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The Interpersonal Whole-Brain Model of Care® (IWBMC™), Cognition, and Academic Performance A Case Study of an Autistic Child

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Abstract. The prevalence of autism spectrum disorder (ASD) diagnoses has increased significantly, with current Center for Disease Control data indicating 1 in 36 children are diagnosed with ASD. Individuals with ASD often face educational challenges stemming from differences in neural and cognitive development. While numerous therapeutic approaches exist, the diverse nature of ASD necessitates individualized interventions. This case study investigates how an integrated model of care affects the academic performance and cognitive functioning of an adolescent diagnosed with ASD. We tracked one participant's progress through the Interpersonal Whole-Brain Model of Care® (IWBMC™) over six years using a longitudinal single-subject design. We collected data through EG assessments, cognitive functioning measures, and standardized academic testing (WRAT4). Results demonstrated improvements across all domains: neurological functioning showed normalization of brain wave patterns, cognitive measures improved across different tasks, and academic performance advanced by 2-5 grade levels in core subjects. While generalizability is limited by the single-subject design, findings suggest that the IWBMC™ model's individualized approach and foundation in empathetic therapeutic alliance may effectively support development across multiple domains for individuals with ASD. This study provides a foundation for larger-scale investigations of integrated intervention approaches.

Keywords. autism, intervention, cognitive development, academic performance

[1] Introduction

Autism spectrum disorder (ASD) is a complex neurodevelopmental condition characterized by a diverse range of symptoms that vary significantly in nature and severity among individuals (Gleeson, 2024). The prevalence of ASD has increased dramatically, with current data from the Centers for Disease Control and Prevention indicating that 1 in 36 children in the United States are now diagnosed with ASD (Maenner et al., 2023), representing a significant increase in diagnoses over the past two decades. Individuals with autism face several key challenges, including cognitive processing and functioning difficulties (including language delay), impaired social communication, and problems with emotional regulation (Mostek, 2022). Educational performance presents a particular challenge for many autistic children (St.

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John, Dawson, and Estes, 2018), with their academic achievement often significantly behind their neurotypical peers in mathematics and reading. Researchers attribute these difficulties primarily to challenges in neurological efficiency, cognition, and executive functioning (Mostek, 2022; Hirota & King, 2023).

In response to these academic, social, and cognitive challenges, multidisciplinary coalitions of researchers, clinicians, educators, and parents have focused on understanding the underlying mechanisms of autism (Angkustsiri et al., 2022). Their research has revealed that autism's causes are both environmental and genetic. The interaction between these factors influences brain development and function, leading to the diverse presentations of ASD observed clinically. This complex etiology underscores the need for personalized approaches in both research and intervention strategies, as risk factors vary significantly between individuals.

To address these challenges, practitioners have developed interventions targeting various aspects of ASD, including communication skills, social awareness and interaction, cognitive processing, and sensory processing and integration (Hume et al., 2021). These interventions aim to enhance both social and physical well-being, ultimately improving the quality of life and functional capabilities of individuals with ASD (Yu et al., 2023). However, a critical review of existing research reveals a tendency toward differentiated rather than integrated practices (Sandbank et al., 2023). While specialized approaches have merit, they may not fully address the complex, interconnected nature of ASD symptoms. This fragmentation in treatment potentially limits intervention effectiveness.

This paper presents a case study introducing a novel integrated model of care and its potential impact on a client's academic progress and cognitive functioning. The strategy employs a complex intervention model, offering a more comprehensive and effective treatment paradigm. This study contributes to the evolving landscape of autism research and treatment while highlighting impacts on autistic students' academic progress and cognitive development. Our goal is to inspire a shift toward more integrated, personalized approaches that better serve the diverse needs of individuals across the autism spectrum.

[2] Literature review

2.1 Evidence-Based Approaches to ASD Treatment

Due to autism's impact on cognitive, social, and physical functions, therapeutic interventions addressing behavior and learning tend to incorporate diverse approaches (Sandbank et al., 2023). Over recent years, several methods have emerged, with particular emphasis on behavioral therapy and sensory integration. Many of these interventions qualify as evidence-based practices (EBPs), with multiple meta-analyses confirming their effectiveness (Hume et al., 2021).

Project AIM (2020) conducted a comprehensive meta-analysis of early childhood autism intervention studies from 1975 to 2019, initially identifying seven core intervention areas: behavioral, developmental, naturalistic (NDBI), TEACCH (school-based), sensory-based, animal-assisted, and technology-based. In their updated analysis, Sandbank et al. (2023) expanded and reorganized these categories to include animal-assisted therapy, behavioral interventions, cognitive behavioral therapies, developmental approaches, naturalistic developmental behavioral interventions (NDBIs), music therapy, sensory integration therapy, sensory-based interventions, Treatment and Education of Autistic and Related Communication-handicapped Children (TEACCH), technology-based solutions, and other interventions. While all methods demonstrated some level of improvement, developmental approaches and NDBIs

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emerged as the most effective interventions, despite behavioral intervention being the most extensively studied.

Project AIM's findings indicate that additional research is needed to validate the effectiveness of certain interventions, particularly in the realm of sensory-based approaches. Nevertheless, the authors endorse these interventions based on consistent positive outcomes reported across multiple studies. Furthermore, researchers emphasize the importance of continued investigation, noting a persistent gap between research findings and practical implementation (Boyd, Stahmer, Odom, Wallisch, & Matheis, 2021).

2.2 An Integrated Direction

Despite theoretical and empirical evidence supporting its value, few studies examine an integrated approach to intervention (Siegel and Drulis, 2023). Preliminary research indicates that combining multiple interventions can reduce autism symptomatology, particularly negative social and emotional behaviors (Sandbank et al., 2023). Given the validation of several individual interventions, researchers suggest the next logical step is developing individualized programming that implements multiple approaches simultaneously rather than relying on single methodologies (Hume et al., 2021). As Hume and colleagues articulate: "Practitioners [should] establish programs with strong program quality as a foundation, develop individualized and clearly articulated goals for children/youth, select and implement practices that may have different theoretical bases but also have demonstrated efficacy" (pg., 4029). The researchers underscore the need for programs that incorporate evidence-based practices, prioritizing both evidence-based practices and strong client-provider relationships. Such integrated programs warrant rigorous study to assess their effectiveness and potential for broader implementation.

The field demonstrates increasing openness to innovative research approaches while maintaining established scientific standards. Bottema-Beutel, Sandbank, and Woynaroski (2023) emphasize the importance of upholding high ethical standards, particularly regarding the disclosure of conflicts of interest and comprehensive reporting of adverse events in intervention research. While the literature validates numerous evidence-based methods for autism intervention, the potential synergistic effects of combining these methods within a comprehensive care model remain largely unexplored. To maintain research quality while exploring this novel direction, we present a single case study examining the impact of an integrated model of care on individual development.

Although limited to a single subject, this study addresses an important gap by focusing on the model of care rather than the client exclusively. We investigate the Interpersonal Whole-Brain Model of Care® (IWBMC™), examining its effectiveness in improving academic achievement and cognitive functioning for individuals with ASD. The IWBMC™ diverges from standardized programming and offers a model that leverages individual strengths and accommodates client uniqueness. This approach aligns with Lord et al.'s (2005) assertion that single-subject studies effectively introduce new methodologies, particularly when employing qualitative descriptors to examine intervention impacts. While acknowledging the limitations inherent in single-subject research, this study represents a crucial step toward developing more effective, individualized approaches to autism care and research. Our investigation centers on a specific research question: How does an integrated model of care help improve the academic performance and cognitive functioning of an adolescent diagnosed with autism spectrum disorder?

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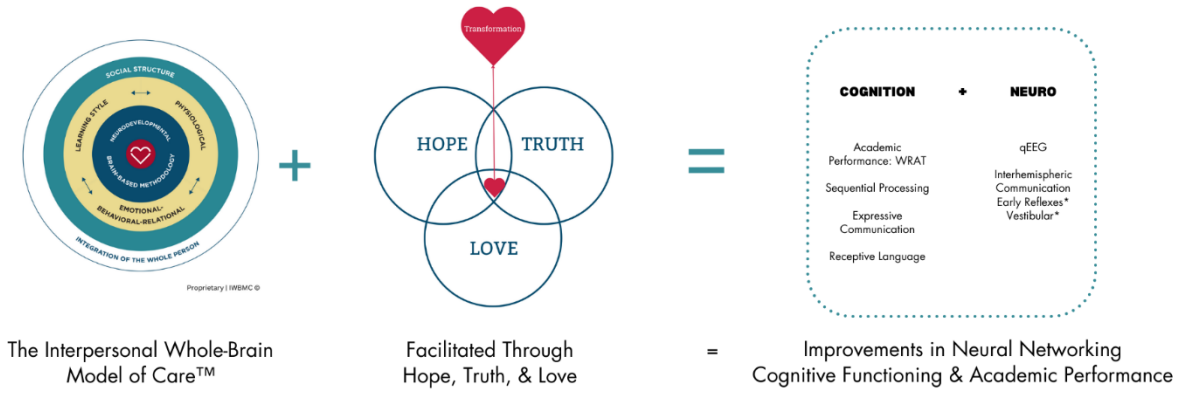
Figure 1 illustrates how the IWBMC™ model functions to enhance both academic performance and neurological-cognitive functioning. The IWBMC™ serves as the comprehensive framework, implemented through a specific approach grounded in hope, truth, and love. Every aspect of the model is executed by trained, empathetic providers who deliver interventions in a highly individualized manner. This delivery method facilitates three key processes:

1. Comprehensive assessment of neurological functioning, identifying strengths and areas for improvement across physiological, emotional, and learning domains
2. Development of personalized intervention plans tailored to each client's unique profile
3. Implementation of these plans by empathetic providers who establish safe, nurturing learning environments

Figure 1.
Logic Model: The Relationship of the Model of Care and Potential Outcomes



The interaction between these model components and their delivery methodology creates the foundation for improved client functioning. Figure 1 depicts this relationship through a logic model, illustrating the hypothesized connections between the IWBMC™ framework, its implementation characteristics, and anticipated outcomes in both cognitive and academic domains.

[3] Methodology

This case study examines the experience of an autistic male client at a small neurodevelopmental center in the southeastern United States. The client participated in an intensive program, engaging with the model of care for six hours daily, five days per week, over a six-year period. The research primarily investigates the model's impact on his academic performance and cognitive development. The following sections detail the specific model of care and interventions implemented through that model of care during his time at the facility.

The field of autism treatment offers numerous therapeutic approaches. However, families often encounter significant challenges due to the fragmented nature of care delivery. Typically, children receive services across multiple settings: educational support at school, supplementary services after school for emotional development and academic enhancement,

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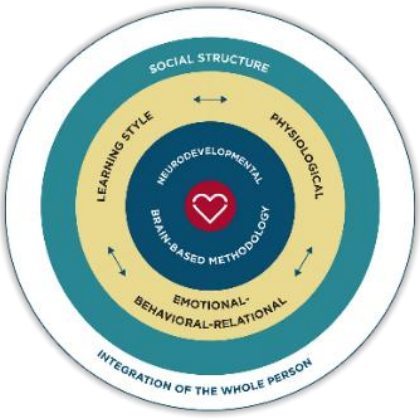
and additional interventions to improve physiological functioning. The Interpersonal Whole-Brain Model of Care® was developed to address many of these challenges by providing parents with an integrated treatment plan. This approach often reduces the emotional and logistical strain on families while fostering a supportive care community that benefits both the child and the family unit. The specific components of the IWBMC™ framework are outlined in the following section.

3.1 The Interpersonal Whole-Brain Model of Care®

The Interpersonal Whole-Brain Model of Care® (IWBMC™) is the culmination of Amy O'Dell's three decades of work with individuals facing neurodevelopmental challenges (O'Dell, Haynes, Saunders, & York, 2024). This comprehensive model integrates theory and evidence-based strategies to create personalized treatment plans. The IWBMC™, shown in Figure 2, encompasses seven core elements that form a comprehensive assessment framework. Beginning with an evaluation of the client's spirit and will, it incorporates a detailed neurodevelopmental analysis alongside assessments of learning styles and physiological attributes. The model examines emotional, behavioral, and relational challenges while considering the client's social support network, including parental and external support systems. These components unite through a whole-brain/whole-person analytical approach to create a complete understanding of the client. O'Dell characterizes this as a "whole-brain, whole person" approach, acknowledging that human development does not occur in isolation. Instead, it is influenced by various biological and environmental factors. The IWBMC™ embraces this perspective, aiming to develop an action plan that addresses the client's biological makeup (including spirit and will, neurobiology, physiological states, and cognitive deficits) and their environmental support systems.

Figure 2.
Diagram of The Interpersonal Whole-Brain Model of Care®



At its core, the IWBMC™ is facilitated by trained, empathetic providers who create optimal environments for growth and learning. This approach acknowledges the complex interplay between internal characteristics and external environments, providing a holistic framework for addressing neurodevelopmental challenges. A key theoretical foundation, though minimally examined empirically in autism intervention literature, is the quality of the therapeutic relationship. Siegel & Drulis established the vital importance of therapeutic relationships in child intervention, proposing that these relationships directly impact brain

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development. He argues that relationships reinforce brain integration and stimulate neural network growth (2023), noting that neurochemical release occurs when individuals feel safe. The established provider-client relationship enables intersubjectivity and information transfer, though this can only occur within a secure environment (Costa-Cordella, Soto-Icaza, Borgeaud, Grasso-Cladera, & Malberg, 2023). Additional research on therapeutic relationships appears primarily in medical literature addressing clinical diagnoses and treatment approaches (e.g., Harrison & Tronick, 2022). By integrating both biological and environmental factors, the IWBMC™ offers a comprehensive strategy for supporting individuals with neurodevelopmental differences, representing a significant advance in personalized care delivery.

The IWBMC™ builds upon interconnected theoretical principles centered on relationship and connection, supported by extensive research on therapeutic relationships (Siegel & Drulis, 2023). The model incorporates multiple established frameworks, including Harter's theories on self-esteem and belonging (2013) and Dweck's growth mindset (2006). Its neurodevelopmental foundation draws from Siegel (2021) and Hannaford (1995), while embracing Bronfenbrenner's (1979) ecological systems theory. Operating on the core values of truth, hope, and love, the IWBMC™ creates individualized "neurological fingerprints" for clients while maintaining realistic expectations about capabilities and potential for change (O'Dell, Haynes, Saunders, & York, 2024). This comprehensive framework addresses neurodevelopmental challenges through an integrated consideration of biological, psychological, and social factors in human development.

3.2 The IWBMC™ in Action: The Participant’s Backstory

Charlie, a 13-year-old boy, entered a neurodevelopmental school in a major metropolitan area in the southeastern United States. Charlie is from an upper-middle-class background, and his family was able to relocate to another state to receive treatment. He was diagnosed with autism at age two.

Charlie’s parents sought help at the neurodevelopmental center after becoming frustrated with a series of interventions in traditional and non-traditional settings. His educational journey took him through public and private schools, where he underwent various pharmacological, behavioral, and educational interventions. Before he arrived at the neurodevelopmental school, Charlie's public school evaluation revealed clinical diagnoses of autism spectrum disorder (ASD), speech-language impairment, and dyspraxia. He also received a later diagnosis of attention-deficit/hyperactivity disorder (ADHD).

State assessments indicated that Charlie's reading comprehension was at a third-grade level. He struggled with receptive and expressive language, particularly engaging in original thought, conversational language, and producing certain sounds and sound blends. Charlie's parents expressed concern about his outbursts and negative behaviors. It was noted in his individualized educational plan that his "cognitive, adaptive, social communication, and academic deficits in addition to delayed developmental rates along with his deficits in expressive and receptive language in addition to articulation needs, impacts [Charlie's] involvement and progress in the general education curriculum" (personal communication, 7/2016). To aid Charlie's progress, the school decided to allow him to receive "appropriated instruction." In addition to accommodation in school, it was noted that Charlie also received four hours of ABA therapy each month. Despite multiple interventions in traditional educational and therapeutic settings, Charlie's progress remained limited. Based on their physician's recommendation, Charlie's parents decided to withdraw him from conventional

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schooling and existing therapeutic programs to enroll him in a facility implementing the IWBMC™ model.

3.3 Engaging the IWBMC™ to Develop Cognitive Abilities & Academic Achievement

The first part of engaging with the IWBMC™ is an initial evaluation that assesses six of the seven components of the model: spirit and will, learning styles, neurological functioning, physiological and emotional strengths and challenges, and social structure. The seventh component of the model—the integration of the whole person drives the selection of interventions for the client. Charlie's initial evaluation at the neurodevelopmental center revealed cognitive development challenges that informed his individualized IWBMC™ treatment plan. The initial assessment highlighted his "Spirit & Will," showing strong learning motivation despite attention issues and anxiety-triggered social withdrawal. He received daily one-on-one support from providers at the center for at least 6 hours daily. Harrison & Tronick's (2022) research on intersubjectivity in autistic children emphasizes the importance of the provider's flexibility and attention to nonverbal cues in creating safe learning environments. The IWBMC™ prioritizes therapeutic relationships, and Charlie successfully built strong connections with his providers over six years (personal communication, 9/16/2024).

The comprehensive IWBMC™ Evaluation provided extensive data through neurodevelopmental assessment and qEEG baseline testing. This evaluation examined early reflex integration, neurodevelopmental abilities, interhemispheric communication, sequential processing, working memory, physiological health, emotional-behavioral-relational abilities, and brain lateralization. The qEEG and LORETA coherence data revealed Charlie's atypical brain activity, showing excessive power across all frequencies (delta, theta, alpha, beta, and high beta), deficient coherence in sensorimotor, pre-frontal, and frontal areas, and dysregulated firing speeds. These patterns indicated his brain struggled to process incoming information effectively, maintaining constant neural activity regardless of whether he was asleep or awake.

Based on his neurodevelopmental evaluation, individualized goals were established to enhance Charlie's emotional regulation, cognitive processing, and neurological functioning. These foundational improvements were designed to create a pathway for academic growth. The following table outlines the general goals:

Table 1.
Sample IWBMC™ Goals for Charlie

Target Area	Intervention
Neurodevelopmental	Address sensory processing, cross-lateral abilities, early reflex integration, vestibular functioning, and visual abilities to improve cognition and attention by participating in a three-month sensorimotor intensive program. a. Utilize a sound therapy program paired with specific neurodevelopmental interventions to specifically address the integration of visual, vestibular, and cross-lateral abilities. b. Increase auditory and visual sequential processing abilities to increase thought and language complexity.

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	c. Increase vocal clarity and use of original thought language through specific oral motor and language processing interventions.
***Academic*:**	Once enrolled in full-time programming, complete academic interventions to address sight-word reading, reading comprehension, listening comprehension, and math computation skills.
***Emotional-Behavioral-Relational*:**	Decrease anxiety, hyperactivity, and emotional dysregulation by addressing neurodevelopmental barriers and employing proactive and reactive supports to teach Charlie to communicate his thoughts and feelings more readily and by teaching him self-regulation skills that can be generalized in any environment.
***Ikndependence, Self-Care, Social, and Communication Skills*:**	1. Increase ability to organize and prioritize simple progressions of tasks 2. Build the ability to express complex feelings 3. Utilize basic self-regulation strategies 4. Increase language abilities to maintain conversations with original thought language. 5. Learn to tie and untie shoes 6. Learn to clean up after meals

These initial goals laid the groundwork for Charlie's increased independence and improved cognitive function. The IWBMC™ emphasizes that small, foundational changes in thinking and behavior gradually enhance overall functioning and learning capacity.

The Intervention Plan: Program Activities

The clinical team utilized Charlie's evaluation results to create a treatment plan addressing goals identified with his parents. They then constructed an "individualized weekly schedule" (IWS) for Charlie, drawing from a bank of over 4,000 evidence-based interventions. Each intervention selected had to be within the assigned provider's capability to implement effectively. On a typical day, Charlie would arrive at the facility at 8:20 am and progress through his daily schedule under his provider's guidance until 2:30 pm. The provider documented Charlie's mood and intervention completion throughout each day. Beyond the structured interventions, Charlie participated in academic lessons paced according to his demonstrated academic level. To ensure continuity of care, providers maintained daily communication with Charlie's parents about continuing learned activities at home. This regular communication about both successes and challenges helped create a seamless connection between the school/clinical setting and home environment. Parent conferences occurred at the end of each semester to discuss Charlie's progress across all settings. Additionally, annual re-evaluations using the initial assessment tools measured his advancement in cognitive, emotional, behavioral, neurological, and physical development. A sample of Charlie's IWS appears in Table 2.

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Table 2.
Charlie's Sample Individualized Weekly Schedule where F and D represent frequency and duration of the activity.

Tactility/Gross Motor Block
All tactility and gross motor activities must be done in partnership with Charlie.

Activity	**F**	**D**	**Comment**
Hemispheric Smell Jars- alternate between left and right	2	1	
Running Program	1	10	

Reflex Block
Reflexes must be completed in sequential order throughout the week. A minimum of 3-4 reflexes MUST be worked daily to address the integration of the reflexes. Please follow the handouts for specific implementation protocols. All 16 reflex protocols must be completed each week.

Activity	F	D	Comment
1. Moro - Upper Moro Connection Points - Lower Moro Connection Points - Moro Arm Extension - Yoga Curl and Half Curl	1	6-8	

Vestibular Block
Complete 1-2 activities from this block every 20 minutes. Use the activities as additional movement breaks throughout the day.

Activity	**F**	**D**	**Comment**
Spin Chair- 10x in each direction	4	1	
Jump on small trampoline- jump 5 times, pause for 3	4	1	

Visual Block

Activity	**F**	**D**	**Comment**
Building Thinking Skills- Level 1 Complete 1pg per day	2	3-5	

Processing
Complete an intensity activity before each processing activity to prime the brain for the incoming information.

Activity	**F**	**D**	**Comment**
Auditory Color- working 5's	1	-	
Auditory Card- working 5's	1	-	

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Oral Motor/Language

Activity	F	D	Comment
1. Trigeminal Stimulation Light and Firm	2	2	
2. Facial Awareness	2	-	

Language Processing

Activity	F	D	Comment
Coordinating Auditory Information	1	3-5	
Developing Logical Reasoning Complete 1-2 pages per week	1	8-10	

Academics

Activity	F	D	Comment
1000, 2000, and 2800 Word List Test all words verbally, then introduce and work 3-check system	1	3-5	Charlie may move quickly through the first list, so continue to test through each list to maintain challenge point.

Additional Therapies

Activity	F	D	Comment
Integrated Listening Systems with specific vestibular, visual, and movement activities	1	60	Very important to address sensory motor integration

The IWBMC™'s final components focus on whole-person integration and social structure. Charlie's parents demonstrated exceptional support, relocating from another state based on their physician's recommendation and exploring various interventions before finding the IWBMC™ model. Beyond providing transportation, they learned center strategies, including Leah Kuyper's Zones of Regulation®. The wraparound support enabled them to reinforce Charlie's development at home, while the center's integrated services reduced travel to multiple specialists. In interviews, the parents noted that the center was their first experience with a structured plan for their child, describing the process as "transformative for the entire family" due to their comprehensive involvement from the beginning (personal communication, 11/2019).

Measuring Charlie's Progress

Based on Charlie's initial evaluation results, we conducted a longitudinal analysis of his development across three key domains using data from his annual assessments over his six-year participation in the program. The analysis examined: (1) neurological changes through sequential qEEG assessments, (2) cognitive development through standardized tasks measuring interhemispheric communication, sequential processing, visual tracking, expressive and receptive language, and perspective taking, and (3) academic progress through annual Wide Range Achievement Test 4 (WRAT4) assessments (Wilkinson & Robertson, 2006). The cognitive assessment tasks utilized in this study were derived from established evidence-based practices in neurodevelopmental evaluation, and the annual evaluations were conducted by trained evaluators. This comprehensive evaluation approach enabled us to track and document

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Charlie's progress across multiple developmental dimensions throughout his time in the program. Table 3 outlines the various tasks used to measure cognitive processing.

Table 3.
Charlie's Initial and Annual Evaluation Cognitive Assessments Descriptors and Targets

Task	Task Description
Interhemispheric Communication: Belly Crawl	Provides insight into the client's interhemispheric communication abilities based on their ability to crawl forward while prone using a cross-lateral pattern. Distance of 10 feet. It is measured by % growth on a 4-point scale.
Interhemispheric Communication: Cross Skip	Provides insight into the client's interhemispheric communication based on their ability to skip forward and touch the raised knee with the opposite hand. Assessed for 30 seconds. Measured by % growth on a 4-point scale.
Auditory Sequential Processing	Provides insight into the amount and complexity of unrelated auditory information a client can process at one time. Sequential processing levels should be equivalent to a client's age up to 7. The average amount of information an individual can process from age 7 through adulthood is 7 items.
Visual Sequential Processing	Provides insight into the amount and complexity of unrelated visual information a client can process at one time.
Fluid Visual Pursuits—Horizontal	Provides insight into the client's eye-teaming, sustained visual attention, and head-eye dissociation abilities as they follow an item moving on the horizontal plane. The client is expected to follow a slow-moving item approximately 18" away from the bridge of their nose as it moves on a horizontal plane without needing support to dissociate their eye and head movements. Measured by % growth on a 4-point scale.
Fluid Visual Pursuits—Vertical	Provides insight into the client's eye-teaming, sustained visual attention, and head-eye dissociation abilities as they follow an item moving on the vertical plane. The client is expected to follow a slow-moving item approximately 18" away from the bridge of their nose as it moves on a horizontal plane without needing support to dissociate their eye and head movements. Measured by % growth on a 4-point scale.
Vestibular Functioning	Provides insight into the client's vestibular functioning level, which correlates to attention, focus, language processing, and auditory self-stimulatory behaviors. Measured using a nystagmus test indicating the average number of seconds of deviance from the normal when turning right and left.

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Expressive Language: Complex Deductive Reasoning Abilities	Provides insight into a client's higher-level expressive language skills based on their ability to use deductive reasoning to draw conclusions based on the provided auditory statements. Four statements are assessed.
Expressive Language: Maintain Conversation	Provides insight into a client's conversation skills based on their ability to respond to questions and initiate questions, maintaining a conversation. Measured by % growth on a 4-point scale.
Expressive Language: Perspective Taking	Provides insight into a client's ability to engage in perspective-taking based on parent/guardian and clinical observation. Measured by % growth on a 4-point scale.
Receptive Language: Understanding Five- to Eight-Word Statements	The score is based on the client's ability to correctly identify the corresponding picture from a field of three pictures when given a five- to eight-word descriptor. Based on the total number correct out of 10. Measured by % growth on a 4-point scale.

[4] Methodology

4.1 Exploring the Changes in Cognitive & Neurological Functioning and Academic Performance

Were there any changes to Charlie's cognitive and neurological functioning after working through the interventions? Did he demonstrate any change in academic performance? The results of Charlie's annual evaluations are explored below in relation to his neurological, cognitive, and academic functioning.

4.1.1 Neurological Changes

As part of Charlie's initial evaluation, a qEEG was conducted to identify areas of atypical brain processing. Clinical notes from his initial observation highlighted several areas of concern in brain function and communication. The qEEG revealed excessive activity in delta and theta wave frequencies, indicating potential difficulties with inattentiveness and learning. These waves play a crucial role in higher cognitive processing, and their overactivity can strain the brain, affecting "cognitive processing, concentration, memory, controlling impulses, mood regulation, and hyperactivity." Given Charlie's documented challenges with school, anxiety, and ADHD, this brain map aligned with his presenting conditions.

The qEEG also revealed excessive activity in beta and high beta waves. High beta waves provide insights into cognitive processing during active, awake states, with typical functioning being essential for cognitive processing, attention, and perception—the components of conscious thought. After three years of attendance, Charlie's qEEG data demonstrated a shift toward typical processing in his high beta waves. By his sixth year, his qEEG map indicated that his high beta wave functioning had moved within the typical range.

Figure 2 presents the progression of Charlie's qEEG results from 2016, 2019, and 2022. Within three years of participating in various IWBMC interventions, his brain activity began approaching typical function. By 2022—despite an interruption in care due to the worldwide COVID pandemic—Charlie's qEEG brain activity fell within the typical range of the general population for most brain states and functions (e.g., absolute power, symmetry).

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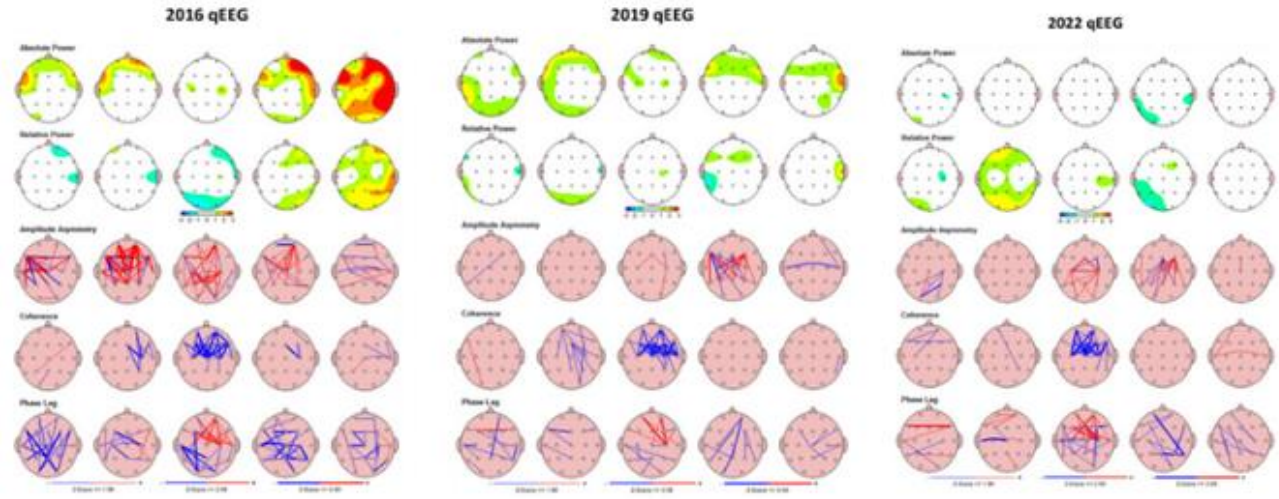
Charlie's phase lag measurements also showed significant improvement over this period. His initial phase lag had indicated potential difficulty in processing information. The clinical team developed targeted interventions based on these evaluation results. Through annual re-evaluations, they adjusted strategies according to his updated qEEG maps, learning styles, emotional-behavioral development, and physiological status. This adaptability of the IWBMC™, with its focus on individual functioning, enables a fluid process of annual assessment and strategic refinement as needed.

Figure 2.
Images of Charlie's qEEG in 2016, 2019, and 2022



4.1.2 Cognitive Changes

The neurological changes that Charlie experienced were not the only shifts observed during the intervention. Basic cognitive skills are critical to the development of executive functioning, which in turn is necessary for academic achievement. Given this relationship, it was important for Charlie to work on essential cognitive tasks. The interventions selected for his weekly schedule focused on improving these foundational skills, with the goal of enhancing his overall executive function and, ultimately, his academic performance. Although Charlie was assessed annually on his overall development in these areas, his providers regularly assessed his performance on smaller tasks related to each area and adjusted his weekly schedule accordingly so that he progressed from challenge point to challenge point. The results show that Charlie showed improvement in every area of cognitive functioning based on the tasks presented. Some of these improvements occurred within his first two years at the facility. His cognitive gains were sustained across almost every area, even following the disruption in attendance caused by the COVID-19 pandemic. When he resumed his weekly schedule, his evaluation results remained consistent with his prior performance. The table below reveals his progress in each area of cognitive function.

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Table 3.
Results of Assessments of Cognitive Functioning

Task	Task Description	Initial Observation	Highest Observation	Ending Observation	Time to Highest Observation
Interhemispheric Communication: Belly Crawl	Provides insight into the client's interhemispheric communication abilities based on their ability to crawl forward while prone using a cross-lateral pattern. Distance of 10 feet. Measured by % growth on a 4 point scale.	2	4	4	1 yr
Interhemispheric Communication: Cross Skip	Provides insight into the client's interhemispheric communication based on their ability to skip forward and touch the raised knee with the opposite hand. Assessed for 30 seconds. Measured by % growth on a 4 point scale.	1	4	4	3 yrs
Auditory Sequential Processing	Provides insight into the amount and complexity of unrelated auditory information a client can process at one time. Sequential processing levels should be equivalent to a client's age up to 7. The average information an person can process from age 7 through adulthood is 7 items.	5	6	6	1 yr
Visual Sequential Processing	Provides insight into the amount and complexity of unrelated visual information a client can process at one time.	4	7	6	3 yrs
Fluid Visual Pursuits—Horizontal	Provides insight into the client's eye-teaming, sustained visual attention, and head-eye dissociation abilities as they follow an item	3	4	4	1 yr

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	moving on the horizontal plane. The client is expected to follow a slow-moving item approximately 18" away from the bridge of their nose as it moves on a horizontal plane without needing support to dissociate their eye and head movements. Measured by % growth on a 4 point scale.				
Fluid Visual Pursuits—Vertical	Provides insight into the client's eye-teaming, sustained visual attention, and head-eye dissociation abilities as they follow an item moving on the vertical plane. The client is expected to follow a slow-moving item approximately 18" away from the bridge of their nose as it moves on a horizontal plane without needing support to dissociate their eye and head movements. Measured by % growth on a 4 point scale.	3	4	4	1 yr
Vestibular Functioning	Provides insight into the client's vestibular functioning level, which correlates to attention, focus, language processing, and auditory self-stimulatory behaviors. Measured using a nystagmus test indicating the average number of seconds of deviance from the normal when turning right and left.	Left: 0 Right: 2	Left: 16 Right: 17	Left: 13 Right: 13	Left: 2 yrs Right: 4 yrs
Expressive Language: Complex Deductive Reasoning Abilities	Provides insight into a client's higher-level expressive language skills based on their ability to use deductive reasoning to draw	1	4	4	5 yrs

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	conclusions based on the provided auditory statements. Four statements are assessed.				
Expressive Language: Maintain Conversation	Provides insight into a client's conversation skills based on their ability to respond to questions and initiate questions, maintaining a conversation. Measured by % growth on a 4 point scale.	2	4	4	5 yrs
Expressive Language: Perspective Taking	Provides insight into a client's ability to engage in perspective-taking based on parent/guardian and clinical observation. Measured by % growth on a 4 point scale.	1	4	4	5 yrs
Receptive Language: Understanding Five- to Eight-Word Statements	The score is based on the client's ability to correctly identify the corresponding picture from a field of three pictures when given a five- to eight-word descriptor. Based on the total number correct out of 10. Measured by % growth on a 4 point scale.	4	4	4	No change

Analysis of Charlie's developmental progression reveals a clear pattern in skill acquisition, with abilities emerging along different timelines based on their complexity (see Table 4). Some foundational skills developed within the first year, while intermediate skills emerged over three years, and complex abilities required five years to mature fully. This development followed a logical progression from basic to advanced capabilities. In the domain of interhemispheric communication, Charlie first mastered the relatively straightforward task of coordinated crawling, which requires basic bilateral brain function. This foundation then supported the development of more complex cross-skipping abilities, which demand sophisticated interhemispheric coordination.

The data also demonstrate a sequential pattern in processing abilities. Auditory processing skills emerged relatively quickly, reaching proficiency within the first year. Visual processing, however, required an additional two years to fully develop. Once these fundamental processing abilities were established, they appeared to support the emergence of higher-order cognitive functions, including deductive reasoning, sustained conversation skills, and perspective taking. This developmental sequence suggests that mastery of foundational skills

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creates a platform for acquiring more sophisticated abilities, highlighting the importance of addressing basic competencies as prerequisites for complex skill development.

Table 4.
Milestone Achievement by Year

Year	Milestone
1	Motor & Sensory Skills
3	Processing Abilities
5	Language and Higher Order Cognitive Skills

Charlie's cognitive development aligns with the foundational principles of the IWBMC™ model, which emphasizes addressing fundamental skills before progressing to more complex abilities. The intervention strategy systematically targeted core processing capabilities, allowing Charlie to build progressively more sophisticated cognitive functions during his time at the facility. The concurrent improvement in his brain functioning, as evidenced by qEEG data, suggests that the intervention successfully created an optimal learning environment. This environment appears to have supported his development by matching instruction to his functional level, providing opportunities for successful learning experiences, and allowing him to advance at an individually appropriate pace.

The synchronization between cognitive improvements and neurological changes indicates that the IWBMC™ model's approach of meeting clients at their developmental level while gradually increasing complexity may facilitate both behavioral and physiological progress. This alignment between intervention strategy and observed outcomes provides preliminary support for the model's effectiveness in promoting comprehensive development.

4.1.3 Academic Progress

Charlie's neurological and cognitive advances were reflected in his academic performance, providing evidence that the intervention's impact extended beyond fundamental processing abilities to practical educational outcomes. When Charlie arrived at the neurodevelopmental center, a key issue was his educational performance. For many autistic youth, underperformance in academics (particularly reading and math) is common (Bullen, Zajic, McIntyre, Solari, & Mundy, 2022). Despite several interventions starting in preschool to address cognitive deficits, he still performed well under grade level. He was a sixth grader performing on a second-grade or lower level in many subjects. According to a learning ability evaluation summary, just before enrolling at the neurodevelopmental center, the Detroit Tests of Learning Aptitude placed his mental age at nine years and nine months of age. His initial evaluation as part of the IWBMC™ using the Wide Range Achievement Test 4 (Wilkinson & Robertson, 2006) revealed below-grade-level performance in several subjects, including math and reading.

The tables below reveal his performance over six years (Tables 5 & 6). Charlie demonstrates continual improvement in his academics and grade level before 2020. What must be noted is that in March 2020, the worldwide COVID-19 pandemic disrupted education. During that time, many educational facilities had to shift to online education. Charlie's individualized program to address his vestibular system and other neurodevelopmental barriers was initially developed to be in-person and hands-on. So, while Charlie was on a very positive trajectory with his work, there was an interruption in 2020 in his educational services.

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Table 5.
WRAT4 Grade Equivalency by Subject (2016-2019)

Age	Spelling	Math	Word Reading	Sentence Comp (List)	Sentence Comp (Read)
13	1.5	1.5	2.2	3.2	0.8
14	2.8	4	2.6	5.3	4.1
15	3.1	4.8	3.4	7	5.5
16	2.8	5.1	3.7	8.5	6.2

*Scores are indicated by grade and month. A score of 1.2 would mean that the client is performing at a first-grade level in the second month of that grade.

Table 6.
2021-2022 WRAT4 Grade Equivalency by Subject: Post-COVID Revaluations

Age	Spelling	Math	Word Reading	Sentence Comp (List)	Sentence Comp (Read)
18	2.1	3.5	2.9	3.2	3.2
19	2.1	4	4	6.2	4.3

Charlie's educational trajectory following the COVID-19 disruption demonstrates the intervention's lasting impact. Although he experienced learning loss during the pandemic, as was common among students during this period, he showed renewed progress upon resuming the program. His academic performance improved across nearly all subjects when he returned to care, and he began approaching his pre-COVID achievement levels. This progress is particularly noteworthy when viewed in historical context. During his first six years of traditional education, Charlie's performance remained at early elementary levels (kindergarten through third grade) across most subject areas. In contrast, after three years in the IWBMC™ program, he advanced to fifth-grade mathematics and demonstrated sixth to eighth-grade comprehension skills. While the pandemic temporarily affected some of these educational gains, he maintained overall improvements across all subject areas through the conclusion of the program.

Perhaps the most compelling evidence of the intervention's effectiveness lies in Charlie's post-program success. Upon graduating from the facility, he enrolled in a specialized degree program for autistic students at a prominent southeastern urban university, where he continues to make satisfactory progress toward completion. This progression from early elementary performance to college-level academic engagement suggests that the foundations established through the IWBMC™ model supported not only immediate academic growth but also created sustainable learning capabilities. The parallel development of Charlie's neurological functioning, cognitive abilities, and academic skills suggests that improvements in fundamental processing capabilities may have supported his educational progress. This alignment between physiological changes and academic advancement provides valuable insight into how enhanced neural functioning might translate into improved classroom performance.

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[5] Discussion

In the context of this case study, the Interpersonal Whole-Brain Model of Care® (IWBMC™) appears to have been a catalyst for Charlie's physiological, cognitive, and behavioral improvement. The model's strength lies in its ability to give clients a lasting sense of belonging and consistent growth in all they do—a critical aspect of the IWBMC™, fostered largely by the client-provider relationship, that promotes personal well-being and provides the necessary qualities for human flourishing. Without this piece, it seems unlikely that the model would have allowed Charlie to achieve the same level of progress during his time at Jacob's Ladder. Unlike other effective models of care that merely target behavioral and cognitive outcomes, the IWBMC™, with its grounding in the core values of "Hope, Truth, Love," also sets out to impact the spirit and will of clients to achieve greater results.

The foundational values of "Hope, Truth, Love" are clearly represented in the relationship between the client and provider. Through their connection, a safe and caring learning environment is established and maintained to promote the necessary conditions required for humans to thrive regardless of the unique challenges they face. Providers are trained to implement the model of care with respect to these core values, and because of this, clients become open to building the trusting and caring relationship that they desperately need to nurture their development. Ideal relationships should prioritize emotional safety—when individuals feel secure and truly cared for, their systems function optimally, free from any unnecessary stress that makes progress more challenging than it needs to be (Mate, 2022). In this regard, the provider plays a special role in facilitating the client's progress, ensuring that they have the necessary resources in place to secure a therapeutic bond and a healthy environment that promotes holistic wellbeing. The core values of "Hope, Truth, Love" serve as philosophical pillars of the IWBMC™, and a closer examination of these values reveals how/why they successfully guide providers in their work to produce significant positive outcomes like the ones we see in Charlie's development under this uniquely integrated, personalized model of care.

Philosophers and psychologists assert that "Hope" essentially conveys a combination of wish (i.e., desire) and expectation to attain a goal (Leshem, 2023). Providers and clients develop hope when the desire and expectation to achieve a positive outcome is possible, but not necessarily guaranteed. In other words, hope does not exist for things we believe are impossible or inevitable. In this context, providers have a responsibility to inspire hope in their clients and truly believe in their potential for progress—especially in times when they need it most. This concept of hope underpins the idea that every individual has the capacity for growth and transformation, and that the IWBMC™ can reliably help them achieve it. By cultivating and reinforcing this sense of hope, the IWBMC™ aims to reduce feelings of helplessness in clients and their families while promoting resilience and sustained engagement in program activities that work to produce positive outcomes. Under this model, providers implement what they learn in their training to stimulate the client's interest and motivation to learn/improve despite their nuanced daily struggles.

It is also critical that clients and providers establish and maintain a sense of trust and confidence in their work that validates the model with every achievement—here is where "Truth" finds its home in this evidence-based methodology. Truth, as it relates to the IWBMC™, represents a commitment to scientific integrity in all therapeutic interventions while providers embody authenticity and honesty in their implementations. By adhering to the best evidence-based practices and keeping up with the latest scientific research, the model's flexible and inclusive nature ensures that its methods are as effective and ethical as they can be, always

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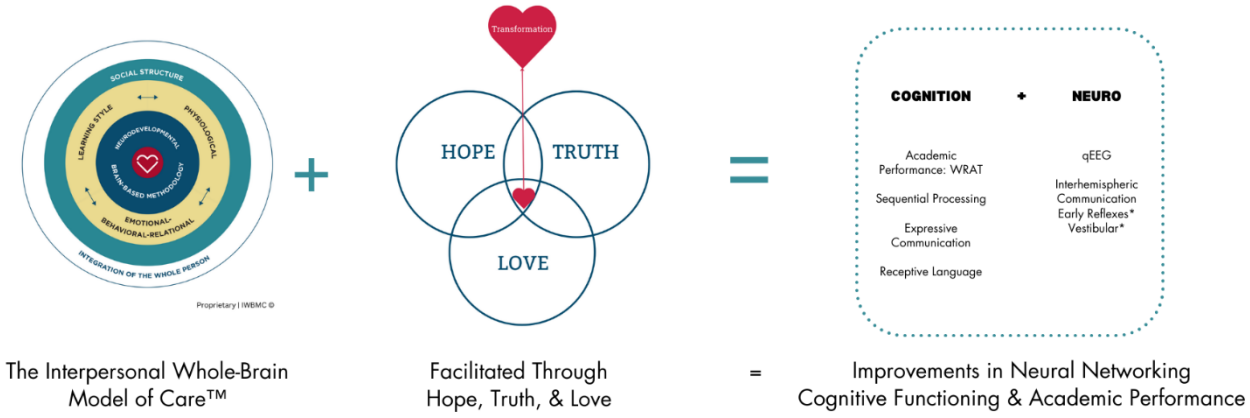
adapting and aligning itself with the best methods available and delivering them with respect to these core values. Furthermore, when providers are trained to understand the reality of their client's situation and properly meet them at their level, they can ensure that their approach remains therapeutic and appropriate throughout the practice—always considering their client's challenge point and adjusting their program as they advance through the model. Because of this, clients and their families can develop a strong sense of trust in the integrity and reliability of this dynamic, personalized methodology.

In addition to a genuine belief in the potential for growth and transformation, and a strong commitment to scientific integrity, a loving/caring piece fulfills the model. "Love" represents the foundation of compassionate, relational care that underlies every interaction between providers and their clients. This notion of love requires great sacrifice from the provider to uphold a high standard of care by modeling appropriate behavior and emotional regulation throughout their work—especially in challenging situations where a deeper sense of interpersonal connection and compassion is needed most. This concept of love promotes emotional safety and a genuine sense of belonging—qualities that are essential for building healthy relationships and environments. When providers and caregivers are attuned to the individual's emotional and physical needs, they supply a safe and healthy environment that promotes growth and exploration (Mate, 2022). This critical blend of "Hope, Truth, Love", as it relates to the IWBMC™ to provide a holistic, integrated, and personalized methodology, sets this model of care apart from others—offering clients and families a unique and effective option that has the potential to transform the quality of their lives for the better. If we return to the logic model in Figure 1, we find that the model holds up, but now future research is needed to test these individual components and their direct relationship to neural and cognitive growth and development.

Figure 1.
Logic Model: The Relationship of the Model of Care and Potential Outcomes



The IWBMC™'s comprehensive approach allowed for a nuanced understanding of Charlie's neurodevelopmental profile and behavioral patterns. This holistic perspective enabled the development of targeted interventions that were precisely aligned with his fundamental needs. By focusing on the underlying factors contributing to Charlie's difficulties rather than

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merely addressing surface-level symptoms, the model paved the way for more substantive and sustainable progress.

It is also important to note another component of Charlie's growth within the IWBMC™ framework was his participation in neurotherapy. Based on his evaluation data, the clinical team had recommended neurotherapy to support emotional regulation in January 2020, just before the onset of the COVID-19 pandemic. The timing proved fortuitous, as neurotherapy became an essential tool for helping Charlie manage increased anxiety during the pandemic period. The integration of neurotherapy with other interventions in a supportive environment appeared to produce two significant outcomes: First, Charlie experienced reduced anxiety, which enhanced his ability to focus on tasks. Second, this improved focus enabled him to resume his pre-pandemic learning trajectory. The combination of neurotherapy and the broader IWBMC™ approach significantly enhanced his neurodevelopmental functioning and behavioral regulation. The synergy between these targeted neurological interventions and the overarching principles/values of the IWBMC™ appeared to create a particularly effective treatment environment for Charlie that allowed him to flourish.

This case study suggests that the IWBMC™'s multifaceted, individualized approach may offer advantages over more limited or singular intervention strategies that often fail to address the root causes of individuals' behavioral, neurological, and physiological symptoms. By considering the complex interplay and impact of these factors on his life, the model provided an ideal framework for comprehensive care that was finely tuned to Charlie's unique profile. The observed improvements in Charlie's functioning underscore this integrated, personalized approach's potential efficacy in addressing a variety of complex neurodevelopmental challenges.

[6] Limitations

This case study, while demonstrating the potential benefits of innovative programming for an adolescent autistic child, has several limitations to consider. Firstly, as a single-subject study, the results have limited generalizability. Secondly, the emphasis on positive outcomes may introduce bias, although some persistent behavioral challenges were mentioned. To address this, future research could explore the challenges of this approach more thoroughly and incorporate perspectives from a wider range of providers and evaluators.

Selection bias is another concern, as the client and family were satisfied with the child's transformation, presenting an ideal outcome. Expanding the study to include perspectives from both enthusiastic and less enthusiastic clients would provide a more balanced view. The supportive nature of Charlie's parents, for instance, raises questions about whether similar results would be achieved with less involved families.

Potential confounding variables that may have influenced Charlie's progress should also be considered. While little academic progress was noted prior to Charlie's enrollment in the neurodevelopmental school, the role of maturation in his development cannot be discounted entirely. Additionally, we are not able to make a causal statement between the neuronal changes and his cognitive and academic performance. These questions could be addressed through an expanded sample size or by comparing outcomes with students in different settings. Despite these limitations, the case study provides valuable insights into the potential of this innovative approach for autistic adolescents.

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[7] Future directions

This case study also lays the foundation for future research contributing to the efficacy and validity of the IWBMC™ as it relates to the assessment of neurological, behavioral, and developmental conditions including Autism Spectrum Disorder (ASD). While the demand for innovative methodologies and a deeper understanding of ASD and other related disorders/conditions continues to rise, Pillar Research will push to evaluate the impacts of this model on social, behavioral, neurological, and academic progress for individuals with unique neurodevelopmental profiles. There will also be a push for research that establishes the generalizability of outcomes for a variety of different conditions under the IWBMC™. Ultimately, this case study marks the beginning of a long, yet inspiring, road to establishing a truly innovative and transformative standard of care with the potential to positively impact the lives of millions.

As previously noted, this therapeutic alliance, a distinctive component of the model, warrants further investigation. Future studies should explore how providers scaffold learning and interact with their clients within the IWBMC™ framework. Understanding the influence of these interactions on outcomes is essential. Given the low 1:1 or 1:2 in-center ratio compared to other facilities, it would be valuable to examine both the IWBMC™ as a model and the therapeutic alliance that underlies the work. This dual focus could help distinguish the effects of the model itself from those of the intensive, personalized attention provided. While this case study yields promising results, it also reveals numerous avenues for future research to fully understand and validate the IWBMC™ approach in autism intervention.

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