

# Understanding Twice-exceptionality (2e): A Multi-systems Perspective

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## ABSTRACT

Although research and interests in twice-exceptionality (2e) have been increasing in the last few decades, most studies have focused on the definition, identification, and academic achievement in twice-exceptional students. Such focus can be understandable due to varying definitions, research operationalizations, and the lack of a typical twice-exceptional profile (Lee & Ritchotte, 2018; Wellisch & Brown, 2013). There is considerably less research focused on cognitive characteristics and least research focused on investigating non-cognitive factors influencing twice-exceptional performance and development (Beckmann & Minnaert, 2018). This paper serves to summarize factors that have been found to impact twice-exceptional, organized through a multi-systems (e.g., interpersonal, intrapersonal, contextual/situational, sociocultural, and socio-economical) approach, starting from individual variables to larger and more distal systems.

*keywords: contextual factors; learning; non-cognitive factors; sociocultural factors; socioeconomic factors*

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## 1. Introduction

Who are twice-exceptional children? Although definitions vary, in general, twice-exceptional children are students that are gifted in one or more areas and also have a disability that makes some aspects of academic achievement difficult (Brody & Mills, 1997). Brody and Mills (1997) wrote of at least three subgroups of twice-exceptional children that might be unidentified within the educational system: underachieving gifted students; students identified primarily for special education services (without support for their gifts); and students whose gifts and disability mask each other.

Conservative estimates of twice-exceptional students within the United States in kindergarten through 12th-grade public schools vary from 360,000 (National Education Association, 2006) to almost 610,000 (Bernard-Brak et al., 2015) depending on definition criteria. The number of US public school students receiving special education services since 2012 has been trending higher. Literature and interest in twice-exceptional though growing in the last few decades have mainly focused on the definition, identification, and academic achievement of twice-exceptional students due to challenges in untangling the wide umbrella of disabilities categories (e.g., Barnard-Brak et al., 2015; Maddocks, 2020; Ronksley-Pavia, 2020). The research focused on cognitive characteristics has been lagging, with the least research focused on non-cognitive factors (Beckmann & Minnaert, 2018). Foley-Nicpon et al. (2011) conducted the first comprehensive empirical literature review between 1990 to 2009 and found a total of 43 empirical studies, five studies that focused on psychosocial factors, and 16 additional studies reporting secondary non-cognitive characteristics/findings. Recent neuroscience findings support embodied understandings of human development and cognitive processes (e.g., Badcock et al., 2019), thus non-cognitive factors have become critical to further our understandings. In this selective review, current twice-exceptional research findings and discourse will be organized around a multi-systems perspective beginning with individual

differences followed by interpersonal factors and ending with macro systems factors such as socio-cultural and socio-economical influences.

The multi-systems perspective refers to the approach that understanding complex systems (twice-exceptionality) requires the study of not only multiple levels of analysis, but also the dynamic interactions between different systems and within systems. The multi-systems approach derived from the mathematical disciplines and have been applied to the bio-social realm in the 1940s (e.g., Chapin & Zipf, 1941), and to human development, childhood, and parenting in the 1970s (e.g., Bronfenbrenner, 1974, 1977, 1980). In recent years, multi-systems perspectives have been applied to development systems (e.g., Blumberg et al., 2017; Marmeleira & Duarte Santos, 2019; Van Geert, 2019), education (e.g., Baker et al., 2012; Lesh, 2006). Mayes and Moore (2016a) have applied an ecological theoretical framework with their research on African American twice-exceptional students. However, this perspective has not been applied as an overarching framework to understand twice-exceptionality and its complexities.

## **2. Intrapersonal Domains**

### *2.1. Cognitive Skills*

Intergroup research that is conducted around cognitive abilities/characteristics of twice-exceptional individuals mainly center around school age through college students and include comparisons between typically developing, gifted, twice-exceptional, and students with disabilities such as Specific Learning Disability (SLD), Autism Spectrum Disorder (ASD), or Attention-deficit/hyperactivity disorder (ADHD) (e.g., Coleman, 2001; Nielsen & Higgins, 2005; Ottone-Cross et al., 2017, 2018, 2019; Waldron, & Saphire, 1992).

Ottone-Cross et al. (2017, 2018, 2019) investigated gifted, SLD, and gifted with SLD (G/SLD) students with performance on the Kaufman tests of Educational Achievement. They found that G/SLD students performed more like SLD students on lower-order skills (e.g., decoding, math computation) while performing like gifted students on higher-order skill assessments. Similarly, verbal comprehension was a strength for gifted students with a specific learning disability in written language (G/SLD/WL) and gifted learning disabled (G/LD) children (Assouline et al., 2010; Bireley et al., 1992) while sequencing factors were challenging for G/LD children (Bireley et al., 1992).\_ Also, G/SLD students showed more asynchrony in their academic performance (Ottone-Cross et al., 2019). Coleman (1992) found G/LD middle schoolboys used more planful problem-solving in coping with school frustration compared with LD boys.

In contrast, Bireley et al. (1992) found less activation in brain regions associated with planning in G/LD students compared to peer controls but not under conditions of frustration.\_A wide range in cognitive assessment scores was found within gifted SLD written language (G/SLD/WL) students (Assouline et al., 2010), pointing to the need for further research into cognitive assessment variabilities for the twice-exceptional population. Zentall et al. (2001) reported parent and teacher agreements in reports of twice the number of attentional issues and difficulties in completing lower-level skill tasks for gifted and ADHD (G/ADHD) elementary boys compared to gifted or ADHD boys.

### *2.2. Explicit Beliefs/Attitudes*

Beckmann and Minnaert (2018) examined 23 studies and found that G/SLD students have negative views of school and attitudes. Interviews with successful college G/LD students revealed themes of positive self-knowledge, self-acceptance, and self-determination (Dole, 2001).

### *2.3. Developmental Factors*

Fine-motor difficulties findings in G/SLD/WL (Assouline et al., 2010) and G/ASD (Assouline et al., 2011) paired with the finding of fine-motor skills being predictive in math achievement

(Assouline et al., 2011) points to further nuanced considerations for twice-exceptional children using achievement performance as indicators of cognitive abilities.

#### *2.4. Self-Concept/Esteem/Perceptions*

Negative/low self-concept/esteem have been found in G/ADHD boys (Cramond, 1994), G/SLD students (Bechmann & Minnaert, 2018), G/LD adolescents (Barber & Mueller, 2011), African American students (Mayes et al., 2014), and G/LD college students (Reis & Colbert, 2004). Baum and Owen (1988) found G/LD students perceived themselves as less successful academically and feel shy compared to LD and typically developing 4<sup>th</sup> to 6<sup>th</sup> graders. Other studies such as Foley-Nicpon et al. (2015) found that the overall self-concept of G/ASD or G/SLD youths to be in the average range, and unrelated with cognitive ability and education delivery models (accommodations for disabilities and gifted programming, academic acceleration). Vespi and Yewchuk (1992) found G/LD children and gifted children exhibit high expectations in non-academic contexts and high independence, while self-image oscillations and fear of failure were unique G/LD characteristics. Assouline et al. (2010) found wide variability within subscales of the self-concept scale reported by G/SLD/WL students even though total and all subscales were all in the average range.

#### *2.5. Neurophysiology*

Studies investigating neurophysiology focus mainly on intergroup cross-sectional comparisons such as low or high capacity, LD, or gifted subjects using brain imaging techniques such as functional magnetic resonance imaging (fMRI) and/or electroencephalogram (EEG) (Bireley et al., 1992; Newman, 2008). Newman (2008) proposed three areas of consideration when studying neural bases of giftedness (functional connectivity, malleability of processing networks, and neural efficiencies).

A pilot brain mapping and visual testing study on 11 G/LD children between nine to 14 years were conducted by Bireley et al. (1992). They found significantly higher levels of cortical arousal in both open eyes and eyes-closed resting EEG in G/LD children compared to LD or peer controls in the occipital, parietal, central, and frontal regions of the brain (central theta). Eyes-closed EEG produced the highest central theta activity and is found in mammals and humans under states of relaxed alertness. This study also found G/LD students with almost three times higher visual perceptual processing patterns compared to peer controls and twice higher than LD students. Auditory processing patterns were delayed in both selective attention and decision-making-stimulus evaluation in the G/LD group compared with peers, with auditory processing skewing towards the right hemisphere, indicating right temporal brain processing before the information is sent to the left temporal region for processing. G/LD children were found with vi-quo-spatial preferences when processing complex task stimuli. In addition, G/LD children had less focused frontal lobe activity, which was interpreted as indicating less efficient, flexible, or adaptive use of planning.

#### *2.6. Creativity*

Cramond (1994, 1995) proposed overlaps in creativity and ADHD behavioral symptoms from her review of ADHD literature. Teachers were found to view G/LD 4<sup>th</sup> to 6<sup>th</sup> grade gifted LD students as more creative compared to LD students, and G/LD students had more creative productive interests (Baum & Owen, 1988). Zentall et al. (2001) also reported creativity in G/ADHD elementary boys. LaFrance (1995) investigated gifted, GD/LD, and LD children using the Torrance Tests of Creative Thinking Figural Form B (TTCT) and the Descriptive Discriminant Analysis (DDA) and six predictors of TTCT discriminated gifted from LD and GD/LD children on creative thinking characteristics, with cognitive factors found to be the top three predictors. Other researchers such as Morrison (2001) investigating core characteristics

shared by gifted and a disability category such as emotional or behavioral disabilities (EBD) and also identified creative thoughts as a characteristic of this twice-exceptional population.

### *2.7. Emotions and Mood*

G/LD children were found to resemble LD children with negative academic frustration and anxiety (Vespi & Yewchuk, 1992). Antshel et al. (2008) Gifted ADHD (G/ADHD) youths had higher rates of anxiety, depressed affect compared to gifted youths in their study. G/SLD students were also found to have negative emotions and felt frustrated with the discrepancy between school performance and potential (Beckmann & Minnaert, 2018). Coleman (1992) found G/LD middle school boys used fewer expressions of helplessness in coping with school frustration compared with LD boys. Morrison (2001) described gifted students with EBD to be highly sensitive and intense.

### *2.8. Behaviors*

Fourth to 6<sup>th</sup> grade G/LD students were found to cause more classroom disruptions compared with LD or typically developing students (Baum and Owen, 1988). Antshel et al. (2008) found that G/ADHD youths had higher rates of school problems (aggressive behaviors, delinquency) and withdrawn behaviors compared to gifted youths in their study. High Intellectual and school status, happiness and satisfaction, and low anxiety are all positively correlated with higher behavior adjustment in a sample of 46 gifted autistics with specific learning disability (G/ASD/SLD) youths (Foley-Nicpon et al., 2015). Coleman (1992) found G/LD middle school boys used less distancing and less escape avoidance in coping with school frustration compared with LD boys. On the other hand, G/LD children resembled LD children with negative work habits (Vespi & Yewchuk, 1992). Assouline et al. (2010) found large individual variabilities in scores for G/SLD/WL students on atypical behaviors, hyperactivity, and aggression, signaling clinically significant externalizing behaviors for some but not all G/SLD/WL students in their study. Studies that examined successful gifted LD college students found positive self-advocacy built positive identities (Dole, 2001).

## **3. Interpersonal Domains**

G/ASD students often have poor socialization and communication skills (Assouline et al., 2008; Rubenstein et al., 2015). Foley-Nicpon et al. (2015) discussed the possibility for G/ASD/SLD youths to present with positive illusory bias, citing studies showing low correlations in behavior, social and emotional self-reports, and reports by parent or teacher. Wang and Neihart (2015) reported that Singaporean twice-exceptional students perceived parent, teacher, and peer support most influenced their strategy use.

### *3.1. Family/ Primary Care Takers*

Dare & Nowicki (2015) found parental reports of extreme strengths and weaknesses, awareness of difference, and desire to be accepted in their twice-exceptional children, often leading to frustrations and stress. On the other hand, parents were first to recognize and act on frustrations experienced by their children. Parents of G/ASD students perceived asynchronous development, need for strict structure and predictability, lacking social skills, and intense interests paired with high intellect as challenging (Rubenstein, 2015). Antshel et al. (2008) found that G/ADHD youths had higher rates of problems with parents compared to gifted youths. Parental reports on G/SLD/WL students reveal more behaviors at risk (hyperactivity, withdrawal, attention problems) compared to teacher's ratings and students' self-report (Assouline et al., 2010). G/SLD/WL students also self-report more positive feelings around emotions, relationships, environments, and behavior in contrast to ratings by parents and teachers. Mothers of twice-exceptional children perceived that they played a big role in their

twice-exceptional children's academic success in adulthood (Neumeister et al., 2013), while another study found that twice-exceptional adolescents perceived maternal relations less positively compared to gifted and non-gifted adolescents (Barber and Mueller, 2011). It is plausible that successful and unsuccessful twice-exceptional individuals may have differing relationship perceptions.

### *3.2. Peers*

Vespi and Yewchuk (1992) found G/LD children to be like gifted children in non-verbal ability to interpret and communicate while having unique characteristics of possessing social skills but inconsistency in using social skills. Foley-Nicpon et al. (2015) found significant but weak positive relationships between processing speed and popularity self-perceptions in their sample of G/ASD or G/SLD youths. On the other hand, Antshel et al. (2008) found G/ADHD youths had higher rates of problems with peers, and the opposite sex compared to gifted students in their study. G/LD college students reported peers treating them negatively during elementary and secondary years (Reis & Colbert, 2004). Wang and Neihart (2015) investigated Singaporean twice-exceptional students' perceptions of supports by peers, teachers, and parents, and found that peers were perceived to most influence their success. On the other hand, African American students perceived their peer relationships to be negatively impacted by their participation in special education services (Mayes et al., 2014).

### *3.3. Mental Health and Educational Professionals*

Teacher expectations and beliefs have been found to impact twice-exceptional students through teacher gifted referrals (e.g, Bianco, 2005; Bianco & Leech, 2010), instructional choices, and strategies (e.g., Missett et al., 2016).

Foley-Nicpon et al. (2013) found differential levels of familiarity with twice-exceptional in regular teachers, special educators, gifted specialists, and psychologists. Additionally, teaching students with diverse abilities was an area early-career Australian teachers reported feeling less prepared (Rowan et al., 2016). Such perceptions seem mirrored in reports by twice-exceptional students. G/LD college students reported negative and painful school experiences during elementary and secondary school years from problems with teachers (students were called lazy and told to work harder), grade retention, placement in self-contained special education class with developmentally delayed students, to repeated punishment for untimely work, which impacted their social and emotional growth (Reis & Colbert, 2004). Half of the G/LD college students reported seeking professional counseling after high school due to complex emotions around mixed messages received up through high school. Mayes et al. (2014) reported that African American students perceived that their relationships with educators and counselors were negatively impacted by their participation in special education services.

Assouline et al. (2010) found teachers' self-reports of G/SLD/WL students to have mild challenges to adapting environmental changes (this was not reported by parents) while possessing average adaptive skills indicating the ability to communicate needs, social skills, change adaptability, and show leadership. Zentall et al. (2001) reported teacher interest and individualized attention were most helpful to increase motivations in G/ADHD elementary boys.

## **4. Contextual/Situational/Variabilities**

### *4.1. Within School Environments*

#### *4.1.1. Specific Academic Domains*

Al-Hroub (2009) found declined self-concept for math in Jordanian math gifted learning difficulties (MG/LD) students after five weeks of regular traditional math teaching, in contrast to increased self-concept for MG/LD students taught with a multi-sensory math approach.

However, looking at within-group changes in math self-concept, there was no change for almost half of the students in either math teaching condition, suggesting varying sensitivity to context for MG/LD students.

#### 4.1.2. Academic Acceleration

Foley-Nicpon et al. (2015) found significant positive relations between whole-grade acceleration and verbal comprehension in G/ASD but not G/SLD youths. On the other hand, Assouline et al. (2012) found subject and grade acceleration did not predict academic achievement in G/ASD in written language, reading, math, and oral language. Their study included subjects with a wide age range (five years six months to 17 years 11 months), which might have impacted results.

#### 4.1.3. Talent Development Gifted and/or Special Education Programming

G/ASD/SLD youths, who participated in talented and gifted programming, tended to have higher verbal comprehension and working memory (Foley-Nicpon et al., 2015). G/ASD students were found to experience more security and higher quality friendships when they participated in talent development opportunities (Foley-Nicpon et al., 2015). In contrast, academically driven Gifted youths with self-reported social difficulties, who participated in a two-week summer enrichment and received social skills interventions were found to have smaller changes in friendship closeness scores (Foley-Nicpon et al., 2017).

### 4.2. *Beyond School Environments*

#### 4.2.1. Support Systems

Successful college G/LD students were interviewed, and Dole (2001) found supportive systems formed by parents, peers, friends, teachers, and mentors supported positive identity formation in their study.

#### 4.2.2. Extracurricular Activities

Dole (2001) also found successful G/LD college students to report extracurricular activity opportunities that allowed the building of strengths and self-esteem.

## 5. **Sociocultural, Socioeconomic Influences**

Giftedness and disability have been proposed as social constructs (Foley-Nicpon & Assouline (2020) with socioeconomic, gender, and race prejudices impacting identification, access, and understanding (Bireley et al., 1992). Asian American twice-exceptional parents were found to be aware of Asian cultural expectations of emphasis on education and hierarchical family relationships, yet their parenting was found to be influenced by their parental values and twice-exceptional children's traits (Park et al., (2018). It remains to be seen how multi-culture exposure interacts with parenting practices, values, and individual traits of twice-exceptional children.

Ambrose (2002) also wrote about paying attention to achievement motivation and talent development opportunities shaped through larger socio-economic contexts. Academic self-concept was found to be embodied within social interactions (Townend & Brown, 2016). Furthermore, highly unequal societies such as the United States are supposed by Ambrose (2013) to suppress social mobility through lack of affordances due to lack of resources and adequate supports. As such, studies such as the empirical study conducted by Barnard-Brak et al. (2015), using a random nationally representative sample of existing special education elementary students and found females, Black, and Hispanic students are least likely to be identified and participate in gifted programming although they meet the gifted qualifying criteria. Such findings are in line with research around certain racial and economically

disadvantaged students being under-identified for exceptionalities (Ambrose, 2002, 2013). On the other hand, researchers such as Mayes and Moore (2016b) reported an overrepresentation of African American students in special education while being under-representation in gifted programming, further demonstrating the need to pay attention that socio-cultural and socio-economic factors may impact twice-exceptional student growth and development differentially.

## 6. Implications and Future Directions

An inductive meta-analysis conducted by Beckmann and Minnaert (2018) on 23 studies concluded that studies supporting both positive and negatives were found although more studies were finding negative self-perceptions, negative interpersonal relationships, high creativity, negative attitudes, negative emotions, positive motivation, more resilience and coping, and higher metacognition. Such findings point to the complexity of conducting a meta-analysis on twice-exceptional literature. Perhaps clearer patterns across studies may appear if there are sufficient research studies to conduct a meta-analysis with interpersonal, contextual, sociocultural, and socioeconomic factors as dependent variables.

Most studies are cross-sectional, developmental influence via longitudinal data is an area in need of future research (Lee & Olenchak, 2015). Twice-exceptional students have complex developmental profiles, and pre-school and early elementary services for such students seem most lacking between kindergarten through secondary education (Chamberlain et al. (2007). Another area within the developmental trajectory that requires more research concerns school transitions and their relationship with the twice-exceptional student neuro-biological development. Prior (2013) proposed school transitions as opportunities for schools to identify twice-exceptional students.

Cain et al. (2019) conducted secondary data analysis and multilevel analyses using Pre-Elementary Education Longitudinal Study and the Special Education Elementary Longitudinal Study datasets to model growth in academic outcomes over time. They found GD/ASD students had higher academic performance compared to ASD students and showed more improvements over time compared with ASD and the general student population. It is not clear if this trend may hold for all twice-exceptional students or in particular to the GD/ASD population and indicates the need to further explore performances, growth, and other factors over time and with specific subpopulations of twice-exceptional children.

Additionally, data collected on twice-exceptional individuals should also include other perspectives such as parental, school/educator, professional provider/s, researcher observations, or self-report by twice-exceptional individuals. Such perceptual data collected with objective measurements can serve to better dissect findings from actual differences versus perceived differences. Macrolevel factors such as culture, race, gender, evolutionary history, and societal interactions should always be scrutinized in every study.

Understanding twice-exceptional through refinements in theoretical framework refined through empirical and interdisciplinary investigations is the key to creating understanding and appropriate learning environments for twice-exceptional individuals. A multi-systems approach, such as an ecologic-neurophysiologic-developmental framework, is useful to organize and evaluate current findings, and a critical consideration in the design and interpretation of future twice-exceptional studies and findings.

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