
Case Study with Equipping Minds Cognitive Development Curriculum

Despite all the support from "Marie's" teachers and principal in third grade, her Measures of Academic Progress (MAP) scores—yearly academic tests that measure student growth from semester to semester—stayed stagnant for a full year. In the fall of fourth grade the first MAP scores again showed no growth. Her parents consulted the director of Equipping Minds for advice. She evaluated Marie and designed a cognitive training program for her that specifically worked on visual and auditory processing speed, comprehension, short term memory, working memory**,** long term memory, and reasoning skills. No remedial subject work was done.

Marie was able to phonetically read words at her grade level, but her comprehension was still at a first-grade level. With the support of the school system, the director worked with Marie an hour of every school day for the next twelve weeks. However, at the end of nine weeks the principal met the educational therapist at the school door. "Have you seen the test scores?" inquired the local elementary school principal. "No. What were you wanting to see?" asked the educational therapist. "We like to see a 3-5 point gain in each subject. Marie has increased 20 points in reading, 11 points in math, 25 points in science, and 17 points in language arts. No one goes up double digits in all four areas in a few months."

The principal could not believe this had happened. Until this time, Marie had made minimal progress and her academic test scores had remained static from third to fourth grade. The change in these scores had been achieved over the last nine weeks through one-on-one cognitive developmental exercises for enhancing processing, working memory, comprehension, and reasoning, which was divorced from academic content. Previously, she had received the standard interventions: remediation of content, learning strategies, and accommodations. These may have short-term benefits, but were not targeting the underlying cognitive deficits in processing and working memory, which would increase her cognitive abilities.

Marie would continue the cognitive developmental exercises and continue to progress academically for the next four years. In 2015, she scored in the 39th percentile in mathematics, 36th percentile in science, and the 7th percentile in reading on the Stanford 10 National Assessment Ranking as a 7th grader. Marie's progress is significant for those who still believe 85% of the measureable intelligence is due to nature or one's genetic factors and only 15% due to nurture or environmental factors (Herrnstein & Murray, 1994) which holds to a limited potential for change. Marie has Down syndrome and an intellectual developmental disorder, which many believe limit her ability for significant academic gains. However, Marie's improvement implies that cognitive developmental exercises can be generalized to apply to academic achievement for learners who have an intellectual developmental disorder. Below are the results of the MAP tests after that first nine weeks and over the next four years (Figures 1, 2, 3,4). Marie has made significant gains across the board. It should be noted that while Marie has Down syndrome, the only accommodations she received on MAP testing was extended time and having a reader for math, science, and language. She read the reading assessments herself.

Figure 1

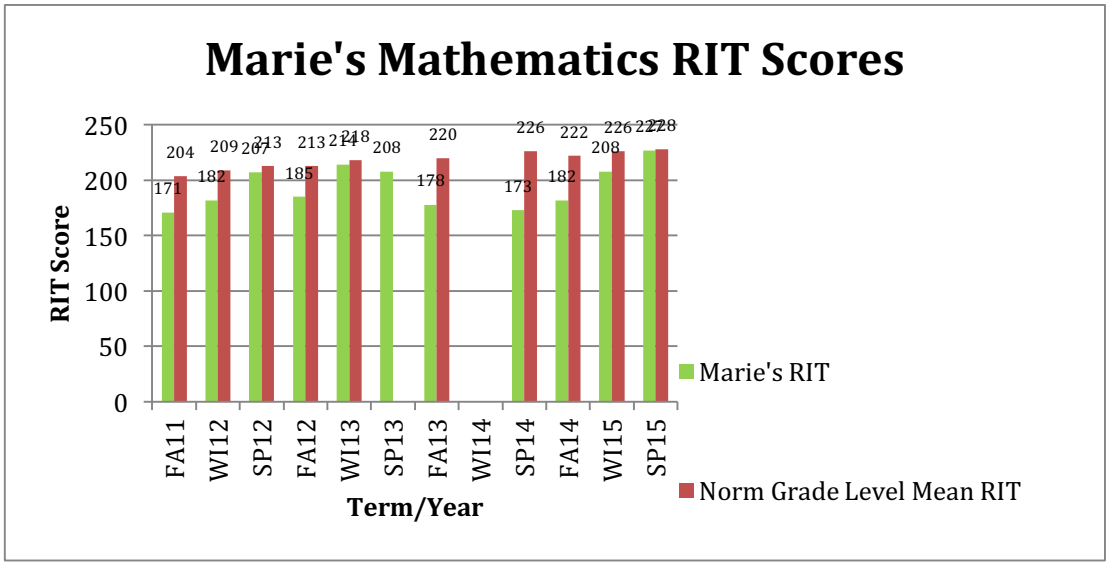


Figure 2

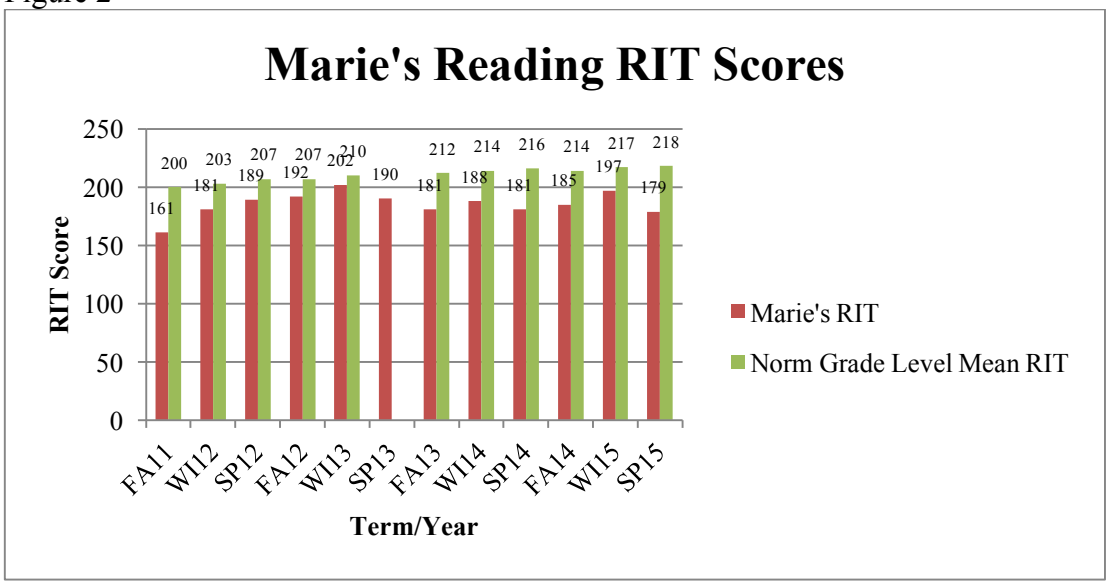


Figure 3

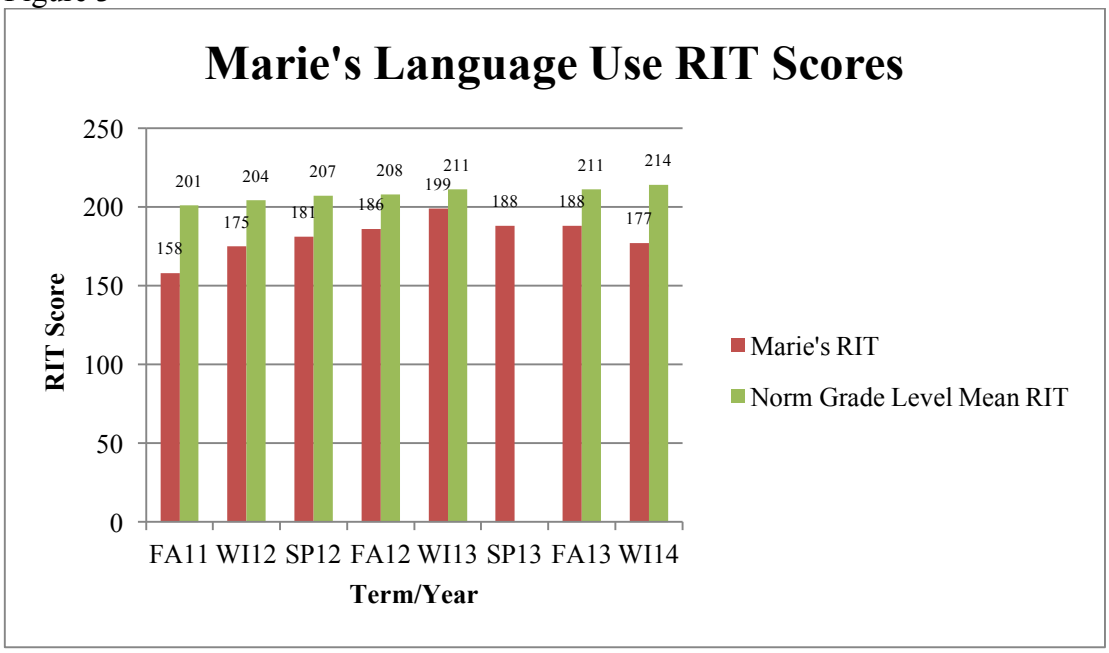
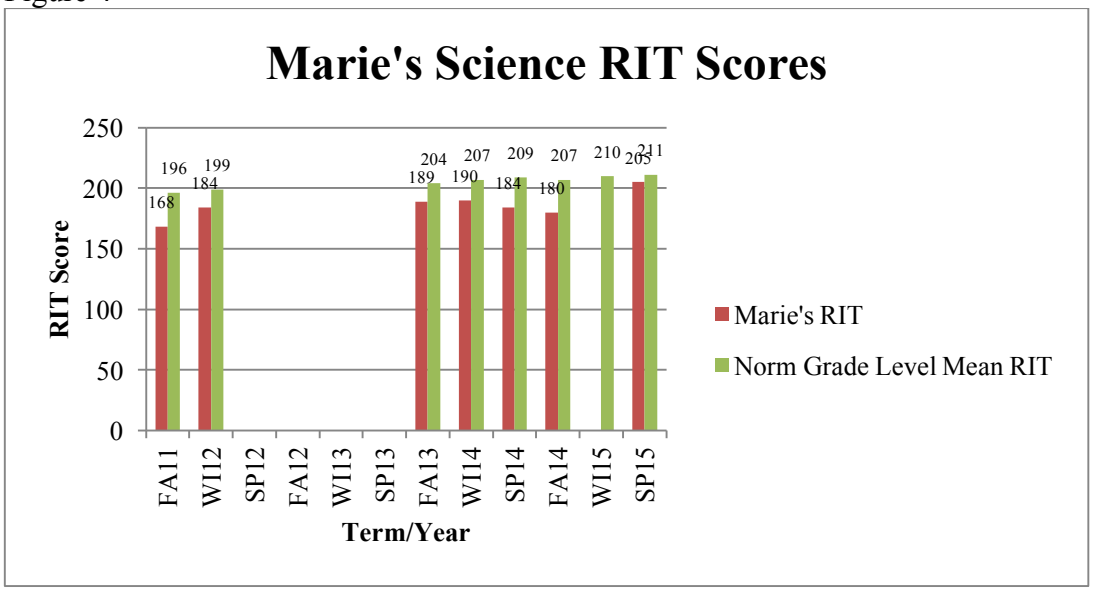


Figure 4



Over the summer of 2012, Marie did a ten-week daily program. The director continued working with Marie privately three days a week through the 2012-2013 school

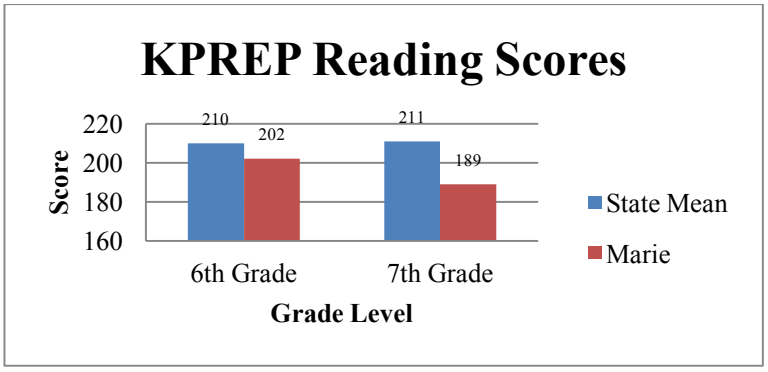
year. The Spring 2013 scores showed a decline after strong scores in the Winter of 2013. Marie has juvenile rheumatoid arthritis which can impact her results.

Marie only did two weeks of cognitive exercises at the beginning of summer of 2013 and then continued doing exercises at home, but not in a strict fashion. The family traveled extensively, and they moved just prior to school starting. This was a big transition for Marie to a middle school in a new city with all new friends. During the school year they did a few daily exercises, but not as intensively as in the past. The fall of 2013 is the first time her MAP scores declined. The director believes this was a result of not doing the cognitive exercises with fidelity and the transition to a new school. However, her Kentucky Performance Rating for Educational Progress (KPREP) scores in 6th grade showed strong growth. (Figures 5,6, & 7) The K-PREP test is more comprehensive and has historically been difficult for Marie. However, her results have further convinced the staff of Equipping Minds that this specific cognitive training is helping her to acquire information and store it. The new report also includes Students Growth Percentile (SGP). Kentucky considers a 40 percent or higher SGP as meeting the goal of yearly growth. In reading Marie's SGP was 93 percent and 63 percent in math as a sixth grader.

Then Marie did more focused training throughout the summer of 2014 between sixth grade and seventh grade for one hour a day, five days a week. She was back on track making gains on the MAP test. Her gains in math and science were exceptionally high. Marie's 7th grade KPREP scores also showed considerable gains in her mathematic abilities (Figure 6). She scored 2 points above the state mean and was 1 point from a proficient status. The apprentice level for the 7th grade states that a student can compute a percent of a number, use ratios to solve problems, evaluate mathematical

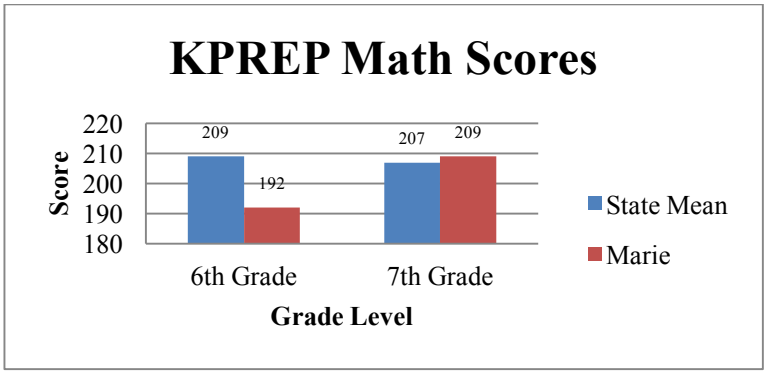
problems using order of operations with integers, solve two-step equations, evaluate algebraic expressions with two or more variables using order of operations, select and apply basic geometric formulas, identify cross sections of a 3-D object taken parallel to a base, identify an appropriate sample for a population, and compute measures of central tendency. Her Stanford 10 National Assessment Ranking were at the 39th percentile in math, 36th percentile in science, and the 7th percentile in reading (Figure 8). Marie's SGP was 4 percent in reading and 96 percent in math in 7th grade (Figure 9).

Figure 5



Marie-202 Apprentice 189 Novice

Figure 6



Marie-192 Apprentice 209 Apprentice

Figure 7

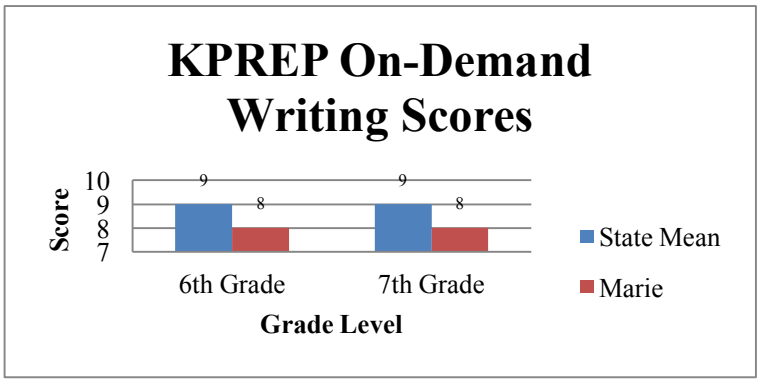


Figure 8

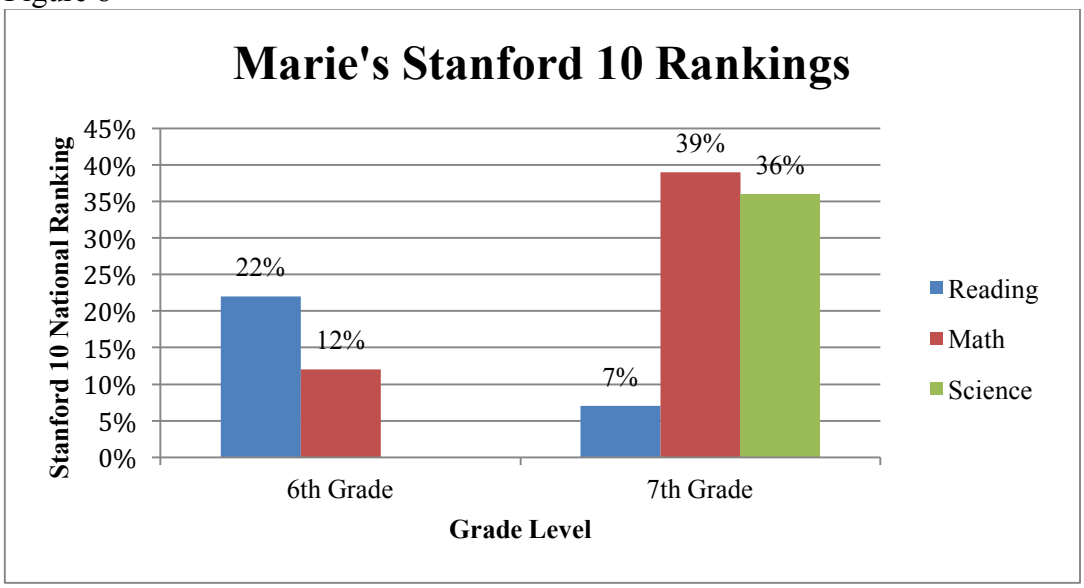
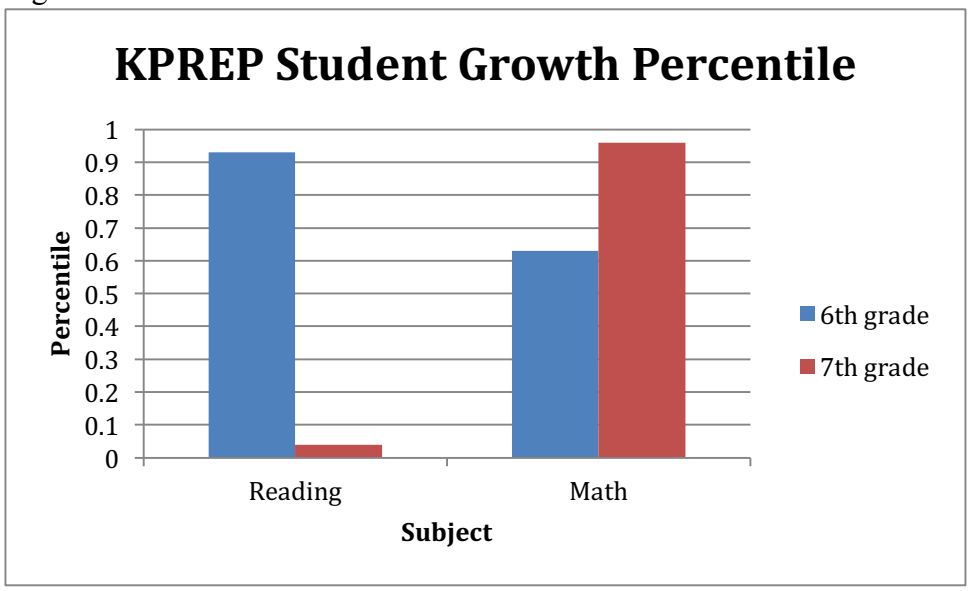


Figure 9



In conclusion, Marie's success may be attributed not only to supportive teachers, but undeniably to specific cognitive training exercises in EMCDC that are targeted to her areas of weakness. This past year Marie has been working more on logic, reasoning, and abstract thinking which is impacting her cognitive, social, and spiritual development.

Some typical children and certainly those with special needs must have someone to "teach" their brains how to think, how to process information, and how to store information in the same way that children with special needs may need physical therapy to teach them how to roll over as infants or how to put one foot in front of the other to walk. The specific cognitive exercises Marie performs with Equipping Minds does just that for her brain.

The other important thing to note is that the educational director is continually changing the exercises as they are mastered and adapting the program for Marie. It's this individualized targeting of cognitive areas that sets this program apart from other programs. Just think, if this program can help a child with Down syndrome learn at this

rate, imagine how it could help other children with neurodevelopmental learning disorders. Minimum remedial tutoring could be replaced with specific cognitive developmental exercises and more hopefully that these exercises would be incorporated into the teaching curriculum for every child.

The Equipping Minds Cognitive Development Curriculum (EMCDC) is based on the theory of Structural Cognitive Modifiability (SCM) and the Mediated Learning Experience (MLE). The Equipping Minds' program employs a holistic approach to educational therapy through visual and auditory processing exercises, neurodevelopmental exercises, and cognitive developmental exercises. Students participated in interactive games and activities to strengthen working memory, processing speed, perceptual reasoning, and comprehension. The cognitive strengthening exercises use what the student already knows setting aside academic skills to target cognitive functions. EMCDC includes a teacher workbook, student workbook, and instructional DVD's for use in the regular or special education classroom, church, or home environment by teachers, therapist, and parents.

Over the last twenty years, research on working memory found reliable correlations between working memory span and several other measures of cognitive function, intelligence, and performance in school (Alloway, 2011). Recent studies on individual differences in mathematical abilities show that aspects of working memory contribute to early arithmetic performance (Raghubar, Barnes, & Hecht, 2010). Further studies examine the relationship between working memory, reading, and comprehension (Carretti, Borella, Cornoldi, & DeBeni, 2010; Andreassen & Braten, 2010). The key to

intelligence is being able to put those facts together, prioritize the information, and do something constructive with it. “Working memory capacity refers to the ability to hold information in mind while maintaining other information to achieve a cognitive task” (Camos, 2008, p. 38). Working memory is the skill that gives a person the advantage of managing all this information and is a stronger indicator of a learner’s academic and personal potential than an IQ test (Alloway & Alloway, 2013).

The purpose of this case study is to use the discoveries in neuroscience and the theories, programs, and research of Dr. Reuven Feuerstein to bring hope to parents, Christian educators, and interventionists of learners with neurodevelopmental learning disorders (NLD): autism spectrum disorders, attention-deficit hyperactivity disorder (ADHD), specific learning disorder, intellectual disability (Intellectual Developmental Disorder), communication disorders, and motor disorders. Dr. Feuerstein is a clinical and cognitive psychologist who has shown that cognitive functioning is modifiable through mediated learning interventions (Feuerstein, Falik, & Feuerstein, 2015). Parents, teachers, and interventionists need to be informed and equipped with the methods and tools to improve a learner’s cognitive abilities rather than focusing on remediation of subject content alone. New concepts of a learner’s ability and development are needed.

There have been advances in effectively including learners with NLD in terms of educational policy, philosophy, and curriculum. Numerous researchers have studied the development of reading and mathematical skills in learners with learning disabilities. However, the cognitive enhancement of learners with severe NLD receives inadequate attention. Research on the impact of cognitive development programs of children with developmental disabilities of Down syndrome and other genetic syndromes, intellectual disabilities, and cerebral palsy is limited (Kozulin, Lebeer, Madella-Noja, Gonzalez, Jeffrey, Rosenthal, & Koslowsky, 2010). Yet the research that has been done

substantiates that learners with intellectual disorders can participate and benefit from cognitive development and enrichment programs. The "Bright Start" program of Brooks and Haywood, which is based on Feuerstein's theories, increases intelligence quotient (IQ), enhances logical reasoning and problem-solving skills, allows children to be included in the regular classroom, and increases academic performance and intrinsic motivation (Haywood, 2004). Paour's (1993)"transformation box" program and Klauer's (2002) inductive reasoning program have demonstrated the ability of learners with intellectual disorders to move beyond the pre-operational level of thinking.

Neuroscience Confirms the Brain Can Change

The belief that cognitive abilities are fixed and non-modifiable has been prevalent in the United States for many years (Tan & Seng, 2008). An individual's intellectual ability has been measured by their "intelligence quotient" (IQ) (Patel, Aronson, & Divan, 2013). Proponents of this *fixist* point of view believe that change in functioning and behavior cannot be made beyond a certain level (Sternberg, 1984).Over the last two decades the field of neuroscience has used non-invasive technologies, such as the fMRI and PET, to show the plasticity of the brain, or *neuroplasticity*, which is the brain's ability to heal, grow, and change (Boleyn-Fitzgerald, 2010).These imaging techniques show brain activity during development and learning. "It is now increasingly recognized that the brain is not a static structure and is in fact a modifiable system that changes its physical and functional architecture in response to its complex interaction with its internal processes and the environment" (Tan & Seng, 2008, p. ix).

Research confirms the modifiability of the brain through experience and training as stated by Richard Davidson, neuroscientist at University of Wisconsin – Madison: "There is tremendous potential for plasticity and for change and for this new knowledge to transform the health care system and our entire education system "(Boleyn-

Fitzgerald, 2010, p. 21).“Neuroplasticity is the most important general discovery in all of neuroscience in the last decade. The brain is built to change in response to experience and in response to training. And it is really because of this active neuroplasticity that we can learn” (p.22). In 2000, Eric Kandel received the Nobel Prize. He showed that learning can ignite genes that change neural structure. In The Brain’s Way of Healing, Norman Doidge recounts the current advances of international neuroplasticians, scientists who demonstrate the brain is plastic. He traveled to five countries to learn the stories of individuals who were told their brain could not be changed but whose brain cells are forming and reforming new connections (Doidge, 2015).

Knowing that intelligence is not fixed, is not limited, and can be grown and improved demands that educators and schools acknowledge this discovery, and that it is reflected in their teaching and student population to include learners with (NLD): autism spectrum disorders, attention-deficit hyperactivity disorder (ADHD), specific learning disorder, intellectual disability (Intellectual Developmental Disorder), communication disorders, and motor disorders.

Reuven Feuerstein: Pioneer of Neuroplasticity

The first program to increase intellectual performance with learners with neurodevelopmental learning disorders was developed more than fifty years ago by Reuven Feuerstein, clinical and cognitive psychologist who believed that intelligence was changeable and modifiable regardless of age, genetics, neurodevelopmental conditions, and developmental disabilities (Feuerstein et al., 2010). Feuerstein worked with a wide range of different groups of people—from Holocaust survivors, to people who had suffered from brain damage, Down syndrome, and Autism, to those who are intellectually gifted. When he began working with the children who had survived the Holocaust, the goal was to rehabilitate them from their traumatic experiences. He asked himself, “How will I be able to speak to them tomorrow morning about what they had learned, or about

Bible chapters,-or about any other study subject? The question that bothered me most of all was: Were these children capable of change after all they had been through?" (Feuerstein et al., p. xvii).

He also disagreed with the accepted concepts of the *critical period* or *critical age,* which states that if a person has not reached a particular function by a certain age, he or she no longer has the ability to learn that skill. According to Brian Boyd, "Feuerstein believed that when someone presents himself or herself as unable to understand something, one does not make the assumption that he or she is unintelligent. Rather, it is assumed that the person's intelligence is lying dormant, and the process of mediation by a teacher allows that intelligence—that latent intelligence—to come to the surface" (Boyd, n.d.). In speaking of the two components of modifiable intelligence, the intellect and the emotion, he would begin with an unusual perspective, an expression of faith:

> But the point we wish to emphasize is that in the beginning there must be a need- a need that will generate the belief in human modifiability. I must have the need to have my students and those with who I am engaged reach higher potentials of functioning. This need energizes me to act and motivates my faith (belief) that there are positive, effective, and meaningful alternatives to be found, to fight for, and to bring this faith into being. I believe that the student is a modifiable being who is capable of change and capable of changing according to his or her will and decisions. Human beings' modifiability differentiates them from other creatures and, according to the Rabbinic Midrash, 'even from the angels.' Herein lies the main uniqueness of human beings. " (Feuerstein et al., 2010, p.6)

"Belief in modifiability" is an essential element of Feuerstein's Theory of Structural Cognitive Modifiability (Feuerstein et al., 2010). According to Alex Kozulin, Academic Coordinator of the International Department at the Feuerstein Institute, Feuerstein was often criticized for deliberately including a "belief system" into his theory, because according to the critics there is no place for "beliefs" in scientifically based programs. In *Changing Minds and Brains*, Feuerstein states, "I have come to believe that spiritual thinking and behavior produces changes in the gray matter of the brain" (Feuerstein et al., 2015, p. 123).

Intelligence Is Modifiable

Since the 1950s, Feuerstein observed the modifiability of the brain through the application of MLE. However, when he addressed the Association for Supervision and Curriculum Development's national convention in the United States fewer than forty years ago and stated, "Intelligence is modifiable," some walked out (Feuerstein & Lewin-Benham, 2012). Today the discoveries in neuroscience confirm and support Feuerstein's theory known as Structural Cognitive Modifiability (SCM) that presents an optimistic view of the learner and one's propensity to be modified. Feuerstein's theory of human development includes three basic ideas:

1. Three forces shape human beings: environment, human biology, and mediation.

2. Temporary states determine behavior: How someone behaves—namely emotional, intellectual, and even habitually learned activities—represents a temporary state, not a permanent trait. This means that intelligence is adaptive. In other words, intelligence can change; it is not fixed once and for all.

3. The brain is plastic: Because all behaviors are open and developing, the brain can generate new structures through a combination of external and internal factors (Feuerstein, Feuerstein, Falik, & Rand, 2006).

Feuerstein insisted that human cognitive abilities can be changed regardless of etiology, severity, or a person's age, even if the condition is generally considered irrevocable and irreparable. "Don't tell me what a person is," said Feuerstein. "Tell me how he is changeable" (Feuerstein & Lewin-Benham, 2012, p. 30)!

Learning Through Mediation

The theory of Mediated Learning Experience (MLE) initially grew as part of

Feuerstein's theory of Structural Cognitive Modifiability (SCM). Mediation is an interaction in which a mediator who possesses knowledge conveys a particular meaning or skill to a child and encourages him or her to transcend, that is, to relate the meaning to some other thought or experience. Mediation is intended to help children expand their cognitive capacity, especially when ideas are new or challenging. Piaget advocated for a natural progression of learning through direct exposure to stimuli, or the "stimulus-organism-response (S-O-R)" model, which holds that it is enough for a person to simply dialogue with nature and the environment for cognitive development to occur (Feuerstein et al., 2015). Piaget is correct in saying that when you explore on your own, a natural progression leads to a natural limitation. Feuerstein believes a human mediator is needed, or "stimulus-human-organism-human-response (S-H-O-H-R)," allowing the mediator to take the learner beyond the natural limitations to reaching his or her full cognitive potential and generate new cognitive structures (Feuerstein et al., 2015).

While Piaget and Feuerstein are both giants in the field of human development, the greatest differences are their beliefs in fixed versus changeable intelligence and the role of a human mediator in developing a child's intelligence (Feuerstein et al., 2010). Piaget did not believe that adults are any different from other objects that provide information, and thus they should not intervene in a child's activity. He believed in spontaneous development: "I will call it psychological—the development of the intelligence itself, what the child learns by himself, what none can teach him, and what he must discover alone " (Piaget, 1973, p. 2). Feuerstein, however, sees the human mediator as essential for an individual to learn (Feuerstein et al., 2010). Feuerstein has sought to identify and correct these deficits to enable students to reach their full cognitive potential, as well as to increase their internal motivation and personal confidence. By using mediation, these deficient functions can be formed and modified in significant ways (Feuerstein et al., 2010).

Implications for Educators

The evidence for cognitive modifiability in learners with NDL can no longer be denied. Educators acceptance of development theories embraced by the American educational system that discount spirituality and have a naturalist worldview can be replaced with a theory of cognitive modifiability from a theist perspective. These developmental theories inform our academic and curricula, define what is normal, and one's cognitive potential based on an intelligence quotient (IQ), a static assessment. The implications for the school, the educator, and the church are substantial since intelligence can be developed when a mediator teaches and trains a student.

1. School administrators, teachers, and parents should be educated on the theory of structural cognitive modifiability and how to be an effective mediator of the environment without over-stimulating the child.

2. Educators need to be trained in mediated learning and cognitive developmental exercises. A combination of cognitive developmental exercises and curricular studies should result in significant advancement of both cognitive and domain-specific skills of special needs children. It is no longer sufficient to allow public schools to be the primary educators of students with developmental disabilities. Training is available through the Feuerstein Institute and Equipping Minds.

3. Lifetime learning is imperative. The brain continues to develop over an entire lifetime. It is important to continue to engage in stimulating learning activities during adulthood and old age.
4. Teachers should see each student with new eyes and as capable of learning. An optimistic attitude is essential. The former ideas of categorizing children into

"bright" or "not so bright" must be changed. This will only happen when teachers begin to engage with children by mediating how to learn and how to think.

5. Stop focusing on a diagnosis or a "label" of Autism, Fetal Alcohol syndrome, learning disabled, Down syndrome, or intellectual disability. It simply does not make sense to follow a deterministic view of development in light of the findings in neuroplasticity.
6. Dynamic assessments should replace static assessments. All academic and intellectual testing should be done with care in administration and interpretation.

Conclusions

Research suggests that it is possible to significantly improve fluid intelligence in children with cognitive impairments, using a comprehensive cognitive development program such as the Feuerstein Instrumental Enrichment, Bright Start, and Equipping Minds Cognitive Development Curriculum based on mediated learning experience. If the brain is constantly changing, it is possible to develop the thinking skills and increase the cognitive abilities for all children. Advances in brain imaging techniques allow us to understand and identify the cognitive neural systems to be strengthened. Neuroscience techniques provide valuable information for cognitive modifiability and hope for learners of all ages and etiologies (Tan & Seng, 2008).

May educators embrace the words of the Father of Modern Education, John Amos Comenius who stressed the need to educate the intellectually and physically handicapped. He pleaded for educators to respond to those with special needs with extra sensitivity (Murphy, 1995). He believed that all humans are created in the image of God and have the capacity to learn:

> It is evident that man is naturally capable of acquiring knowledge of all things since, in the first place, he is the image of God. So unlimited is the capacity of the mind that in the process of perception, it resembles an abyss … for the mind, neither in heaven nor anywhere outside heaven, can a boundary be fixed. The means to wisdom are granted to all men, and he reaffirms the common character of learning potentiality in all of mankind. What one human being is or has or wishes or knows or is capable of doing, all others are or have or wish or know or are capable likewise. (pp.87-89)

Let us join Feuerstein and Comenius by embracing a belief in modifiability and give our children the opportunity to reach all God created them to be.

Recommended Reading

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