NEW VIEWS INTO THE SCIENCE OF EDUCATING CHILDREN WITH AUTISM

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Autism spectrum disorders is an overarching diagnosis that covers a variety of behavioural and cognitive differences affecting all aspects of the educational process.

Generally, an autism diagnosis includes three characteristics:

- disorders in language/communication
- disorders in social skills
- the presence of repetitive behaviours

But educators know this umbrella description comes with innumerable variations. Some with autism have no usable speech; others have ample speech but use it in atypical ways. Some students struggle to learn to read while others learn to decode and read aloud but are unable to comprehend.

Some with autism calculate exceptionally well, a la "Rain Man", while others struggle with basic numeracy. Some children are passive and self-stimulating while others are aggressive and hyperactive.

This heterogeneity means that each child with an autism diagnosis will have unique educational needs. Historically, many of these children have required a one-on-one aid even when enrolled in a self-contained special education classroom. Often, students with an autism diagnosis, because of an array of attention and behaviour difficulties, need a variety of accommodations to function in a classroom, much more than the accommodations necessary to demonstrate content mastery on standardised tests.

Even more challenging to the administrator is the familiar dilemma within schools where adaptations developed for one student with autism differ radically from those required for another student with the same diagnosis.

Fortunately, new research provides an altered direction with more promising educational outcomes for students with autism spectrum diagnoses and is beginning to unravel the perplexing variety of learning differences and behavioural issues these children exhibit.

Researchers have speculated for decades that autism spectrum disorders must have something to do with brain processing differences. But early brain imaging technologies revealed no such differences. That is because the technologies of the late 20th century provided anatomical displays and gross electrical measures (EEGs) in which children with autism were shown to have relatively “normal” brain anatomy and indistinguishable EEGs.

The work of Margaret Bauman of Harvard University indicated some microscopic variability in motor regions — a brain structure called the cerebellum, but none of this explained the vast difficulties these children exhibit in educational settings, nor did it provide any direction for educational intervention (Bauman & Kemper, 1994).

But since the turn of the century, newer technologies are changing this picture - literally. Within the past decade, neuroscience research has enabled views of the brain at work - functional brain imaging - as well as views of brain pathways. This emerging technology now points to marked developmental differences in the brain connections of individuals with autism. Jeffrey S. Anderson of the University of Utah and his colleagues recently reported on research that supports the “cortical under-connectivity theory” of autism (Anderson et al., 2001).

Simply put, this theory maintains that individuals with autism have trouble connecting sight to sound, sound to meaning, or one thought with another. This is because it appears that the long fibre tracts that process and integrate complex information across vast brain territories are not developing in a typical way.

Rather, Sam Wass at Birkbeck College in London recently summarised research indicating that there is over-connectivity of short fibre tracts that become overused, possibly explaining why individuals with autism show stereotypical but non-purposeful repetitive behaviours (Wass, 2011).

This newer research indicates that the heterogeneity of behaviours and learning problems that we observe in students with autism are not so variable as they are unique. The specific repetitive behaviours we observe, although different from child to child, likely still represent the same underlying problem: Long integrative highways needed for most learning are scuttled by short traffic circles with no off-ramps.

Although this new research is interesting and helpful toward understanding the student with autism spectrum disorders, it begs the question of how it applies to education. Or, perhaps the more important question is, "What can an educator do to enable these children to progress in school?" Fortunately, the answer to both of these questions is at hand and comes from another branch of neuroscience.

Brain plasticity

Researchers now agree that the human brain is exceptionally malleable, even into adulthood. The fact that each of us, even as a mature adult, can learn and become fairly proficient in a foreign language or a new sport like golf, for example, illustrates how flexible the typical brain is at learning to do new things.

This inherent malleability - neuroscientists call it plasticity - of the human brain is what enables educators to teach in the first place. From the perspective of neuroscience, teaching builds the human brain in very specific ways, depending on what is being taught.

So, how does the student with autism differ from the typical student? For most children, the brain has spent the first four or five years of life establishing a neural highway system that will support literacy and numeracy. The reason that students worldwide begin formal education around five years of age is that it is the average age at which the basic brain scaffolding, in the form of long interconnecting neural pathways, has reached a level that supports reading and math.

According to Wass and others, it now appears that a student with an autism spectrum disorder enters school with some or most of the longer highways underdeveloped so their brain detours incoming information to something akin to cul-de-sacs or circular unending off-ramps. Traditional approaches to education simply cannot work because the information cannot be processed adequately. However, interventions that drive development of these long interactive fibre tracts hold the greatest promise.

There are two lines of research investigating interventions designed to drive a more typical brain development in children on the autism spectrum.

One approach being investigated at the University of California, Davis, MIND Institute is to identify children at risk for autism at an early age and provide maternal guidance in ways to play and interact with their young children to stimulate development of these long fibre tracts. Parents have a natural tendency to do things with toddlers that the children enjoy and to avoid activities the child does not enjoy.

A toddler who is at risk for autism spectrum disorder, for example, may enjoy electronics more than blocks or inanimate toys like trains but be less interested in toys like stuffed animals. The same toddler may reject being read to or being cuddled. Yet, these are the very activities the under-connectivity theory suggests are necessary to build the longer integrative neural pathways.

By teaching parents how to encourage activities the child is not drawn to, but needs, researchers hope these children at risk will develop in a more typical way. If this research is determined to be useful, it can have a powerful effect on approaches toward early intervention.

Neuroscientists have developed game-like exercises specifically designed to drive development of the long-left hemisphere fibre tracts essential for language, reading, and mathematics (Merzenich et al., 1996). The programs they developed - Fast ForWord®, marketed by Scientific Learning Corporation - systematically targets those specific pathways in ways entertaining to the child.

Many of the tasks are similar to those used conventionally by speech and language pathologists or reading teachers in the treatment of language, reading and processing disorders. But the Fast ForWord programs also include unique speech stimulation exercises acoustically enhanced to conform to the perceptual needs of children with auditory processing problems.

In addition, all exercises are performed on a computer, which is very compelling to children on the autism spectrum. During initial testing of the first neuroscience intervention approach in 1997, almost 500 children nationwide received the intervention. The results were astounding. The average language gain for the children, achieved after only a few weeks of training, was almost two standard deviations in most cases - representing a year and one-half growth in language skills.

Among the children who participated in the field trial were several who had diagnoses of autism spectrum disorders. Surprisingly, those children made almost as dramatic gains overall as the children who were struggling learners.

The results

A few years later, Melzer and Poglitsch (1999) surveyed 34 professionals who implemented the Fast ForWord Language product with 100 children on the autism spectrum nationwide. They reported the following changes:

- 81% of the children who completed the program showed improvements in attention skills for testing, computer activities, structured therapy activities, listening to stories, and/or group activities.
- 83% of the children showed changes in receptive and expressive language skills, including following directions, understanding humour, using new vocabulary, lengthening phrases, verbal fluency, and response to questions.
- 60% of the children showed improvements in speech intelligibility.
- 76% of the children showed improved pragmatic skills, including eye contact, appropriate attention-getting behaviour, ability to verbally negotiate, and initiation of communication.
- 59% of the children demonstrated improvements in academic performance.
- Overall, 77% of the children increased an average of 1.25 years in age-equivalent scores on standardised language assessment after completing the program (Melzer & Poglitsch, 1999).

Neuroscience research offers both an improved understanding of children on the autism spectrum and a promise of new interventions that target the underlying causes of the disorder, namely under-connection of long neural fibre tracts essential for educational success.

Dr. John Gabrieli referred to the introduction of neuroscience into educational pedagogy as "the new science of learning" (2009). His view is that educational focus on curriculum has been necessary but, when educators face children with learning challenges, a combination of neuroscience and technology can enhance learning capacity and efficiency, even in children with neurological differences.

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