foley Nicpon, et al., 2011).

As an example, Massachusetts, which has one of the best, if not the best, K-12 statewide public educational systems, currently has no state-mandated gifted program (Education Week, 2018). In Massachusetts only 5.3% of K-8 schools have a gifted program, well below the national average of 68.3% (Tyner, 2018).
Chapter 6: The Challenge of Identifying 2E Students

I am somehow less interested in the weight and convolutions of Einstein’s brain than in the near certainty that people of equal talent have lived and died in cotton fields and sweatshops.

—Stephen Jay Gould

One of the biggest issues for 2E students is the problem of initially identifying them. For example, in a qualitative study of 112 high-ability students with IEPs (IQ score of 116 or above), not a single student was referred for gifted and talented services. Furthermore, these students received fewer educational modifications than classmates with IEPs in the average- or low-ability groups (Crim, 2008). Gifted students with disabilities may appear “not impaired enough” for disability-related services if they perform at grade level, and “not gifted enough” to receive gifted education services (Silverman, 2003). Federal law ensures all students with disabilities the right to FAPE. However, current policies governing identification processes contribute to the under-identification of 2E students. The emphasis on below-grade-level performance, without regard to gifted abilities or potential weaknesses, masks twice-exceptional students. Those who perform at grade level, by using advanced conceptual abilities and hard work to compensate, may still require interventions and accommodations to manage increasing educational demands (Gilman, et al., 2013). Conversely, when gifted students with SLD are identified and treated as gifted and have access to gifted/enrichment programming, large gains are made regarding self-concept and attitude toward school (Olenchak, 2009).

6.1 Problems with Identifying Twice-Exceptionality under IDEA

Under IDEA 1999, children with SLDs were identified through comprehensive individual assessment of ability, achievement, and all areas of potential weakness by qualified professionals (34 C.F.R. 541, 543). The use of ability-achievement discrepancies for the identification of children with learning disabilities was an important criterion for detecting SLDs. Through the comprehensive assessment process, gifted children who performed at the average level in areas of disability, well below expectations for their ability, were frequently identified and provided services for learning disabilities.
The next reauthorization, IDEA 2004 changed policy to mandate that the criteria adopted by each state “must not require the use of a severe discrepancy between intellectual ability and achievement for determining whether a child has a specific learning disability” (Assistance to states, 2006, p. 46647). Parents have no due process if children are missed (McCallum, et al., 2013). This is a disservice to 2E students since any such exclusionary model will result in the systematic denial of services to children with IQs above 100, the higher the IQ the more likely the denial of services. Yet, these are most likely to be the ones able to benefit most from services for the learning disabled. Below-grade-level performance criteria are too low to reliably locate higher ability children (not just the gifted) with learning disabilities. Conversely, giftedness may also remain hidden without comprehensive assessment due to the "masking" effects of concomitant exceptionalities, which can reduce achievement and increase the likelihood that the students will be denied access to gifted programs (McCallum, et al., 2013).

The 2004 legislation places the primary responsibility for diagnosing SLDs in the hands of teachers, based on multiple classroom achievement measures. Through a process commonly called Response to Intervention (RtI). Children performing below grade level are located and provided tiered interventions of increasing magnitude to alleviate performance delays, While RtI is an effective remedy for the “wait-to-fail” curriculum-based assessment process, it could lead to fewer referrals for services for those students who are performing average or above in a given academic area, despite the relative discrepancy between this performance and their cognitive abilities. Children considered for services under IDEA 1999 might not be so treated under IDEA 2004 as interpreted by states. Without a history of accommodations for a problem, accommodations for later standardized tests (e.g., College Board exams) become inaccessible. The termination of periodic comprehensive assessment for high school students may make essential college accommodations inaccessible because most colleges require assessment within 3 years of college entrance to grant them, even if the student has a history of special education services (an IEP or 504 Plan) or accommodations (cf. MIT Student Disability Services, 2018). Unidentified twice-exceptional students have no access to the supports that might prevent or mitigate course failures in high school, and may be pushed out of school when failed coursework cannot be fully made up by taking remedial summer courses. Average work for twice-exceptional students may represent a “failure to thrive” and should not be construed as evidence that a student has no disabilities (Gilman, et al., 2013).

6.1.1 Using the WISC as a Diagnostic Tool

School districts use many approaches to identify gifted students. Some states and districts employ comprehensive individual IQ tests as one of several identifiers. The most popular of these is the Wechsler Intelligence Scale for Children, Fourth Edition (WISC) (Lubin, et al., 1971). Even in districts where IQ tests are not used in student selection, the WISC is often administered when the parents appeal the decision to deny a child services. The WISC is designed for students aged 6 to 16 years old. The most current version, the WISC-V was
published in 2014. It generates a Full Scale IQ (formerly known as an intelligence quotient or IQ score) that represents a child's general intellectual ability. It also provides five primary index scores: Verbal Comprehension Index, Visual Spatial Index, Fluid Reasoning Index, Working Memory Index, and Processing Speed Index. These indices represent a child's abilities in discrete cognitive domains. Five ancillary composite scores can be derived from various combinations of primary or primary and secondary subtests (National Association for Gifted Children(3), 2009).

The inclusion of the Working Memory Index, and Processing Speed Index in Full Scale IQ may eliminate twice exceptional students from being identified and receiving appropriate programming. Twice-exceptional students often score lower than others in these two categories. An alternative composite score, the General Ability Index (GAI) describes a student’s higher order cognitive functioning without the influence of working memory and processing speed, and is thus a more accurate tool for identifying such students (Vespi & Yewchuk, 1992).

The WISC is used not only as an intelligence test, but as a clinical tool. Five complementary subtests yield three complementary composite scores to measure related cognitive abilities relevant to assessment and identification of attention-deficit hyperactivity disorder (ADHD) and specific learning disabilities, particularly dyslexia and dyscalculia. This is usually done through a process called pattern analysis, in which the various subtests' scores are compared to one another and clusters of unusually low scores in relation to the others are searched for. (Kaplan, 2001) While the WISC should not be used alone to diagnose learning disabilities (LDs) (Watkins, 1997) it can be used as part of an assessment battery to identify intellectual giftedness, learning difficulties and cognitive strengths and weaknesses. For example, gifted spatial learners with weak verbal skills are worth noting. Individuals with high spatial ability often have relative weaknesses in verbal ability. When tested using the verbally-loaded Full Scale IQ measure, students may obtain FSIQ scores below cut-off score requirements for gifted programs (Silverman, 2002).

6.1.2 Struggles Particular to 2E Students

Twice-exceptional children often display typical gifted traits including curiosity, a well-developed vocabulary, intense and wide interests, high creativity and divergent thinking. Twice-exceptional children also share many characteristics with typical disabled children, in that they frequently display deficits in comparison to the so-called norm. These deficits can include inconsistent performances at school, deficits in planning and organization, deficits in cognitive processing, deficits in receptive and/or expressive communication and deficits in motor skills (Trail, 2011). Twice-exceptional students often are faced with negative school experiences and interactions, which can lead to internalized feelings of failure, depression, low self-efficacy and worthlessness, along with externalizing behaviors such as aggression and hyperactivity. This negative emotionality is particularly disheartening because these students were found to have a great capacity for motivation and confidence (Vespi &
Yewchuk, 1992). It is crucial that educational interventions are aimed at building strengths as well as addressing weaknesses. When gifted students with SLD are treated as gifted and have access to gifted/enrichment programming, large gains are made regarding self-concept and attitude toward school (Olenchak, 2009).

As noted above, under IDEA, a gifted child that performs at or near grade level in his or her area of weakness is not eligible for special education services, even if diagnosed with an SLD such as dyslexia (Colorado Dept. of Ed., 2011).
Chapter 7: Dyslexia

Human beings invented reading only a few thousand years ago. And with this invention, we rearranged the very organization of our brain. Which in turn expanded the ways we were able to think, which altered the intellectual evolution of our species. Our ancestors’ invention could come about only because of the human brain’s extraordinary ability to make new connections among its existing structures, a process made possible by the brain’s ability to be shaped by experience. This plasticity at the heart of the brain’s design forms the bases for much of who we are, and who we might become. Dyslexia cannot be anything so simple as a flaw in the brain’s “reading center”, for no such thing exists. In the evolution of our brain’s capacity to learn, the act of reading is not natural, with consequences both marvelous and tragic for many people, particularly children.

-Maryanne Wolf

7.1 What is Dyslexia?

The International Dyslexia Association defines dyslexia as a specific learning disability that is neurobiological in origin. It is characterized by difficulties with accurate and/or fluent word recognition and by poor spelling and decoding abilities. These difficulties typically result from a deficit in the phonological processing abilities that is often unexpected in relation to other cognitive. Secondary consequences may include problems in reading comprehension and reduced reading experience that can impede growth of vocabulary and background knowledge. This definition is incorporated into many state laws.

Dyslexia is a complex, heterogeneous disorder. For example, two of its main components, phonological skills and rapid naming, each have separate, significant heritability (Wolf, 2007). Dyslexia is persistent. A student who reads poorly in 1st grade has a 90% chance of reading poorly in 4th grade and a 75% chance of reading poorly in high school (Gabrieli, 2009).

7.2 Prevalence of Dyslexia

Learning to read is perilous for the 5 to 17% of children who have developmental dyslexia (Shaywitz, 2003). That confusingly wide range is frequently quoted. The reason it is so wide according to MIT Neuroscientist John Gabrieli is because, “...like so many developmental differences there’s not a bimodal distribution. It’s all one big bell curve and where you draw a line is a little bit of a subjective choice. The reason [the subjective choice] matters is
twofold. Who gets in that category drives research. And more practically it also drives services in schools” (Gabrieli, 2018) (Shaywitz, et al., 1992). To get a rough understanding of how many “stealth dyslexics” there are undetected within that bell curve, note that during the 2013-14 school year only 4.5% of public school students qualified for Specific Learning Disability services, the that includes dyslexia (National Center for Educational Statistics, 2017).

7.3 Dyslexia and 2E Kids

Research shows that, for typical readers, reading and IQ are not only dynamically linked over time but they also influence each other. This mutual interrelationship is not perceptible in dyslexic readers suggesting that reading and cognition develop more independently in dyslexia (Ferrer, et al., 2010). Thus, in dyslexia, a highly intelligent person may read at a level above average but below that expected, based on his or her intelligence, education or professional status (Shaywitz, et al., 2016). This is the central reason why dyslexia is often masked in gifted students. Even dyslexic children who improve their accuracy for reading single words often continue to read text laboriously and slowly; the effort expended to read words in text often detracts from their ability to construct the meaning of what they are reading (Gabrieli, 2009).

This dysfluency makes accessing curriculum increasingly difficult as a student transitions from “learning-to-read” to “reading-to-learn” in the later elementary grades. Others start to fail in high school. Truly brilliant LD students might not have to crack a book through high school only to run into trouble when confronted by massive amounts of reading they need to do for their required undergraduate humanities classes, according to Kathleen Monagle, MIT’s Associate Dean of Student Disability Services (Monagle, 2018).

7.4 The Psychology of Dyslexia

I believe that reading, in its original essence, (is) that fruitful miracle of a communication in the midst of solitude.

– Marcel Proust

Because reading involves multiple linguistic, visual and attentional processes, it is probable that variable patterns of weakness may contribute to reading difficulty across children (Figure 7-2). Although it is unlikely that there is a single causal mechanism of dyslexia, some frequent likely causes have been identified. The best understood cause for dyslexia is a
weakness in phonological awareness (PA) for spoken (auditory) language that predicts and accompanies dyslexia (Norton, et al., 2014).

The phonological module of the brain is dedicated to processing the distinctive sound elements that constitute language. The phoneme, defined as the smallest meaningful segment of language, is the fundamental element of the linguistic system. Different combinations of just 44 phonemes produce every word in the English language. The word “cat,” for example, consists of three phonemes: “kuh,” “aah,” and “tuh.” (Figure 7-1) Before words can be identified, understood, stored in memory or retrieved from it, they must first be broken down, or parsed, into their phonetic units by the phonological module of the brain (Shaywitz, 1996).

![Figure 7-1 Neural Architecture for reading](image)

Letter identification activates the extrastriate cortex in the occipital lobe; phonological processing activates the inferior frontal gyrus (Broca’s area); and accessing meaning activates primarily the superior temporal gyrus and parts of the middle temporal and supramarginal gyri (Shaywitz, 1996)

In spoken language, this process occurs automatically, at a preconscious level. As Noam Chomsky has convincingly argued, language is instinctive, all that is necessary is for humans to be exposed to it. A genetically determined phonological module automatically assembles
the phonemes into words for the speaker and parses the spoken word back into its underlying phonological components for the listener (Shaywitz, 1996). Or, as Harvard cognitive scientist and linguist Steven Pinker puts it, "Children are wired for sound, but print is an optional accessory that must be painstakingly bolted on."

Although both speaking and reading rely on phonological processing, there is a significant difference: speaking is natural, and reading is not. Reading is an invention and must be learned at a conscious level. The task of the reader is to transform the visual percepts of alphabetic script into linguistic ones—that is, to recode graphemes (letters) into their corresponding phonemes. To accomplish this, the beginning reader must first come to a conscious awareness of the internal phonological structure of spoken words. Then he or she must realize that the orthography—the sequence of letters on the page—represents this phonology. That is precisely what happens when a child learns to read.

When a child is dyslexic, a deficit within the language system at the level of the phonological module impairs his or her ability to segment the written word into its underlying phonological components. This explanation of dyslexia is referred to as the phonological model, or sometimes as the phonological deficit hypothesis (Shaywitz, 1996).

A second psychological weakness associated with dyslexia relates to rapid automatized naming (RAN) Figure 7-2. Slowness in naming may reflect difficulty in the integration of cognitive and linguistic processes involved in fluent reading. Often, children who are especially poor readers have weaknesses in both PA and RAN, but some children exhibit only one of these weaknesses. (Norton, et al., 2014)

A third category of potential causal explanations for dyslexia relates to basic perceptual processes that may underlie the more proximal PA or RAN weaknesses, such as temporal sampling or processing, visual–spatial attention or perceptual learning deficits. These explanations are more mechanistic, but perhaps because they are more distal from reading per se, they are also more debated. (Norton, et al., 2014)
<table>
<thead>
<tr>
<th>Construct</th>
<th>Definition</th>
<th>Example tasks</th>
<th>Example standardized assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonological awareness (PA)</td>
<td>Knowledge of, and ability to manipulate, the sound structure of words</td>
<td>• Say game without the /g/</td>
<td>• Comprehensive Test of Phonological Processing (CTOPP-2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• What word do these sounds make? /s/- /l/- /t/</td>
<td>• Phonological Awareness Test (PAT-2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Name a word that rhymes with star</td>
<td></td>
</tr>
<tr>
<td>Rapid automatized naming (RAN)</td>
<td>Speed with which a series of familiar stimuli can be named aloud, reflecting efficient visual-verbal connections</td>
<td>Name, as quickly as possible, a 10x5 array of five randomly repeated objects, colors, letters, or numbers</td>
<td>• Comprehensive Test of Phonological Processing (CTOPP-2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Phonological Awareness Test (PAT-2)</td>
</tr>
<tr>
<td>Reading fluency</td>
<td>Ability to read single words and connected text with sufficient accuracy and speed so as to support efficient comprehension</td>
<td>• Read aloud a list of common words or pseudowords as quickly and accurately as possible</td>
<td>• Test of Word Reading Efficiency (TOWRE-2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Read aloud, quickly and accurately, paragraphs of increasing complexity</td>
<td>• Gray Oral Reading Test (GORT-5)</td>
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<td></td>
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<td>(Norton, et al., 2014)</td>
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Figure 7-2 Key constructs in reading and potential deficits in dyslexia

### 7.5 The Neurobiology of Dyslexia

Since the late 19th century scientists such as French neurologist Jules Déjerine have known that certain regions of the brain are important to reading (Martin, 2006). In the last 30 years, researchers have used functional magnetic resonance imaging (fMRI) to further refine our understanding of how the reading brain works. fMRI measures brain activity by detecting changes in cerebral blood flow. The technique is accurate to a few millimeters but can only capture image data every few seconds so it has a high spatially resolution but a relatively low temporal resolution.
Beginning readers use the slow and analytic parieto-temporal (Figure 7-5) region of the brain to pull apart a word and link its letters to their sounds. After a child has analyzed and learned to correctly read a particular word, she creates a permanent neural model of that word’s form including spelling, pronunciation and meaning, which is stored in her occipito-temporal system (also referred to as the “word form area”). Once a word form is stored in the occipito-temporal system, a skilled reader can access it by simply seeing it’s printed form without conscious thought or effort in less than 150 milliseconds. A third reading pathway in Broca’s area in the front of the brain also helps in slowly analyzing a word. FMRI mapping of the neural pathways of skilled readers show that they primarily activate the word form area in the rear of the brain as well as Broca’s area in the front. In contrast, dyslexic readers show an under-activation of the neural pathways in the rear of the brain. Consequently, they have trouble analyzing words and transforming letters into sounds and even as they mature, they remain slow in dysfluent readers (Shaywitz, 2003).
Neuroimaging of children with dyslexia also shows altered white matter connectivity. White matter is found in the deeper tissues of the brain and contains long nerve fibers called axons (Figure 7-4). These axons are coated with myelin which acts as an insulator allowing nerve impulses to travel approximately 100 times faster than is possible in unmyelinated fibers (Fields, 2008). During a lecture at the MIT Media Lab, John Gabrieli described these bundles of axons as “information superhighways that orchestrate relatively distant parts of the brain into ensembles or networks to accomplish important things” (Gabrieli, 2018).

![Figure 7-5 The left arcuate fasciculus](image)

*The left arcuate fasciculus is classically posited to facilitate communication between Broca’s and Wernicke’s areas.*

White-matter pathways of the brain may be characterized by diffusion tensor imaging (DTI). DTI visualizes white matter connectivity in the brain by measuring the flow of water at the micron-scale, microstructural level. The left Arcuate fasciculus *(Figure 7-5)* is the name of the white matter pathway connecting Wernicke’s and Broca’s area. (Gabrieli, 2018). Higher composite phonological awareness scores in older readers have been significantly and positively correlated with the volume of the left arcuate fasciculus (Klingberg, 2001). More recently researchers have discovered that the left arcuate fasciculus is already smaller and has less integrity in kindergartners who are at risk for dyslexia because of poor phonological
awareness. These findings suggest a structural basis of behavioral risk for dyslexia that predates reading instruction (Saygin, et al., 2013).

Greater volume and FA of the left arcuate fasciculus are associated with superior phonological awareness. a, Volume of the left arcuate fasciculus plotted against individual raw scores of the Blending Words subtest. b, Phonological awareness.

DTI studies of dyslexia also report greater-than-normal white-matter connectivity in the corpus callosum, the large white matter tract connecting homotopic regions of the left and right hemispheres (Dougherty, 2007). These findings suggest that, in dyslexia, white-matter pathways supporting reading project too weakly within the primary reading pathways of the linguistic left hemisphere and project too strongly between hemispheres. This may reflect an atypical reliance on right-hemisphere regions for reading that is observed in a number of functional neuroimaging studies of dyslexics (Gabrieli, 2009).
The surprises on this landscape increase daily. Recent advances in neuroimaging research begin to paint a different picture of the brain of a person with dyslexia that may have enormous implications for future research, and particularly for intervention. Understanding these advances can make the difference between having a huge number of our future citizens poised to contribute to society and having a huge number who cannot contribute what they could otherwise. Connecting what we know about the typical child's development to what we know about impediments in reading can help us reclaim the lost potential of millions of children, many of whom have strengths that could light up our lives (Wolf, 2007).
7.5.1 Diagnosing Dyslexia

“Science has moved forward at a rapid pace so that we now possess the data to reliably define dyslexia, to know it’s prevalence, it’s cognitive basis, it’s symptoms and remarkably, where it lives in the brain and evidence-based interventions which can turn a sad, struggling child into not only a good reader, but one who sees herself as a student with self-esteem and a fulfilling future.

Education must, and can be, aligned with science. We must ensure that scientific knowledge is translated into policy and practice and that ignorance and injustice do not prevail. We know better, we must act better.”

-Sally Shaywitz, Congressional Testimony, 2014

The causes of dyslexia have been misconstrued for decades (Shaywitz, et al., 2016). Early explanations of dyslexia, put forth in the 1920s and persisting through today, hold that defects in the visual system are to blame for the reversals of letters and words thought to typify dyslexic reading (Shaywitz, 1996). Others correlated it with apathy: “Thirty, forty, fifty years ago people blamed (dyslexic) students for being lazy, sloopy and unmotivated. They viewed it as a character flaw rather than the brain difference that we now know it clearly is (Gabrieli, 2018).” Now that we know dyslexia is a highly specific disorder relating to problems with phonological processing we’re better able to diagnosis it.

Currently, most children with dyslexia are not diagnosed until they are in third grade, or about 9 years old, although it is possible to recognize children at risk for dyslexia as young as 4-5 years of age (Shaywitz, et al., 2016). Even before formal reading begins in school, children can be observed for signs of being at risk. These risk indicators include delayed language, trouble learning common nursery rhymes, a lack of appreciation of rhymes, mispronounced words, difficulty in learning names of letters and numbers and failure to know the letters in his or her own name as well as a positive family history of dyslexia (Shaywitz, 2003).

Particularly when a reading disorder is associated with high IQ, a child may function at or near grade level in the early grades, and the Reading Disorder may not be fully apparent until the fourth grade or later. These students may not receive special education services under IDEA until their reading falls below grade level. Compounding the problem is the fact that dyslexia is not its own disability category. To wit, “An individual student who has had a diagnosis of dyslexia may or may not be eligible for special education services—it is never an automatic conclusion that if a student is identified as having dyslexia, that student is also eligible for special education services (Colorado Dept. of Ed., 2102) (pg7).” Yet, early reading intervention is key to preventing learning problems in all subjects and a potential loss of
motivation to learn, especially if the child’s veiled struggle is interpreted as laziness (Gilman, et al., 2013). Unremedied reading issues compound themselves over time. In one study, first graders who scored in the lowest 20 percent of their class on a test of phonology were reading at a 2.6 grade level in the 5th grade while their classmates who scored higher were reading at a 5.9 grade level (Shaywitz, 2003).

Current research is trying to identify which children could benefit from early intervention aimed at preventing reading difficulties. For example, the READ Study, a collaboration between the Gabrieli Lab at MIT and the Gaab Lab at Boston Children's Hospital, is trying to understand how brain differences in kindergarten children might predict their reading ability in 2nd grade. In order to do this, they are imaging children’s brains in kindergarten and then again in first and second grade. The researchers theorize that even at birth, or shortly after, children's brain structures can show signs of developing reading disorders. They hope their current research will trickle down to classrooms and help eliminate "the dyslexia paradox."

7.5.2 Teaching Strategies for Dyslexia Remediation

Studies have suggested that intervention is most effective in kindergarten or first grade, however, under current educational practices, students need to show several years of reading failure before they can get a diagnosis of dyslexia, typically at the end of second grade or beginning of third grade. Studies with children conducted before reading instruction may determine whether the differential organization of white matter is predictive of developing dyslexia or is a consequence of reading practice. Once children are diagnosed with dyslexia because of reading failure, treatment consists of intense reading instruction. Typical public school and special education interventions often stabilize the degree of reading failure rather than remediate (normalize) reading.

Controlled studies consistently show that instruction yields substantial improvement in reading accuracy for many, but not all, children. For it to work, instruction must be more intensive (for instance, 100 min per day for 8 weeks), must occur in small groups (1 or 2 students per teacher), and must include explicit and systematic instruction in phonological awareness and decoding strategies. Gains are maintained for at least a year or two by approximately half of all children after they return to the school’s standard curriculum. Those children who retain their benefits improve from year to year, but they do not further catch up to typical readers. Such improvements are much more likely to occur in children who are beginning to read (ages 6 to 8) than in older children and are much more difficult to achieve for fluency than for accuracy. Thus, these resource-demanding interventions are effective for many children, but there are still challenges in developing interventions that are effective for all children (MIT Gabrieli Lab, 2013). This intensive training will typically need to last for one to three years or longer in order for a student to start catching up with her peers. Because of the intensity of these programs and the small teacher to student ratio, successful remediation rarely occurs in public schools (Shaywitz, 2003). A list of assessment strategies and standardized tests for dyslexia can be found in (Figure 7-2).
7.6 The Strengths of Dyslexics

7.6.1 Do Dyslexics Tend to Have Enhanced Visual-Spatial Abilities?

Take, for example, the case of children with dyslexia. In a significant number of cases, such children show enhanced facility with visual or spatial activities. These strengths can be mobilized to help students excel in vocations and avocations that exploit visual-spatial...

-Howard Gardner

Given all innovators that showed signs of dyslexia, Edison, da Vinci, Einstein, it seems like Gardner must be right, right? The jury is still out whether or not dyslexics are born with stronger visual-spatial skills. For starters, though biographical information does seem to indicate that these historic figures had language-based learning, critics argue that you can't diagnose dyslexia retrospectively. Mark Seidenberg contends that “The brain isn’t a zero-sum game in which a deficit in one area entails and advantage in another”. Seidenberg goes on to wryly ask: “Could the conditions that cause a reading impairment have beneficial side effects, such as special talents? I can tell you that there isn’t much hard evidence on the question because it is so difficult to study. No one has undertaken a large-scale prospective longitudinal study of individuals at risk for high achievement” (Seidenberg, 2017). While it is clearly possible to be both dyslexic and have advanced visual-spatial strengths, proof of a causal relationship between the two has been elusive. It is worthwhile to celebrate inspirational figures who have overcome dyslexia, but it is important not to trivialize their struggles, as popular writer Malcolm Gladwell did when he glibly described dyslexia as a “desirable difficulty” (Gladwell, 2013). Dyslexia is an incurable, lifelong challenge, even for successful adults who have overcome its worst effects.

7.6.2 Creative Approaches Gained through Overcoming Dyslexia

... while I would scarcely recommend the imposition of a disability on any person, the experience of dealing with and overcoming a disability can itself become a great ally in dealing with subsequent challenges.

-Howard Gardner
Many dyslexics have found success despite (or because of?) their learning difficulties. Sir Richard Branson described his success in an interview with Charlie Rose, “If I wasn't dyslexic, I never would have done it” (Shaywitz, 2003). Examples of other successful self-reported dyslexics include Stephen Spielberg, Mohammed Ali and Pablo Picasso.

Media Lab co-founder Nicolas Negroponte described how he is able to learn, despite the fact that he continues to be a dysfluent reader as an adult: “You learn by listening. You learn by doing. You learn by making. And a lot of people who do their learning by doing become, to some degree, more creative. They're accustomed to making things. And you ask a question, and some person says, well, I'll go read about it, or I'll study it. And another person says, well, let's build it and try it. Let's see if it'll work. And it's a much more, if you will, constructionist approach to learning.”

Because so many of the world’s most successful and creative people are dyslexic, it is reasonable to believe that overcoming a learning disability as a child can foster innovative thinking as an adult. Through my research I’ve come to believe that children who are forced to constantly find improvisational workarounds for doing things that are easy for other people can learn to think differently as a survival mechanism; being intellectually gifted can act as a creativity force multiplier.

7.6.3 Research on the Cognitive and Perceptual Abilities of Dyslexics

Dyslexia is a complex, heterogeneous disorder and we still have much to learn about the little-studied benefits derived from its neurological and cognitive differences. However, some intriguing studies that have shown that many people with dyslexia possess distinctive perceptual abilities. For example, there is growing evidence that dyslexics have wider peripheral vision than normal readers. MIT cognitive scientists Gadi Geiger and Jerome Lettvin have used a mechanical shutter, called a tachistoscope, to demonstrate that dyslexic readers can identify letters farther out in their field of vision while non-dyslexics are more adept at recognizing letters in the center of their visual field (Lorusso, et al., 2004). While this trait is disadvantageous during reading it helps recognize broad features and patterns when taking in visual information.

Additional evidence that dyslexics process information from the visual periphery more quickly also comes from the study of “impossible figures”. M.C. Escher often etched images of three-dimensional objects that could never exist in real life. A typical example is his Waterfall lithograph (Figure 7-8). Waterfall shows a water wheel powered by water pouring from a flume which is then directed uphill creating an impossible perpetual cycle. This visual joke activates regions in the brain’s right prefrontal cortex (Error! Reference source not found.), an area that is sensitive to the perception of causality (Fugelsang, 2005). Psychologists, including a team led by Catya von Károlyi of the University of Wisconsin-Eau Claire have used these impossible figures to study human cognition. The researchers asked subjects to distinguish impossible figures from similarly drawn ones that did not violate
causality. Dyslexics were able to pick out the impossible figures in an average time of 2.26 seconds. Typical viewers took a third longer (von Károlyi, 2003).

Further study in this area has been led by astrophysicist Matthew Schneps, the longtime director of the Laboratory for Visual Learning, located within the Harvard-Smithsonian Center for Astrophysics. Schneps has explored the possibility that dyslexics may have some perceptual advantages in visually intense domains such as science and mathematics and art. Scientists in his line of work must make sense of enormous quantities of visual data and accurately detect patterns that signal the presence of entities like black holes. Schneps observes that the central and peripheral visual fields are structurally segregated in the brain and are differentiated by their anatomical and functional characteristics. While the central
field appears well suited for tasks such as visual search, the periphery is optimized for rapid processing over broader regions. People vary in their abilities to make use of information in the center versus the periphery. Schneps proposes that this bias leads to a trade-off between abilities for sequential search versus contemporaneous comparisons. His parameter of periphery-to-center ratio (PCR) describes the degree of peripheral bias, which evidence suggests is high in many people with dyslexia. That is, many dyslexics favor the peripheral visual field over the center, which results in not only search deficits but also (more surprisingly) talents for visual comparison. The PCR framework offers a coherent explanation for these seemingly contradictory observations of both deficit and talent in visual processing. The framework has potential implications for instructional support in visually intensive domains such as science and mathematics (Schneps, 2007).
Chapter 8: Other Prevalent Learning Disabilities in 2E Students

8.1 Conditions that Frequently Co-Occur with Dyslexia

The most common conditions that co-occur with Dyslexia are speech and language disorders, ADHD and math impairments. Between 12 and 24% of those with dyslexia also have ADHD (Shaywitz, 2003). The conditions mainly co-occur because language, reading and math make use of many of the same cognitive capacities. Deficits in these shared capacities can create comorbidity. In this case the impairments do not just co-occur, they overlap. Comorbidity makes developmental disorders harder to identify. Behaviors such as inattentiveness, distractibility or defiance of authority can easily mask an underlying reading problem. Conversely, a conspicuous reading problem can also mask a co-occurring condition such as ADHD. A comprehensive clinical workup by a skilled clinician, a clinical neuropsychologist or speech-language pathologist (specializing in developmental disorders including dyslexia), taken with information gathered from parents and teachers, can help to sort through these possibilities (Seidenberg, 2017).

The phonological processing system plays an important role in many attention-related functions, including working memory and executive functioning. Working memory is the kind of short to intermediate-term memory that helps us “keep things in mind” for active conscious processing. Like RAM in a computer, the phonological processing system forms a phonological loop that keeps auditory-verbal information alive in active working memory until it can be processed, organized and put to use. When auditory-verbal working memory is limited or has too short a working span, the brain may fail to finish all the processing it needs to perform before this “internal speech tracing” fades away. The result is working memory overload, which causes symptoms like inaccurate language processing, slower language-based learning, problems with organization and task management and inattention during difficult work. (Eide & Eide, 2011) Working memory overload resembles what happens when you try to run a memory-intensive program on a computer with insufficient RAM. The computer slows as it’s memory usage “swaps” from faster RAM to slower disk space.

8.1.1 ADHD

ADHD is a problem reflecting difficulties allocating, focusing and sustaining attention (Shaywitz, 2003). Children with ADHD need accommodations and remediation of executive function deficits, including writing skills (Gilman, et al., 2013). There are two types, the more typical hyperactive/impulsive type (often seen in highly active boys) and inattentive type (which is more likely to be overlooked). A popular view is that ADHD is increasingly
prevalent and over-diagnosed in the gifted though it is equally plausible that ADHD is underdiagnosed in this population (Silverman, 2003). Some states and school districts have instituted the questionable practice of expanding the scope of RtI beyond identifying SLDs to include other disorders, including ADHD, and have denied students accommodations because they do not appear to teachers to be “impaired enough” (Gilman, et al., 2013).

Gifted children with attention deficits can concentrate for long periods of time in their areas of interest, and they are often well-behaved and attentive in one-on-one situations with adults, such as in an individual assessment. However, they find it nearly impossible to focus their attention when they are not intellectually engaged and the hyperactive types have a difficult time controlling themselves in the classroom. While the more typical form of ADHD usually manifests before the age of seven, the inattentive type may not surface until junior high school or later. It closely resembles depression and may respond to antidepressants. The inattentive type of ADHD is extremely difficult to diagnose, particularly in gifted girls. They may seem "spacey," but they compensate well enough to succeed in elementary school. They find it harder to concentrate and organize themselves as they approach adolescence and adulthood. They may not remember what they read, nor understand what is needed to complete their schoolwork. Children with untreated ADHD are likely to be friendless, because they have a hard time reading social cues and are not good at self-monitoring. Hyperactive children are usually rejected by their peers, while inattentive types are generally ignored or neglected by peers (Silverman, 2003).

8.1.2 Auditory Processing Disorder

Auditory processing disorder can result from a simple loss of acuity and is often associated with chronic ear infections. These are more difficult to diagnose in the gifted because these children often have a high pain tolerance and usually compensate well enough to succeed in the primary grades. The problem is usually not decibel loss; on the contrary, some gifted children seem to display hyperacuity (Silverman, 2002). They display impaired listening skills even though their hearing is fine.

Giftedness can mask severe auditory weaknesses in acuity and processing. In average children, the main symptom of an auditory weakness is lack of facility with expressive language. Gifted children with conductive hearing loss usually learn to speak within appropriate age norms. Their abstract reasoning allows them to fill in the missing sounds with a high degree of accuracy. They may be late talkers in comparison to their siblings, or they may have problems with articulation or dysfluency, but they rarely exhibit the types of language difficulties seen in children of average intelligence. Additional symptoms of auditory processing disorder include fluctuating attention, asking to have questions repeated, copying their neighbors to find out what they are supposed to do, mispronouncing words, difficulty remembering instructions, speaking
loudly, turning up the volume on electronic equipment, or covering their ears in noisy settings (Silverman, 2003).

These symptoms are often erroneously attributed to ADHD or "immaturity." (Silverman, 2003) Auditory processing and ADHD have overlapping symptoms; teasing them apart requires evaluating each possibility to learn which to rule out or address (Gilman, et al., 2013).

8.1.3 Sensory Integration Dysfunction

Sensory integration is the organization of sensation, enabling the brain to construct meaning of experience (Ayres, 2005). Sensory integration dysfunction is fine motor difficulties (e.g., writing and drawing), gross motor difficulties (e.g., riding a bicycle and catching a ball), or sensory modulation issues (e.g., intense reactions to sound, touch, light, smell, and taste). The most common signs are sensory defensiveness (e.g., stiffening up when being held), physical awkwardness and lack of muscle tone, not developing hand dominance before school age, and the inability to cross the midline (i.e., use one's right hand left of center). The symptoms for gifted children, however, tend to be subtler. Some gifted children are excellent athletes but cannot write. Some lack physical energy and trunk strength, making it nearly impossible for them to sit up straight. Some have no problem with physical coordination but are in a constant state of sensory overload. They wince at the sound of the vacuum cleaner, squint in fluorescent light, react strongly to perfumes and hairsprays, gag except with certain foods, wear only loose clothing, startle easily when approached from behind, or panic in crowded places. And some chew on their clothing because they are under-stimulated and in constant need of sensory stimulation.

The ability to integrate and make sense of sensory input is the neurological foundation for most functions. It follows that "sensory integrative dysfunctions are the basis for many, but not all learning disorders" (Ayres, 2005). Sensory integration dysfunction is frequently observed in children and adults with a variety of disabilities, such as Asperger's Syndrome, autism, nonverbal learning disorders and dyslexia. Since many symptoms of ADHD and sensory integration dysfunction overlap, an intense program of research is currently underway to determine psychophysiological and behavioral differences between the two syndromes (Silverman, 2003).

8.2 Additional Disadvantaging Factors

8.2.1 Executive Function Issues

Executive functioning is not a learning disability on its own; it is a term referring to a broad class of task management skills (i.e. organization, planning and mental flexibility) and self-
regulation abilities (i.e., regulation of attention, arousal and emotions) that develop throughout childhood and into young adulthood (Geragosian, 2018). Like Auditory Processing Disorder and ADHD, executive functioning problems need to be identified through comprehensive individual assessment by qualified professionals (Gilman, et al., 2013).

8.2.2 Anxiety

As would be expected, 2E students display many of the same negative academic characteristics as other learning-disabled children (Vespi & Yewchuk, 1992). These children are often teased by their classmates, misunderstood by their teachers, disqualified from gifted programs due to their deficiencies, and unserved by special education because of their strengths (Silverman, 2003). Poor performance may become disabling, interfering with academic progress in school and enjoyment of literacy-based activities, and giving rise to lifelong low self-esteem and anxiety (Shaywitz, 2003). 2E students often have difficulty concentrating on school work. They experience high frustration and anxiety at the discrepancy between their performance and potential ability. These negative feelings result in unproductive approaches to academic tasks, which they often hurry through or avoid (Vespi & Yewchuk, 1992).

8.2.3 Cultural, Ethnic and Gender Bias

Girls with learning disabilities often go unnoticed. Traditionally in schools and clinics, boys have been diagnosed with dyslexia between two and five times as often as girls. Studies, including Sally Shaywitz’ 1993 Connecticut Longitudinal Study, have shown that ratio to be biased; the actual prevalence of the disorder is nearly identical in the two sexes (Shaywitz, 2003).

Also of concern are the particular needs of racial, ethnic and cultural subgroups of gifted children. Black, Hispanic and Native American children appear in gifted programs at only about one-half or less their prevalence in the larger society (Gallagher, 2003). To counter this, educators must use culturally sensitive assessment processes to prevent language and cultural differences from creating bias in the identification process (Ralabate, 2006).

8.3 Outcomes for Unsupported 2E Students

Twice-exceptional students represent a potential national resource whose future contributions to society are largely contingent upon offering them appropriate educational experiences. Without appropriate education and services, their discoveries, innovations, breakthroughs, leadership, and other gifts to American society go unrealized. Underachievers are more likely to drop out of school and add to the social program costs of
the community (such as homelessness, low-income housing, criminal activity) (Ralabate, 2006).
Chapter 9: A Design Tool for Developing Empathy

Personas are a tool used by designers to help uncover the latent needs of a particular group of people. A persona is a fictional archetype of a particular group of people based on real data patterns. They help designers create empathy for their target group and avoid self-referential solutions. The user anthropology research required to create a persona gives the designer a better understanding of the needs of the people they are designing for.

Fifteen-year-old Brianna

Ninth-grade African American girl. Dyslexia Diagnosed in 4th grade after years of denials by school.
Reads at 5th-grade level.
Has inattentive ADHD.
Tests above the 90th percentile in verbal understanding and fluid reasoning abilities.
Superior auditory comprehension skills.
In pullout classes to remediate reading three times per week.
Excellent athlete.

Because of the complexities of Brianna’s cognitive profile, she is often misunderstood by her well-meaning parents and lacks appropriate accommodations at school. She is pulled out of English class for reading remediation in the special education office along with students with intellectual disabilities and behavioral problems. This situation is extremely detrimental to her already flagging self-esteem. Because of her sex, ethnicity and inconsistent grades, it is statistically unlikely that she will ever be in a gifted program with her intellectual peers. Despite having an above grade-level vocabulary, she is self-conscious of her poor spelling. This causes her to write using simplistic words and phrasing which masks her extraordinary story telling abilities. Attempting to read at grade level requires extreme cognitive effort, leaving her tired, moody and anxious at the end of the school day. Using her exceptional auditory comprehension ability, she benefits greatly from audio books. When class content is not available in audio form her grades suffer. Her self-esteem, anxiety and attention issues cause her to miss social cues and as a result, she has trouble making and keeping friends. She is a gifted volley ball player but has quit her team because of troubles navigating the social complexities of team sports. The resulting reduction in exercise has had negative effects on her physical health, anxiety, self-esteem and sleep. Brianna’s story illustrates how 2E students often have latent social and emotional needs as a result of their academic issues.
Eleven-year-old Ryan

Sixth-grade Caucasian boy.
Child of a working single mom.
Diagnosed dyslexic midway through second grade
First-grade reading skills.
IEP created end of second grade.
Poor rote memory skills.
Undiagnosed auditory processing disorder.
Gifted Math and Science skills.
Loves comic books and Legos
Excellent chess player.

Ryan is a dysfluent reader despite having an IEP for the last 4 years. During that time his school has set unambitious goals for his reading progress and does not accommodate for his reading struggles in other classes or his undiagnosed hearing problems. He gets pulled out of his general education classes for reading remediation but is taught by paraprofessionals who are not trained in research-based strategies to address his phonological processing weakness. Ryan’s superior high-level math skills are undermined by his difficulty with basic math facts. Similarly, he is not able to access the textbook-based grade-level science curriculum. He is discouraged from bringing comic books, Legos and baseball cards to school by teachers who don’t understand their value as multi-modal reading, science and math learning opportunities. His auditory processing disorder causes Ryan to be hyperaware of ceiling fans, passing cars and other distractions that most people can filter out as white noise. His classroom is not equipped with sound field technology or other increasingly common accommodations for students with auditory disabilities. Ryan himself resists using other, more visible accommodations that his IEP calls for, such as using a calculator or having extended time to take tests, because he doesn’t want the other kids to think he’s “not normal”. His academic struggles have in turn impacted his self-esteem. He sometimes calls himself stupid. Each year his reading abilities fall further behind his classmates’. Due to his inconsistent grades he is not grouped with his intellectual peers in the subjects he is naturally good at. His sole advocate, his mother, does not understand the jargon at his IEP meetings nor is she aware that his educational plan could be crafted to help accommodate many of his co-occurring problems. She cannot afford to hire private educational consultants to help craft a more efficacious IEP. Ryan’s struggles typify those of far too many underprivileged 2E students.
Chapter 10: Thoughts on Educating 2E kids

Underlying the brain’s ability to learn reading lies its protean capacity to make new connections among structures and circuits originally devoted to other more basic brain processes that have enjoyed a longer existence in human evolution, such as vision and spoken language. Computer scientists use the term “open architecture” to describe a system that is versatile enough to change—or rearrange—to accommodate the varying demands on it. Within the constraints of our genetic legacy, our brain presents a beautiful example of open architecture. Thanks to this design, we come into the world programmed with the capacity to change what is given to us by nature, so that we can go beyond it. We are, it would seem from the start, genetically poised for breakthroughs.

—Maryanne Wolf

In order to meet the diverse needs described above, our schools need functional plasticity, like the open architecture of our brains. Twice-exceptional students have complicated educational needs that require individualized accommodations that play to their strengths and support their weaknesses. There is nationwide public support to provide solutions. Eight out of ten registered voters support increased federal funding for gifted and talented education, yet this support is not translating into policy change (National Association for Gifted Children(5), 2018).

A few school districts, such as Montgomery County Virginia, actively support 2E students but they are just a tiny fraction of the thousands of districts in the United States. In practice learning disabilities such as Dyslexia and ADHD are not linked to overall intelligence. In spite of that recognition, government data shows that 2E students are not receiving gifted services at expected rates. While 7% of students without disabilities are participating in gifted and talented education (GATE) programs, only 1% of students with disabilities served under IDEA do so (U.S. Dept. of Education Office for Civil Rights, 2014). Increasing services and providing FAPE to 2E students requires the support of policy makers, which has been flagging since 2016. Federal grants via the Jacob Javits Gifted and Talented Students Education Program, available in previous years, are not planned for 2018. The proposed White House fiscal 2019 budget eliminates the Javits grant program completely (National Association for Gifted Children(5), 2018). National policy toward 2E students is moving
backward rather than forward. Research has identified identification techniques and teaching strategies that are effective in improving outcomes for twice-exceptional students.

10.1 Improving the 2E Identification Process

Whenever a disability is suspected in a gifted child, access to comprehensive assessment is essential to determine the level of giftedness, degree of impairment due to disabilities, areas affected by the disability, and specific accommodations needed. Clarification of IDEA 2004 confirms that an RtI process does not replace the need for comprehensive evaluation, nor can it unduly delay or deny a request for a special education evaluation. Parents have the right to request a comprehensive evaluation at any time, in all areas related to the suspected disability, and can initiate due process if a school refuses, however, some states withhold such assessment or seek to redefine it in a less than comprehensive manner (Gilman, et al., 2013).

A sure way to ensure that all students, abled and disabled, have access to FAPE is to screen them universally. Universal screening should be applied for the purpose of recognizing student strengths and weaknesses in an effort to provide an appropriate education to students whose development is delayed, advanced or both. Progress monitoring, a key component of RtI, is also appropriate for students who are gifted. For these students, who learn more easily and quickly in their area of strength, progress monitoring should be used to document mastery. Once mastery has been documented, students must be given opportunities to continue learning with enriched and advanced materials related to their area of strength (National Association for Gifted Children(4), 2009).

Twice-exceptional students are heterogeneous group and identification procedures must consider assessment in both giftedness and disability. For appropriate intervention to take place, it is necessary to establish causal factors for the learning problems, or at least to rule out other causal factors that could lead to very different interventions. A complete assessment battery is needed to identify and plan interventions for gifted students with learning disabilities, including an individual intelligence test, an achievement battery, indicators of cognitive processing, and behavioral observations (Brody & Mills, 1997).

The following considerations for identifying twice-exceptionality in students have been suggested by specialists in the fields of gifted and special education:

- Use multiple data sources for gifted programming identification: achievement tests, teacher reports, creativity tests, student interviews, portfolio, etc.
- Do not combine data points into a single score to avoid disqualifying 2E students with a range of strengths and weaknesses from gifted programs.
- Reduce qualifying cutoff scores for gifted program to account for depression of scores due to the disability.
• Use both formal (such as standardized tests) and informal (such as student class work) assessments.
• Conference with families about student performance outside of school.
• Be aware that identification is seldom pursued for students whose gifts and disabilities mask one another. As such, be hypervigilant about looking for subtle indicators of exceptionality in students.
• Use culturally sensitive assessment processes to prevent language and cultural differences from creating bias in the identification process.
  (Ralabate, 2006)

10.2 Universal Design for Learning, Building a Base

In the late 80’s, Sam Farber noticed his wife Betsey was having trouble comfortably holding an apple peeler due to her arthritis. This got Sam thinking: why do ordinary kitchen tools hurt your hands? Why can’t they be more comfortable and easier-to-use? Sam saw an opportunity to create a more thoughtful tool that would accommodate his wife’s arthritic hands. This was the inspiration behind his OXO peeler. The common appeal of this comfortable tool made it desirable for anyone who peels apples, not just people with arthritis. This approach is called universal design.

In hindsight, the unspoken need for a comfortable vegetable peeler seems obvious. Why use an outdated relic that doesn’t work for all users? Yet that resembles how our schools function today.

When applied to education this design-for-all process is called Universal Design for Learning (UDL). I mentioned above a personal experience. When my Satellite Engineering professor Kerri Cahoy posted videos of her lectures to our class website it gave me an indispensable accommodation. This content delivery system, live lectures supplemented by online lecture video for review, helped eliminate my barriers to entry including poor memory, laughable lack of math and physics education, attention problems and poor note taking skills to name a few. It also benefitted my classmates who worked off campus, or needed to review the lectures for any number of reasons.

One aim of the UDL approach is to provide full access to students with special needs, particularly through the provision of supportive technologies such as captioned video or text-to-speech options, multimodal teaching, differentiated instruction, cooperative learning, embedded assessment, relevant context and enhanced audio systems. Designing
to accommodate differences helps learners across the neurodiversity spectrum and for all students in general. All students receive research-based, high quality, general education that incorporates ongoing universal screening, progress monitoring, and prescriptive assessment to design instruction.

Data collected at Stanford University documented that over 90% of students with and without learning differences who were interviewed, stated that they believe there is still a negative public stigma associated with being dyslexic or having ADHD. The UDL approach is radical in its emphasis on remediating the learning and workplace environment first, reducing barriers and elevating the options available to students, so that fewer students are identified as disabled and there are more pathways to success (Stanford UDL Innovation Studio, 2018).

10.3 Grouping 2E Students

Numerous educators who have studied gifted children with learning disabilities have found that, ideally, these students should receive instruction as a special group for at least part of the day, from a teacher sensitive to their specific academic, social, and psychological needs, and with peers who share their dual exceptionalities. When grouped together for instruction, the interaction with other talented students is viewed as advantageous for learning and peer support. Self-contained 2E classes eliminate the movement from class to class required when services are provided in a combination of gifted, special education, and general classrooms and may be better suited to meet students’ emotional needs. Such programs typically try to address issues related to raising self-esteem and influencing motivation, as well as individualizing instruction to enhance academic achievement. Special classes for 2E students allow the teacher to develop a program unique to this population, one that is challenging but also provides structure and strategies to accommodate weaknesses (Brody & Mills, 1997). The climate should be designed to encourage interactive participation, flexibility, high standards, student participation in cooperative groups, individualized programming, active listening, and practice in conflict-resolution strategies (Weinfeld, et al., 2002). Almost one-third (32 percent) of students attended school in districts with 25,000 or more students (National Center for Education Statistics, 2001). This implies that for a large percentage of 2E students are in districts large enough to support 2E specific classrooms in each grade.

10.4 2E Students in General Classrooms

For school districts that do not have the scale or resources to support dedicated cohorts of 2E students, accommodations can be made to help them succeed in general classrooms. A part-time resource room model for 2E students is one option for exposing them to peers who share their dual exceptionalities. Consideration should be given to designing an individualized program from the options and special services already available in the school, supplemented by appropriate adaptations that will help ensure success in various settings.
the general classroom teacher accommodates individual differences, or if the general classroom placement is supplemented by time spent in special programs for gifted and/or learning-disabled students, placement in the general classroom may be appropriate.

Subject matter acceleration may be particularly beneficial as a vehicle for 2E students to receive advanced course work in their areas of strength without having to be placed at the same level in their areas of weakness. For example, mathematically talented students might progress rapidly at their own pace through an accelerated mathematics class even if learning disabilities pose some problems for them in creative writing or learning a foreign language. In addition, with moderate accommodations, such as encouraging the use of calculators, word processors, untimed tests, it is likely that many gifted students with learning disabilities could succeed in rigorous and/or accelerated courses in their areas of strength (Brody & Mills, 1997).

10.5 Individualized Instruction

Individualizing children's education is ideally the best solution to meeting the needs of both typical and atypical learners. Whether gifted, disabled, or typical, children deserve personalized educational experiences that provide a wide range of new learning opportunities and that take into account their needs, interests, strengths, and weaknesses (Gardner, et al., 2003). Gifted children with learning disabilities need Individual Educational Plans (IEPs) that take into account both exceptionalities. The IEP should address the development of the child's strengths as well as adaptations for the child's weaknesses (Silverman, 2003).

10.5.1 Teaching the Big Picture

While 2E students often possess outstanding abstract reasoning abilities and are able to see the big picture readily, they may have difficulty remembering and sequencing details (Weinfeld, et al., 2002). Harvard Graduate School of Education Professor David Perkins describes how educators typically approach a complex subject by ramping into complexity gradually by learning elements now and putting them together later. The problem is that elements don't make much sense in the absence of “the whole game”, and the whole game only shows up much later if at all. He names this trend “elementitis,” as if it were a disease. We can ask ourselves when we begin to learn anything, do we engage some accessible version of the whole game early and often? When we do, we get what might be called a “threshold experience,” a learning experience that gets us past initial disorientation and into the game. From there it’s easier to move forward in a meaningful motivated way. (Perkins, 2009) This “elementitis”, approach often systematically eliminates 2E students who, for instance, might have the aptitude and “big picture” skills necessary to excel in advanced science but fail the “drill and kill” introductory courses that require rote memorization skills but not holistic thinking.
10.5.2 Playing to Strengths

My own observations suggest that rarely in life are the fates of individuals determined by what they are unable to do. Their life trajectories are much more likely to be molded by the kinds of abilities and skills they have developed, and these in turn are determined in significant measure by the profile of intelligences with which they were endowed or that was nurtured in their early life. Many of the most creative people in history have had significant learning problems: Thomas Edison, Winston Churchill, Pablo Picasso, and even Albert Einstein come to mind. Far from being crippled by these difficulties, these individuals were able to build on their strengths to make remarkable and remarkably distinctive, contributions to their particular domain of achievement. Accordingly, those entrusted with education need to pay special attention to the strengths and the proclivities of youngsters under their charge.

Howard Gardner

More emphasis should be put on a 2E student’s strengths than weaknesses. Children who are taught to their strengths are often able to find ways to get around their deficits (Silverman, 2003). Although most learning disabilities are lifelong conditions (individuals do not outgrow them, nor do they disappear), many individuals not only gain coping skills but, as many adults have demonstrated, also can learn to thrive in spite of the difficulties. Developing the strengths of 2E students makes them feel safe, valued, and accepted. In order to do this, teachers must gain knowledge of students’ strengths, interests, and talents—information not typically collected when using a deficit model. Such knowledge enables professionals to plan appropriate talent development opportunities and to develop dually differentiated strategies for use within the classroom. (Baum, et al., 2014).

10.5.3 Learning Styles vs. Learning Abilities

When designing an individualized curriculum that takes advantage of a 2E student’s particular strengths or abilities, it is important to distinguish between “learning styles” and “learning abilities”, two terms that are often mistakenly conflated. The learning styles theory is that different students have different self-prescribed modes of learning and that their learning could be improved by matching teaching with the student’s preferred learning mode. Proposed modes have included dichotomies such as linear vs. holistic, impulsive vs. reflective, reasoning vs. insight, and visual vs. verbal. The most popular current conception of learning styles equates style with the preferred bodily sense through which one receives information, whether visual, auditory or kinesthetic (Riener & Willingham, 2010).
Over 90% of teachers believe that learning styles exist and there is a widespread acceptance of these theories among the broader public. These strong beliefs persist even though literature reviews over the last 30 years have concluded that most evidence does not support any of the learning styles theories (Willingham, et al., 2015). It is universally acknowledged that there are differences in learning abilities among students. Understanding these differences and applying that understanding in the classroom can improve everyone’s education. Whether we call it talent, ability or intelligence, people vary in their capacity to learn different areas of content. Interest and attention are preconditions of learning and vary from student to student, depending on the subject. Students differ in their background knowledge and that difference influences their learning. Finally, some students have specific learning disabilities and these affect their learning in specific ways (Riener & Willingham, 2010).

Learning styles are different than learning abilities. Learning styles are a student’s preference about how she learns whether it be, for example, through an auditory channel or visually. A favorite mode of presentation (e.g., visual, auditory, or kinesthetic) often reveals itself to be instead a preference for tasks for which one has high ability and at which one feels successful (Riener & Willingham, 2010). Cognitive scientists have shown repeatedly that there is no statistical interaction between the learning styles of individuals and the method of instruction (Willingham, et al., 2015).

So why is the belief in learning styles so pervasive? Part of the problem seems to be a simple semantic confusion, transposing “styles” for “abilities”. For example, for over 30 years, a generation of teachers seem to have misinterpreted Howard Gardner’s theory of multiple intelligences, which is about abilities, to be a learning style theory. Gardener set the record straight a few years ago. He draws three primary lessons for educators. First, individualize teaching as much as possible, instead of a “one-size-fits-all” approach. Second, pluralize your teaching in order to reach students who learn in different ways. Finally, drop the term “styles,” it will confuse others. (Gardner, 2013).

Gardner advocates individualizing content for each student, using multiple modalities. That content, however should be targeted to the student’s unique “jagged profile of intelligence” (i.e., her abilities, not her self-perceived styles). What cognitive science has taught us is that children do differ in their abilities with different modalities, but teaching the child in his best modality doesn't affect his educational achievement. What does matter is whether the child is taught in the content's best modality. For example, to teach a student the shape of the State of Massachusetts you would naturally show them a picture. Describing it verbally would be a tedious process.

10.5.42e Teaching Strategies
The most effective way to address 2E students’ deficits is within an enriched curriculum so they can apply and transfer skills in authentic ways. (Baum, et al., 2014).

Twice-exceptional students often struggle with executive processes. They have a difficult time organizing, prioritizing, and generalizing information. Teachers can help by modeling and teaching executive function skills. Because processing speed is usually compromised in disabled learners, timed tests should be avoided. Students can qualify to take college board exams and other standardized tests with more liberal time limits if slow processing speed can be documented through individual assessment. Children with writing disabilities should be taught keyboarding skills and allowed to use a computer for all written assignments (Silverman, 2003).

Other compensation strategies should be actively taught to twice-exceptional learners. Some of these include use of day-planners, task lists, visualization techniques, spell-check, having a quiet place at home to study, audio and video recordings of lectures, noise-canceling earphones, and having a place to retreat when overstimulated. Rote memorization, forced oral reading, text-based instruction, and the use of only teacher-directed activities are not successful practices. Instead, teachers should use instruction that obviates weaknesses; provides for production of alternative products; provides “real-life” tasks; provides open-ended outlets for the demonstration of knowledge; designs tasks that fit the student's cognitive strength; differentiates instruction; and uses collaboratively designed rubrics (Weinfeld, et al., 2002).
Chapter 11: Conclusion

The twice-exceptional mind has the potential to do exceptional things as evidenced by the great artists, inventors, engineers and scientists that have this paradoxical cognitive profile. More gifted students with learning differences exist than most people realize. Their abilities are often masked by their disabilities and vice-versa. Oftentimes they are misidentified as underachievers and not provided opportunities to develop their strengths and support their weaknesses. Their intelligence enables them to develop compensation strategies that hide their disabilities which often delays time-sensitive diagnosis. Lack of identification and targeted services can contribute to a student’s low academic self-efficacy and self-esteem. Students who understand their personal pattern of strengths and weaknesses are better equipped to actively participate in their learning. With appropriate support structures, 2E students can learn to leverage the powerful combination of their cognitive gifts and their perseverance gained through previous struggles.
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