

The education context for twice-exceptional students: An overview of issues in special and gifted education

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ABSTRACT

Twice-exceptional children (2e) identified as having a disability and areas of high ability require a diverse range of support and enrichment services. However, services associated with special education and gifted programs present numerous barriers to the appropriate education of 2e students. In this manuscript, the author briefly recounts his experiences as a 2e child and shares experiences of 2e students and their families presented at the 2021 *Summit on the Neuroscience of Twice Exceptionality*. Challenges associated with the provision of special and gifted education to 2e students are also described. The role of neuroscience in education, as it relates to 2e students, is also discussed. Although many of the barriers to effective education for 2e children are systemic in nature, school-level reforms, as well as scientific advances, have the potential to improve services for this population.

1. Introduction

I was diagnosed with a specific learning disability (SLD) in writing in 1992, when I was a third-grader. My issues with oral expression and pragmatic language provided the basis of the diagnosis. The battery of tests I completed over the previous year revealed specific problems related to communication, writing, and motor coordination. Then, as now, special education evaluations involved specialists and educators who, with the consent of parents, evaluate children who may be at risk of disability using informal and formal assessment methods (Yell et al., 2011). The speech-language pathologist's evaluation suggested I had a number of difficulties in conversational speech, including a rapid, forced vocal presentation; the tendency to make contradictory points within a single statement; having numerous breaks and errors in conversation; an inability to change subjects; and difficulty letting others participate. I struggled to distinguish between similar sounding words, despite showing no signs of physical hearing issues during an audiometric screening. I also exhibited significantly below-average performance on tests of following oral directions, sentence formulation, and auditory word discrimination. Perhaps the most salient issues I exhibited related to visual processing and handwriting. In addition to being generally illegible, I frequently reversed both letters and numbers (i.e., dysgraphia, Fig. 1).

In addition to characteristics indicative of a disability, I also performed well on a range of academic and cognitive tests. This included

high scores on tests of expressive vocabulary as well as full-scale and verbal IQ scores between 1 and 2 standard deviations above average. The psychologist noted that, due to the diverse range of my abilities, the full-scale IQ score did not fully represent my global skills. My performance IQ was slightly above average, but severely hindered by deficits in motor control. Additionally, many of my scores on academic tasks such as calculation and writing fell within the average range. However, I exhibited exceptionally high scores in reading, particularly reading comprehension. My pattern of achievement was observed in approximately 7% of children, and, like many children with my specific profile, potentially explained the frustration I experienced when confronted with activities in which I did not excel (Beckmann & Minnaert, 2018). In other words, my evaluation suggested that I was what would now be considered twice-exceptional (2e), though this was before the concept became commonplace in the literature or familiar to professionals working in my community (Baldwin et al., 2015). Though highly variable, 2e students generally possess attributes associated with giftedness as well as the characteristics of one or more physical, cognitive, behavioral, and/or socio/emotional disabilities.

Leaving aside their inexperience with 2e children, my evaluation committee realized my pattern of high scores in some areas and low scores in others could lead to significant difficulties in an academic setting. Their thoughts on how best to accommodate these issues became a point of contention with my mother, a single woman working as an attorney at a local nonprofit legal-aid services provider. The evaluation

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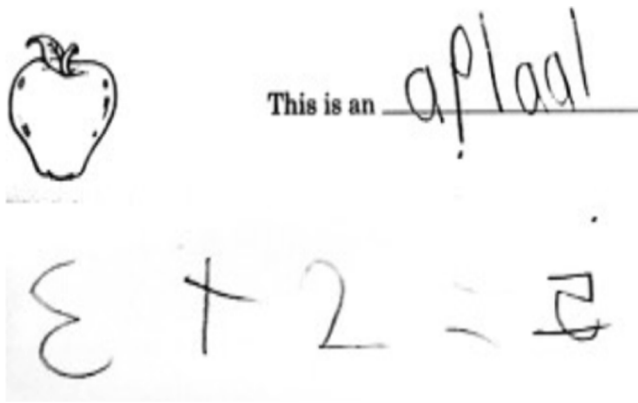


Fig. 1. Sample from author's special education evaluation demonstrating issues with letter-sound correspondence (top) and reversal of written characters (bottom).

team initially recommended I spend up to 60% of the school day outside of inclusive, general education settings. My mother, and an attorney from her workplace who agreed to assist pro-bono, emphatically disagreed. After exchanging several heated letters, the team eventually agreed placement in a general education classroom for the majority of the day would represent the least restrictive environment—or the setting where I would have the opportunity to interact with children without disabilities while also receiving an effective education.

Another point of contention was the committee's view of my unsuitability for the gifted and talented program offered at the school. On this the committee was less inclined to yield, or at the very least, uncomfortable with making decisions for representatives of the gifted program who were not involved in the evaluation process. The committee insisted that, whatever my scores on other tests, a child identified as requiring special education services could not, by definition, be gifted. In addition, my full-scale IQ score—though high and potentially deflated due to my disability—was a few points short of the score required for entry. The gifted program was an all-or-nothing affair, where students who met criteria took all of their classes away from the rest of the school. In the face of sustained pressure from my mother, however, the committee agreed to let me “audition” for entry. They watched my progress in my weaker subjects, where I tried hard to make people think I was “smart” despite my difficulties. I remember crying in math class when a low grade or other infraction threatened to keep me out of the program. Whether it was because of these outbursts, my mother's insistence and willingness to confront teachers and administrators, or the fact that I made sufficient improvements across subjects, the committee eventually agreed to place me in the gifted program during the middle of my fourth-grade year. I remained in gifted and other accelerated programs until the end of high school.

Once granted entry into the gifted program, I received much less in the way of special education. I no doubt had many opportunities to learn material that I may not have encountered in self-contained special education settings. On the other hand, I still have difficulty telling left from right; struggle with motor coordination; adopt an intense, forceful speaking tone by default; find social situations difficult; and continue to exhibit the worst handwriting that my colleagues—some of whom have worked in special education for decades—have ever seen. I do wonder if perhaps I would not have some of the same difficulties if I had not been told to choose one form of service over another. I have not been in the habit of identifying as a person who has a learning disability, or as gifted and talented, or as 2e, until I was offered the chance to represent special educators at the *Summit on the Neuroscience of Twice-Exceptionality (2e Summit)*.

Participating in the *2e Summit* represented a tremendous opportunity to learn about advances in neuroscience pertinent to individuals with exceptionalities and to hear 2e individuals and their families describe

their engagement with the education system. I had hoped to hear the experience of 2e students had improved. Instead, I learned that things have remained the same in many ways. Like me, many students had been denied entry into gifted and talented programs because they previously qualified for special education services (Student panel, 2021). An eloquent young person identified as gifted and talented at an early age described their frustration at being unable to obtain assistance even after receiving a diagnosis of autism at the age of 17. Mental health support was difficult to access because of their association with the gifted and talented program. Another young participant was thankful that their 2e status had been identified and accommodated relatively early.

Parents suggested many educators continue to be unaware of the existence of 2e students, placing them in a position of having to fight for enrichment opportunities and confront education professionals responsible for the administration of gifted and talented programs (Parent panel, 2021). My mother had the advantage of a law degree and access to free legal representation during her engagements with the school; most families are not so fortunate (Hyman et al., 2011). As in my experience, parents suggested that their child's placement in accelerated courses and academic clubs, for which they might otherwise be eligible, became contingent upon improvement related to individualized objectives emphasized in special education. Parents also reported feeling estranged from the evaluation and creation of the individualized education program, an all-too-common complaint regarding a process families are supposedly entitled to direct (Ankeny et al., 2009; c.f., Lai & Vadeboncoeur, 2013).

1.1. Purpose

As is clear from the presentations at the *2e Summit* and manuscripts appearing in this special edition of *Neurobiology of Learning and Memory*, neuroscience has the potential to contribute to understanding, identifying, and educating 2e students (e.g., Gilger & Olulade, 2013; Kliemann et al., 2013). Advances in this area, however, occur in the context in which 2e students receive education services. My own experiences and the experiences of 2e individuals and their families suggest that the supports related to disability diagnosis and enrichment activities associated with gifted education are often disjointed or withheld entirely, resulting in suboptimal outcomes for this population (Reis et al., 2014). The purpose of this article is to describe characteristics of special and gifted and talented education, with an emphasis on features that impede the provision of services for 2e students. It concludes with a brief discussion of the potential integration of neuroscience research and education.

2. Special education

2.1. Overview

Special education refers to programs encompassing an array of supports (e.g., instruction, transportation, post-secondary transition) and implemented across a range of service areas (e.g., classroom, resource room, home; Francisco et al., 2020). An entitlement originally secured in 1975 and subsequently expanded through the series of reauthorizations and amendments comprising the Individuals with Disabilities Education Act (IDEA), special education provides free and individualized services for eligible individuals from birth to age 21 with support from federal funds (Yell et al., 2011). Additional protections under the law include the right of individuals to receive services in the least restrictive environment—a response to historic policies segregating people with disabilities from the general population—as well as various due process rights granting recipients and their stakeholders' considerable input into how and whether services are delivered (Winzer, 2014).

IDEA also established the individualized education program as the primary vehicle for deciding the nature, duration, location, and objectives of service delivery and further established that recipients should

have a primary role in developing and evaluating measurable goals (Ruble et al., 2010). Although the extent to which special education was required to provide optimal services has been contentious, the Supreme Court recently affirmed the importance of providing meaningful benefits to students in their landmark *Endrew F. v Douglas County School District* (2017) decision (Yell & Bateman, 2019). IDEA further requires states to locate and refer students who might require special education (i.e., child-find), with eligibility for services ultimately depending on the consent of parents, the presence of a disability as defined under IDEA, and a demonstrable need for special education as evinced by the adverse effect of the disability (Zirkel, 2017).

Twice-exceptional children would benefit from supports designed to address their disabilities and fully develop their talent domains. However, specific aspects of special education limit the extent to which 2e students may consistently receive services. The remainder of this section describes factors that impede 2e students' access to special education; specifically, disability classification procedures and the scope of special education practice can potentially limit access to special education.

2.2. Barriers to service: classification, identification, and scope of practice

The disabilities enumerated within IDEA and their relation to the provision of school-based special education services present obstacles to providing adequate instruction for 2e students. Although other services may be possible, special education has the advantages of being free, widely available, comprehensive, and accountable to consumers. Yet the students eligible for special education are far less numerous among the range of students who might be considered 2e. This is because enrollment for services under IDEA is partially dependent on the extent to which a child's disability corresponds with specific categories in the statute (Yell et al., 2011). Some IDEA categories, such as emotional/behavior disorders or orthopedic impairment, encompass a wide range of specific conditions (Santoro et al., 2011). Regardless, the definition of disability included in IDEA is far less encompassing than the *Americans with Disabilities Act* (2012) or the *Diagnostic and Statistical Manual of Mental Disorders* (DSM; *American Psychiatric Association*, 2013a).

Many pervasive conditions frequently associated with 2e, such as attention-deficit/hyperactivity disorder (ADHD), though tacitly covered under more general categories (e.g., other health impairment), do not necessarily entitle a child to special education services (Assouline & Whiteman, 2011). Additionally, mental and behavioral disorders identified in the DSM (e.g., conduct disorder) are often excluded by the intentionally restrictive definition of emotional/behavioral disorders included in IDEA, and many students with mental health issues do not receive services as a result (Mitchell et al., 2019). States are permitted to offer special education to a larger range of students, and federal laws including the *Americans with Disabilities Act* or *Section 504 of the Rehabilitation Act* (2012) increasingly protect students with disabilities from discrimination and entitle them to supports needed to access education (Zirkel & Weathers, 2016). Unlike IDEA, mandates featured under the *Americans with Disabilities Act* and *Section 504* are not supported through federal funds and do not require the provision of individualized education.

Compounding the classification issue is the shifting criteria for disabilities included in IDEA. Uncertainty regarding which levels of performance or characteristics merit intervention can result in the delay of services or the disruption of instructional programming when students move between areas with different identification standards. This results from disparities at the district and state level, which have some degree of latitude in making eligibility decisions (Sullivan et al., 2019), as well as changes to IDEA at the federal level. Autism, currently the fastest growing disability listed in IDEA (*American Psychiatric Association*, 2013b), received recognition as a disorder distinct from emotional/behavioral disorders in 1990 (Prykanowski et al., 2015). Decisions regarding other disabilities, such as SLD, are largely based on the subjective judgement of practitioners and have been subject to broader

changes in how the disability is conceived and identified (Maki et al., 2017).

Dramatic changes to the definition and identification of SLD, as well as challenges to the validity of the designation more generally, have resulted in confusion regarding eligibility for special services, with specific implications for 2e. Evaluation teams historically identified SLD—the largest disability under IDEA formerly comprising over half of all service recipients—by comparing IQ scores to subject area achievement (i.e., discrepancy approach; Milburn et al., 2017). Problems with the discrepancy approach include differences in how states defined a significant discrepancy and the limited reliability of discrepancy over time (Maki & Adams, 2019). Additionally, the discrepancy approach disproportionately excluded children with average or below average IQ scores. Typical assessment procedures often fail to identify disabilities in children with the highest IQs because high cognitive ability can effectively hide the effect of disabilities in many instances (i.e., masking, see below). Under the discrepancy approach, however, children with above-average IQs and relatively poor achievement were generally more likely to receive services than students with average IQs and low achievement who often did not qualify for services until after elementary school (i.e., the “wait-to-fail” model; Turse & Albrecht, 2015). The inconsistent discrepancy criteria have been cited as a reason to doubt the existence of 2e students with SLD (Lovett & Sparks, 2013).

In 2004, IDEA permitted states to determine SLD using response-to-intervention, or the extent to which students improve—or respond—following progressively intensive instruction (Fuchs & Fuchs, 2006). As the precise definition of “response” varies across states, and many states continue to allow the use of the discrepancy approach, there is considerable uncertainty regarding who qualifies for SLD services (Hauerwas et al., 2013). The number of children identified as having an SLD has dramatically decreased since the emergence of response-to-intervention. Although ostensibly a positive development, the repeated periods of instruction and assessment necessary to determine the presence of a disability in response-to-intervention represents a potential source of delay in diagnosing SLD in 2e children (Gilman et al., 2013).

Students who have at least one disability corresponding to any of the IDEA categories must also be found to have a need for special education during the evaluation process (Garda, 2014), a requirement that can prevent 2e children from receiving services. Establishing need involves demonstrating that the disability impedes social, emotional, and/or academic performance in a way that would benefit from special education (Zirkel, 2015). The process may be problematic for 2e children due to masking (Assouline & Whiteman, 2011). Masking occurs when disability impedes the identification of giftedness or—as is most relevant to IDEA—when the characteristics generally associated with giftedness prevent educators from perceiving a student's difficulties. Because of the confounds created by concurrent talents and disabilities, 2e students are often at risk of being misdiagnosed or may even fail to receive a diagnosis. In terms of disability diagnosis, a student who struggles with specific academic content but who possesses compensatory cognitive strengths may be denied services due to an inability to demonstrate an adverse effect of the disability on performance. Behavioral concerns stemming from a disability may also be misperceived as impertinence when observed in a child classified as gifted. Additionally, families without resources often cannot afford independent evaluations, are dependent on the conservative findings of the school, and may be denied services as a result (Hyman et al., 2011). The effect of masking on the identification of strengths among individuals with documented disabilities will be discussed in a separate section.

The fundamental focus of special educators on accommodating disability represents an additional challenge to integrating special and gifted education for 2e children (Baum et al., 2015). Many within the field have emphasized strengths-based models for assessment and practice that focus on areas of student competence and ability as a means of promoting development (e.g., Steiner, 2011). Professional

organizations, such as the Council for Exceptional Children, consider education for gifted and talented students to fall within the purview of special education (Council for Exceptional Children, August 2021). Nonetheless, developing the strengths of students often represents a secondary concern in practice given that special educators are legally responsible for ensuring that their plans and objectives address the disability (Steiner, 2011). Although all teachers report they hesitate to refer a child diagnosed with a disability for gifted and talented services, special educators are the least likely to make a referral in such instances (Foley-Nicpon et al., 2013). The limited emphasis on student ability is compounded by the lack of training special educators receive in gifted education (Bianco & Leech, 2010) and limited guidelines for service delivery for 2e students (Pfeiffer, 2013).

Barriers to appropriate services for 2e students also stem from the implementation of special education more generally. Despite the increasing emphasis on inclusive education, teachers who are not specifically trained as special educators receive little preparation related to disabilities (Zagona et al., 2017). Consequently, 2e students may not receive the support they need across their full range of instructional settings. The number of personnel involved in administering support services in special education can further stymie efforts to integrate special education into instruction for 2e students. Depending on the specific needs of the child, special education may involve speech-language pathologists, audiologists, physical therapists, and other professionals (Dillon et al., 2021). This often prevents collaboration within special education, let alone across general or gifted and talented education. Difficulties in coordinating services can prevent 2e students from receiving the blended instruction that accommodates their disabilities and talents (Baum et al., 2015).

To summarize, the lack of consistency regarding the identification of disability and implementation of special education poses challenges to 2e students. Children with disabilities may be deemed ineligible for services due to the lack of correspondence with a category within IDEA, changes in how disability is defined or identified, or the finding that special education is not necessary despite the presence of an eligible disability. The emphasis of special education on disability further prevents many 2e students from access to the full range of services they need. These issues are not unique to special education, however, and are complimented by concerns unique to the administration of gifted and talented education.

3. Gifted and talented education

3.1. Overview

Gifted and talented education refers to instructional services designed to address the needs of individuals who exhibit outstanding abilities. Beginning in the 1960s, identification and instruction program development were mandated in California and Illinois, with additional states mandating their own programs in the 1970s and 1980s (Van-Tassel-Baska, 2018). Notwithstanding the limited funds available through the fitful passage of education initiatives, the Jacob K. Javits Gifted and Talented Students Education Act (1988) and its subsequent reauthorizations represent the primary federal contribution to the education of gifted and talented students (Renzulli et al., 2014). The Javits Act established the Office of the Gifted and Talented and provided funds for assessment of the needs of gifted and talented children, large-scale research projects pertaining to program development, and funding for services of students from historically disadvantaged groups. Unlike IDEA, the Javits Act does not represent a mandate or procedural structure for the provision of instructional services, but has proven critical to the dissemination of findings related to the identification and optimal instructional arrangements for gifted and talented students (Gubbins et al., 2014).

Given the lack of a federal mandate, gifted and talented education is diverse. This includes how various programs address the fundamental

question of what qualifies as gifted and talented as well as types of services students receive. Historically, IQ represented the primary variable used in identifying gifted individuals (Fernández et al., 2017). Modern definitions tend to emphasize a wider array of abilities. Federal sources (e.g., U.S. Department of Education, 1993) generally define gifted and talented students as those who demonstrate high intellectual, creative, artistic, academic, or leadership capacity. However, states are permitted to depart from the federal definition in identifying and serving students (Woods, 2016). Scholars and advocacy groups increasingly advance broad conceptions of giftedness including memory, physical performance, and interpersonal skills (e.g., National Association for Gifted Children, 2019; Piirto, 2007). The goal of gifted and talented education is to maximize student learning; however, there exists a wide range of opinion regarding the most effective forms of instruction (Lockhart et al., 2021).

One unfortunate point of consensus, however, is that gifted and talented students—particularly those from historically marginalized or disadvantaged groups—are often underserved (Peters et al., 2019). The difficulties 2e students may have in receiving an appropriate education are exacerbated by the current state of gifted and talented services. The remainder of this section describes challenges 2e students face in accessing gifted and talented services, many of which relate to procedures for identification and quality of services. A systemic approach to addressing these issues, multitiered systems of support (MTSS), is also discussed.

3.2. Issues with identification and service delivery

The absence of a federal mandate related to gifted and talented education permits states a great deal of flexibility in responding to local needs, but also ensures a disparity in available services (Rinn et al., 2020). State definitions of gifted and talented are more restrictive than those used by the National Association for Gifted Children (2019), with IQ, creativity, and academic ability serving as primary determinants (Rinn et al., 2020). This contradicts expert recommendations for specialists in the education of the gifted and talented, whom are advised to use multiple sources of data when making a determination (National Education Association, 2006). Special educators, by contrast, are legally obligated to conduct a multicomponent, nondiscriminatory evaluation (Yell et al., 2011). Aggregating findings from subtests of standardized test batteries can obscure high performance in individual areas, thus preventing identification (National Education Association, 2006). Standardized IQ and achievement assessments are also notable for being far more likely to exclude Black, Native American, and Hispanic students relative to nontraditional methods aligned with multifaceted conceptions of giftedness (Hodges et al., 2018).

Specific criteria and methods for identification of gifted and talented students, though derived from state definitions and required in the majority of states (75%), are partially or fully left to local education agencies in most cases (Rinn et al., 2020). Relying on teacher discretion in the nomination process, though common, may be problematic given that many educators receive limited training related to gifted and talented students or accept narrow conceptions of giftedness (Gubbins et al., 2014; Rinn et al., 2020). Although generally associated with the identification of students who need additional instructional support, only a small number of states have adopted universal screening (i.e., routine assessments administered to all students; VanMeveren et al., 2020) to assist in the comprehensive identification of gifted and talented students (Rinn et al., 2020). As with the varying definitions of gifted and talented, the inconsistent procedures used at the district and school level suggests identification can be a result of geographic location rather than actual student performance (Hodges et al., 2018).

Characteristics unique to 2e students tend to exacerbate the limitations of identification procedures for gifted and talented children more generally. As noted previously, masking can prevent the identification of disabilities in individuals who have been identified as gifted and

talented. When attempting to identify students as gifted, masking likewise occurs when the characteristics of a disability preclude the identification of strengths and talents (Assouline & Whiteman, 2011). The effect of masking can be particularly pronounced for students with autism spectrum disorders or other disabilities characterized by issues with verbal and social skills (Burger-Veltmeijer & Minnaert, 2011). The boredom that may result from placing children within insufficiently challenging contexts can produce inappropriate behavior, which can be wrongly ascribed to an existing or comorbid disorder (Gilman et al., 2013). The confluence of characteristics of disability and giftedness may vary depending on the nature of the disability, suggesting that expertise relevant to both populations may be required in order to effectively diagnose 2e students.

Gifted services are reportedly mandated in all states except South Dakota; however, little more than half of states provide funding, dedicated personnel, or specific instructional standards, and many decisions are relegated to the district level (Rinn et al., 2020). Callahan et al.'s (2017) examination of district-level instructional decisions revealed few programs articulate measurable outcome goals and emphasize creativity or problem solving over other potential areas of development. The most common service delivery model is differentiation of instruction in the general education classroom, in which individual teachers must plan to account for different ability levels within a heterogeneous environment (Rinn et al., 2020). Yet the quality of differentiation is highly variable (Lockhart et al., 2021), and has historically been observed to occur far less often than districts suggest (Gubbins et al., 2014). Compounding issues with differentiated instruction for gifted and talented children is the lack of accountability mechanisms, such as annual reports of progress, in most states (Rinn et al., 2020). More effective options, such as acceleration (i.e., allowing students to move through programs at a faster pace; Siegle et al., 2013), are reportedly provided less frequently and require funding, qualified personnel, or other resources that are often not available for gifted and talented programs (Lockhart et al., 2020). The limitations of gifted and talented instruction are likely to be more critical for 2e students, whose patterns of strengths and needs require additional resources in terms of training and experience across special and gifted education (Foley-Nicpon et al., 2013).

There is tremendous inconsistency in fundamental aspects related to gifted and talented education, including how students are defined, identified, and educated (Rinn et al., 2020). Given current special and gifted education practices, there is a chance that 2e students may not be identified for either service (Assouline & Whiteman, 2011). Due to masking, identification as having either a disability or area of high ability appears to reduce the likelihood of receiving services relative to the other, unidentified status. In addition to problems with identification, the two entities designed to serve 2e students face challenges in terms of providing practitioners with adequate professional development, promoting collaboration across disciplines, and identifying appropriate instructional approaches.

3.3. MTSS: A potential solution to issues of service delivery

The barriers to effective services for 2e students are primarily systemic in nature (Lockhart et al., 2021). Potential solutions such as raising awareness, additional training and resources, and guidelines to establish consistent criterion and multifaceted evaluations therefore require comprehensive, systems-level change (Gubbins et al., 2014). The tumultuous history of the Javits Act, which perennially struggles to maintain funding, suggests the impetus for such changes may be elusive (VanTassel-Baska, 2018). One positive development is the increasing application of schoolwide MTSS frameworks. Originally inspired by the delays associated with special education services, MTSS allocate resources (e.g., targeted small group instruction) to students on the basis of ongoing assessment (e.g., progress monitoring; King et al., 2012). MTSS engages the entire school in providing a continuum of support for students regardless of formal diagnosis, thus alleviating some of the

difficulties many 2e students face in the evaluation process (e.g., Yssel et al., 2014).

A hypothetical model of MTSS designed to address the needs of students in need of both academic support and enrichment appears in Fig. 2. Multiple points of assessment ascertain whether a student requires support or enrichment, which would be provided to the entire population across multiple levels of intensity (i.e., tiers). As in current models of MTSS, placement would occur on a domain specific basis, increasing the likelihood that 2e students would receive appropriate instruction. In order to prove most effective for 2e students, promising instructional frameworks such as MTSS must be accompanied by advances in identification and instruction. The next section addresses the role of neuroscience in education, and its relation to challenges faced by 2e students.

4. Comments on neuroscience and 2e education

Admittedly, the relationship between neuroscience and the challenges associated with the education of 2e identified in previous sections may not be readily apparent. Devonshire and Dommert (2010) suggest differences in the language, research paradigms, and objectives of neuroscience and education as potential barriers to a functional partnership. Education is an applied discipline concerned with achieving specific instructional goals in the classroom, whereas neuroscience investigates basic scientific questions concerning brain function that may not be relevant to educators in the field. Much of the research in neuroscience pertains to molecular and genetic factors, neurotransmitters, brain imaging, the origin of various disorders, and observations concerning typical behavior. Aside from applications to special education related primarily to assessment, these foci have little direct implications for how to provide instruction in the classroom.

Though there may be some truth to Devonshire and Dommert's (2010) assessment, neuroscience increasingly has important implications for education, particular as it pertains to individuals with disabilities, including 2e individuals (Bruer, 2016). Much of this work involves examining biomarkers associated with SLD, ADHD, autism, and other disabilities. There is admittedly much work to be done in the area of diagnosis, and the field is likely many years away from a time when neuroscience will supplement policy-based approaches to identification (e.g., MTSS). Nonetheless, work in neuroscience already exhibits potential alternative means of identifying and conceptualizing disorders and giftedness. Recent work in dyslexia (i.e., SLD in reading), for example, proposes the disorder stems from issues with phonological development, and a lack of correspondence between neural activity and the rhythms of speech (e.g., Goswami, 2018). Advances have likewise been made in the objective identification of ADHD (e.g., Mahony et al., 2014). In terms of gifted and talented education, studies have also identified differences in brain activity that correspond with academic ability in individuals with autism (Iuculano et al., 2020), and such assessments may allow for the more effective diagnosis of 2e students.

Objective assessments of disability and giftedness offer many advantages in term of identifying 2e students, whose profiles tend to obfuscate the existing diagnostic process, as well as potential service recipients more generally (Assouline & Whiteman, 2011). There are nonetheless several caveats to consider as research concerning objective assessment emerges. Many diagnostic techniques associated with neuroscience are relatively novel, and therefore have difficulty distinguishing between disorders with similar symptoms, accounting for variability within a single disorder, or controlling for the effect of environmental factors on development (Thomas et al., 2019). Even as more advanced diagnostic techniques emerge, limited resources and expertise are likely to result in the persistence of less expensive or more convenient alternatives, such as the use of rating scales for ADHD (Mahony et al., 2014). The emergence of more technically sophisticated evaluation techniques could fully supplant alternative sources of identification and have the unintended effect of making an official diagnosis

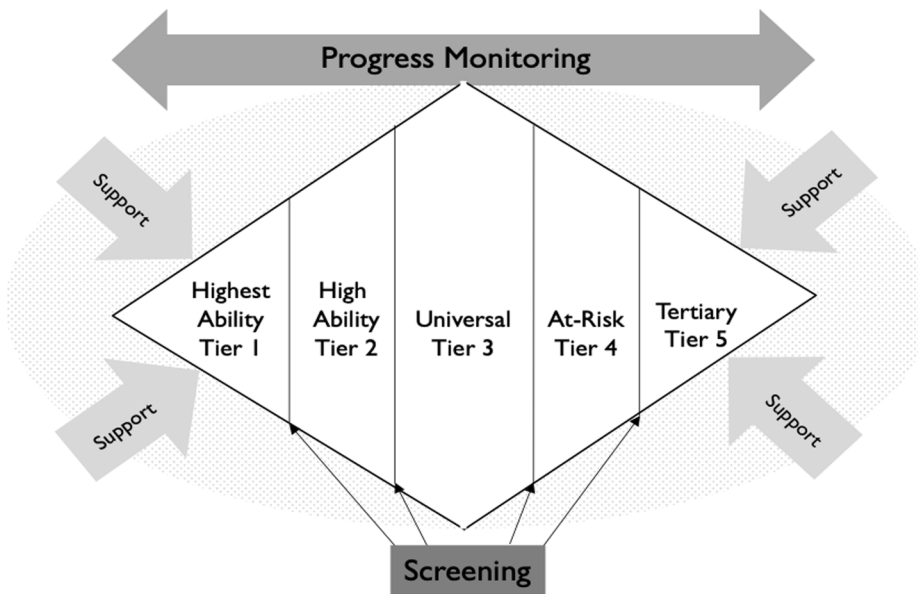


Fig. 2. Hypothetical model of a schoolwide multi-tiered system of support designed to address the needs of children who require support for academic difficulties (e.g., at-risk, tertiary) and enrichment opportunities across appropriately intense levels of instruction provided across the typical school context. Universal screening data at multiple points throughout the year is used to ensure appropriate instructional progress and inform placement decisions. More frequent progress monitoring captures data concerning the more immediate impact of instruction. Support is provided from a range of school personnel, as appropriate. Each school encompasses multiple subject specific continua of supports, increasing the likelihood 2e students receive appropriate services.

of disability or giftedness harder to obtain. Evaluations for special education and gifted programming should be widely available, nondiscriminatory, include multiple sources of information, and, in terms of giftedness, allow students to satisfy a single criterion for identification (Lockhart et al., 2021; Yell et al., 2011).

Relative to assessment, research in neuroscience may be further away from informing actual classroom level instruction; however, this work increasingly provides insight into the internal mechanisms responsible for effective instruction (Thomas et al., 2019). Various studies have examined the effect of neuroinhibitory medication on the effectiveness of various forms of instructional intervention for individuals with disabilities (Travis, 2013). A more comprehensive, instructionally relevant approach to this work remains elusive, in part due to the cultural and dispositional differences of neuroscientists and educators (Devonshire & Dommert, 2010) and the difficulties of examining the functioning of the brain within an education context (Thomas et al., 2019). The relatively small number of 2e students further prevents researchers from conducting largescale studies. Addressing these issues will potentially require using experimental methods common in special education, which commonly conducts research among small populations, but generally unobserved in gifted instruction or neuroscience (e.g., single-case design; Simonsen & Little, 2011; Soto, 2020). Leaving aside methodological concerns, researchers and service providers should seek input from 2e individuals and their families and be aware of the challenges they face within the education system (Parent Panel, 2021).

5. Conclusion

Despite the issues I experienced over the course of my education, I ultimately benefitted from the services I received. Special educators encouraged me to type at an early age, rather than continue to struggle with handwriting, and my experience in a gifted and talented program definitely prepared me for a post-secondary education. But my experiences, and the experiences of others (Student panel, 2021), suggest that 2e individuals continue to struggle in obtaining services that address their strengths and disabilities. Due to issues with identification and service provision, special and gifted education far too frequently provide less than optimal instruction to 2e students. I remain hopeful that the combination of systemic changes and scientific advances—some of which are described in this special issue—will help realize the potential of this underserved population.

CRediT authorship contribution statement

Seth King: Writing – review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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