Creating Infrastructure for Bridging Educational Neuroscience and Classroom-Based Practice: Developing the Centre for Teaching Brain Literacy

James B. Hale, MEd, PhD, ABPdN, ABSNP
Professor of Education, Paediatrics, and Psychiatry
University of Calgary
Teachingbrainliteracy@gmail.com
http://www.educ.ucalgary.ca/braingain

Sciences of Learning Workshop
Singapore National Research Foundation
Nanyang Technological University
4 June 2015
Are We Addressing the Questions Posed of Us?

Where are we now?

- **Positives:** Great interdisciplinary science, methods, results
- **Negatives:**
  1) Homelessness
  2) Science not translated into school practice

What types of bridges need to be built?

- **Knowledge translation**

What are the successful models that can be used?

- **Medicine:**
  1) System focus – consider system dynamics
  2) Interdisciplinary – shared vision
  3) Centralized support – knowledge/skill development
  4) Local adoption/adaptation – Evidence(data)-based practice
  5) Collaborative culture – Central and local partnership

What types of research are needed?

- **Knowledge translation**

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Brain-Based Education
Are We Ready for the Revolution?

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Why Differentiated Instruction Hasn’t Worked (or Has Ever Really Been Attempted)

- Limited teacher training in applying science to practice
- Teachers taught about “multiple intelligences” but few understand how they affect student performance or teaching
- Teachers have limited training in causes of learning problems
- Teachers have to use trial and error to understand how different disorders respond to intervention
- Teachers focus on compensation for difficulty/disability, not remediation
- Teachers want to teach diverse learners, but training and support is not sufficient
Where Do We Begin?  
What Science Tells Us About Effective Teaching  
Meta-Analysis of 500 Studies on Effective Instruction

<table>
<thead>
<tr>
<th>Highly Effective Instructional Approaches</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback</td>
<td>1.13</td>
</tr>
<tr>
<td>Evidence-Based Instruction</td>
<td>1.00</td>
</tr>
<tr>
<td>Direct Instruction</td>
<td>.82</td>
</tr>
<tr>
<td>Remediation</td>
<td>.65</td>
</tr>
<tr>
<td>Classroom Structure</td>
<td>.56</td>
</tr>
<tr>
<td>Goal-Directed Learning</td>
<td>.52</td>
</tr>
<tr>
<td>Peer Tutoring</td>
<td>.50</td>
</tr>
<tr>
<td>Mastery Learning</td>
<td>.50</td>
</tr>
<tr>
<td>Homework</td>
<td>.43</td>
</tr>
<tr>
<td>Teacher Engagement</td>
<td>.42</td>
</tr>
<tr>
<td>Questioning</td>
<td>.41</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Least Effective Instructional Approaches</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advance Organizers</td>
<td>.37</td>
</tr>
<tr>
<td>Games and Simulation</td>
<td>.34</td>
</tr>
<tr>
<td>Computer Instruction</td>
<td>.31</td>
</tr>
<tr>
<td>Testing</td>
<td>.30</td>
</tr>
<tr>
<td>Instructional Media</td>
<td>.30</td>
</tr>
<tr>
<td>Audio-Visual Aids</td>
<td>.16</td>
</tr>
<tr>
<td>Programmed Instruction</td>
<td>.18</td>
</tr>
<tr>
<td>Individualization</td>
<td>.14</td>
</tr>
<tr>
<td>Team Teaching</td>
<td>.06</td>
</tr>
<tr>
<td>Classroom Physical</td>
<td>-.05</td>
</tr>
<tr>
<td>Retention</td>
<td>-.15</td>
</tr>
</tbody>
</table>

Education Mantra:
*It is, after all, just a “black box”*
Just a Black Box?

Research Trends on Brain and Behaviour

PUBLICATIONS, 2009-2013

1.79M

1.79 million articles published in 2009–2013 were considered to fall within the area of brain and neuroscience research, representing approximately 16% the world’s output in this period.

ACTIVE RESEARCHERS

1.73M

The assessment of cross-disciplinary researcher mobility was based on the movement of 1.73 million active researchers in the area of brain and neuroscience research since 1996.

PUBLICATION OUTPUT GROWTH AND ARTICLE SHARE

China

From 2009 to 2013, China showed both the largest growth in research output and world article share in brain and neuroscience research, at 11.6% and 7.5%, respectively.


©James B. Hale, PhD, MEd, ABPdN, ABSNP
Education’s Fixation on Behaviour
Is DSM-5 the Answer?

Blessing or Bane? Allen Frances, M.D.

- Former Chair of DSM-IV says “saddest moment” in 45 years of being leader of psychiatry
- Opposed by 50 mental health organizations, ignore 10 worse changes
- Changes in autism, anxiety, eating, mood, ADHD, and behaviour disorders all problematic
- Not evidence-based – limited to no science behind practice, more based on special interests and financial incentives
- DSM-5 violates most sacred tenet in medicine- First Do No Harm!

National Insitutes of Mental Health: Thomas Insel, M.D.

- Thomas Insel, MD, Director of NIMH: DSM diagnoses “consensus about clinical symptoms” practice largely abandoned in medicine
- Patients with mental disorders “deserve better”
- Embrace Research Domain Criteria (RDoC): genetics, cognitive neuroscience, and neuroimaging to “lay the foundation” for new diagnostic system
A Problem, A Solution:
The Centre for Teaching Brain Literacy
Impetus for Developing a Centre for Excellence in Educational Neuroscience

THE FACT
Parents, teachers, and allied professionals worldwide change the brains of children every day.

THE PROBLEM
Most parents and professionals working with children know little about the brain, or how the brain affects a child’s learning and behaviour.

THE DIVIDE
Innovative neuroscience research documents the biological basis of learning and behaviour, and how the brain changes in response to intervention, but the science is not translated into school-based practice.

THE SOLUTION
The interdisciplinary Centre for Teaching Brain Literacy research, teaching, and service efforts will bridge the neuroscience and classroom practice divide.

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Our Mission:
Debunk Myths about Brain and Behaviour

• The left side of the brain is for verbal abilities, the right brain is for nonverbal abilities
• All children use the same brain areas to do an academic task like word reading or math computation
• Since all children learn the same way, it is important they get the same instruction, and if they don’t succeed, provide increasingly “intense” instruction
• The brain is “hard-wired” and you can do little to change the brain to overcome disability, so use compensatory strategies
• It is best to examine functional outcomes, we just don’t know enough about causes of disability

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Our Mission: Share the Science of Changing Brains

• **Advances in neuroscience** of learning
  (Evidence: research on typical children)

• **Brain changes more quickly** than once thought
  (Evidence: Changes in brain function with intervention)

• Brain matters for **early identification and intervention**
  (Evidence: Individual differences in cognition and learning)

• Brain matters for **differential diagnosis** of disability
  (Evidence: Different brain patterns in children with same overt behaviours)

• Brain matters for **targeted intervention** for diverse learners
  (Evidence: Cognitive influences on intervention response)
Why Education Needs Neuroscience

Three Evidence-Based Realities

Reality #1
→ Cognitive diversity is the norm, not the exception

Reality #2
→ Children with disabilities use different brain areas and processes than typical children to do the same task

Reality #3
→ Intervention results in changes in brain functioning, many disabilities can be prevented or overcome (i.e., not lifelong)
Differentiating Instruction to Meet Diverse Learner Needs in Inclusive Classrooms:  
The Centre for Teaching Brain Literacy

<table>
<thead>
<tr>
<th>Division</th>
<th>Objectives</th>
<th>Specific Activities</th>
<th>Outcomes Expected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Educational Neuroscience Research Group</td>
<td>Interdisciplinary brain research on function, dysfunction, and biological basis of classroom learning and behaviour</td>
<td>Small Grants Program</td>
<td>Small seed grant awarded per cycle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Internal Research Grant Review Panel</td>
<td>Panel guidance leading to external funding</td>
</tr>
<tr>
<td>Educational Neuroscience Software Development</td>
<td>Interdisciplinary group includes government and private sector to develop assessment, intervention, and simulation training software</td>
<td>Translating Educational Neuroscience Journal Editorial Review Board</td>
<td>Review and make editorial recommendations on international manuscript submissions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>C-DM Software for identifying disabilities developed with Seattle technology expert</td>
<td>Software published and sold through CTBL website; pay for fee option available for advanced reports</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In-Class Live simulation software designed to facilitate teacher competence in working with children with Seattle technology expert and Singapore Government</td>
<td>Software piloted in training program study to optimize teacher response to learning and behaviour problems from a neuroscience orientation, with teachers trained in simulation having better child outcomes in classrooms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Diagnostic Practice Live simulation software designed to facilitate clinician interpretation of child presentation, informant report, and other data to foster better diagnosis and treatment monitoring</td>
<td>Software piloted in training program study to optimize clinician response to child presentation, informant report, and interpretation of data, with those trained in simulation to show improved child diagnostic and treatment outcomes in clinical practice</td>
</tr>
<tr>
<td></td>
<td></td>
<td>BrainDx software for clinicians to evaluate child characteristics and likelihood of treatment success</td>
<td>Software developed to enter symptoms and data to be used in school and clinical settings for better child diagnosis and treatment management</td>
</tr>
<tr>
<td>Teacher and Allied Professional Education</td>
<td>Preservice and continuing education opportunities for teachers, allied professionals, and parents</td>
<td>Graduate Educational Neuroscience degrees</td>
<td>Masters/doctoral students enrolled and graduated</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Allied discipline curricula infusion</td>
<td>Course(s) with educational neuroscience content</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Continuing education for professionals and parents</td>
<td>Presentations, workshops, webinars, podcasts, training packets, consults</td>
</tr>
<tr>
<td></td>
<td></td>
<td>International Society for Educational Neuroscience membership</td>
<td>Educational Neuroscientist in Practice newsletter and ED_NEURO listserv privileges</td>
</tr>
<tr>
<td>International Society for Educational Neuroscience International Research Clearinghouse</td>
<td>Gather and disseminate international educational neuroscience research through various knowledge translation</td>
<td>Educational Neuroscience in Practice newsletter</td>
<td>Editor, Chair, Scientist, Practitioner, Translating Science, CE columns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Translating Educational Neuroscience Journal</td>
<td>Manuscripts submitted for peer review and subscription numbers</td>
</tr>
<tr>
<td></td>
<td></td>
<td>International Society for Educational Neuroscience Conference</td>
<td>Papers, panels, posters submitted, attendance, abstracts in Translating Educational Neuroscience Journal</td>
</tr>
</tbody>
</table>

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Developing Brain Literacy: Educating the Educators

Goals

• Develop Graduate Programs in Educational Neuroscience
• Infuse Educational Neuroscience in Curricula of Other Allied Professions
• Continuing Education Opportunities for Teachers, Allied Professionals and Parents
• Create Interdisciplinary, International Society for Educational Neuroscience
Teachers Can Learn How Neurodevelopment Influences Student Achievement and Behaviour

- Vygotsky: Physiological development and environmental determinants, importance of sociocultural exchange
- Hebb: Brain as architect \(\rightarrow\) *active* learning process, *neurons that wire together wire together!*
- More brain not better, more *efficient* is better, LESS brain used for MORE
- *Automaticity critical* to free brain for higher level operations \(\rightarrow\) *practice makes perfect!*
- Plasticity works *both* ways, can be functional or dysfunctional; *natural selection* in each child’s brain
- Bandura’s *Reciprocal Determinism*

©James B. Hale, PhD, MEd, ABPdN, ABSNP
The NIH Study of Typical Brain Development
Deborah Waber, Ph.D - Children’s Hospital Boston and Harvard Medical School

T1W

T2W

DTI Fiber Orientations

Fractional Anisotropy

1 week  3 months  1 year  2 years  10 years
How Teachers Benefit From Brain Literacy: Simple Answers Don’t Address Difficult Questions

“Brain boss” directs and evaluates all brain functions

- Governs motor skills such as handwriting and playing sports
- Governs visual recognition of objects and visual details
- Governs touch or tactile skills for handwriting and grip strength
- Governs auditory processing for reading and speech

©James B. Hale, PhD, MEd, ABPdN, ABSNP
“Joey has an attention deficit.”
“Sara is a auditory learner.”
“Maria has difficulty with her memory.”
“Tom has an emotional problem.”

Teacher’s Can Consider Greater **Specificity in Identifying Child Problems**: Luria’s Working Brain

Teacher’s Can Consider Different Executive Functions in Learning and Behaviour: The Role of the Frontal-Subcortical Circuits

Does circuit impairment lead to emotional and behaviour disorders?

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Teacher’s Can Consider Hemispheric Specializations in Learning and Behaviour

<table>
<thead>
<tr>
<th>Left Hemisphere</th>
<th>Right Hemisphere</th>
</tr>
</thead>
<tbody>
<tr>
<td>More Grey Matter</td>
<td>More White Matter</td>
</tr>
<tr>
<td>More Primary Cortex</td>
<td>More Association Cortex</td>
</tr>
<tr>
<td>More Intramodal Connections</td>
<td>More Intermodal Connections</td>
</tr>
</tbody>
</table>


©James B. Hale, PhD, MEd, ABPdN, ABSNP
Teachers Can Consider Brain-Based Language Differences
Explicit vs. Implicit Language

He stopped at the bank to make a deposit.
Question: What does bank mean?

Left Hemisphere → Explicit Language

He stopped at the bank because he had to stay dry.
Question: What does bank mean?

Right Hemisphere → Implicit Language

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Teachers Can Consider Differences in Auditory Processing: Phonics vs. Prosody
(Zatorre & Belin, 2001)
Teachers Can Consider Visual Processing Differences
(Delis et al. 1986)

Stimulus

N
N
N
N
N
N
N
N
N
N
N
N
N

Response

Left Hemisphere Damage

Right Hemisphere Damage

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Teachers Can Consider Novel-Routinized Distinctions

Left Temporal Lobe → Known Images

Right Temporal Lobe → Novel Images

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Teachers Can Learn Student Functioning on the Three Axes Interpretation

Left Hemisphere
- Routinized/Detailed/Local
- Convergent/Concordant
- Crystallized Abilities

Right Hemisphere
- Novel/Global/Coarse
- Divergent/Discordant
- Fluid Abilities

Anterior/Superior
- Executive Regulation and Supervision
- Motor Output

Posterior
- Sensory Input
- Comprehension

Inferior
- Executive Execution
- Automaticity of Action
Teachers Can Recognize Brain Functions During Learning Stages

**GOAL**

<table>
<thead>
<tr>
<th>Acquisition</th>
<th>Proficiency</th>
<th>Maintenance</th>
<th>Generalization</th>
<th>Adaption</th>
</tr>
</thead>
<tbody>
<tr>
<td>0% to 25%</td>
<td>High Rate &amp; Accuracy</td>
<td>High Rate &amp; Accuracy</td>
<td>Transfer to Settings &amp; Responses</td>
<td>Capitalize on Knowledge And Skills</td>
</tr>
</tbody>
</table>

Rates of Student Progress

- High Rate & Accuracy
- 25% to 85%
- 0% to 25%

Brain Activity

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Teachers Can Learn the Neuroscience of Achievement

**Word Reading Skill**
- Phonological awareness (letter sounds)
- Symbolic representation (letter shapes)
- Phoneme-grapheme Map (alphabetic principle)
- Sequencing (segmenting or blending words)
- Word attack (sound out) or sight (whole) word reading

**Brain Areas/Functions**
- Left superior temporal processes phonemes
- Left inferior occipital-temporal processes letters
- Left angular gyrus makes sound-symbol associations
- Broca’s, basal ganglia, oculomotor circuits
- Angular gyrus “dorsal stream” or inferior temporal “ventral stream”
Neuropsychology of Word Reading: How Do We First Read “DOG”?

Decoding the Word “DOG” Using Word Attack Skills

Teacher says “Read this word.”

DOG

/d/ /p/ /g/

Four legged domestic mammal with long snout, acute smell, and barking voice.

D-O-G
Neuropsychology of Word Reading: How Do Proficient Readers Read “DOG”?

Reading the Word “DOG” Using Automatic Sight Word Skills

Teacher says “Read this word.”

DOG

Four legged domestic mammal with long snout, acute smell, and barking voice.

Automaticity
Training Example:
The Big Candy Store Adventure

Jack and Jill went up the hill to go to the candy store. As they reached the store, Jack peered in the window. Jill said, “Come on, let’s go in.” She held the door open for Jack, and they both went inside. They said hello to Ms. Smith, the store clerk. They each picked out two pieces of candy, and paid Ms. Smith 10 cents for each piece. Jack said “Have a nice day Ms. Smith,” and they left the store together.

Comprehension Questions

1. Did Jack and Jill go down the hill to the store?
2. Who held the store door open?
3. What was the store clerk’s name?
4. How much did they pay for the candy?
5. What will they do next?
Documenting CTBL Training Outcomes: First, Knowledge, Then Practice

Centre for Teaching Brain Literacy
James B. Hale, PhD, ABPdN, Executive Director

CONTINUING EDUCATION WORKSHOP SURVEY
(ATA Workshop February 2015 Results; N = 54)

Please read each item below and then indicate your agreement with the statement using the Likert scale (1 = strongly disagree to 5 strongly agree). Next, please indicate your answers to questions about this workshop. Finally, please provide typed or handwritten comments about the workshop, and how we can improve the instruction and delivery of this workshop.

<table>
<thead>
<tr>
<th>GENERAL ITEMS</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
<th>Pre-Test</th>
<th>Post-Test</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>I have adequate knowledge of brain-behaviour relationships.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>2.53 (.78)</td>
<td>3.45 (.71)</td>
<td>-8.25</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>My interest in understanding brain-behaviour relationships in schools is high.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4.48 (.73)</td>
<td>4.53 (.63)</td>
<td>-.55</td>
<td>.582</td>
</tr>
<tr>
<td>Children with disabilities are just lower than other children in particular cognitive domains, so more intensive instruction is sufficient.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1.95 (.78)</td>
<td>1.71 (.77)</td>
<td>2.03</td>
<td>.047</td>
</tr>
<tr>
<td>Understanding brain functioning is critical for school-based assessment of child strengths and needs.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4.38 (.56)</td>
<td>4.66 (.52)</td>
<td>-3.78</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Understanding brain functioning is critical for intervention in the schools.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4.48 (.57)</td>
<td>4.62 (.59)</td>
<td>-1.53</td>
<td>.132</td>
</tr>
<tr>
<td>The brains of children are largely static and do not change in response to intervention.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1.26 (.55)</td>
<td>1.24 (.71)</td>
<td>.18</td>
<td>.855</td>
</tr>
<tr>
<td>I have attended workshop presentations on brain-behaviour relationships that have been clear and useful.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>2.48 (1.15)</td>
<td>3.86 (.69)</td>
<td>-4.95</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>The left brain is specialized for verbal abilities and the right brain is specialized for nonverbal abilities.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>2.98 (.85)</td>
<td>1.64 (.79)</td>
<td>8.48</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Our knowledge of brain-behaviour relationships has not changed much in the last 20 years.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>1.74 (.98)</td>
<td>1.52 (.90)</td>
<td>.59</td>
<td>.185</td>
</tr>
<tr>
<td>I can link brain structures/functions to everyday real world activities in the classroom.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>3.12 (.99)</td>
<td>4.00 (.62)</td>
<td>-7.01</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>WORKSHOP SPECIFIC ITEMS</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral</td>
<td>Agree</td>
<td>Strongly Agree</td>
<td>Score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------------</td>
<td>-------------------</td>
<td>----------</td>
<td>---------</td>
<td>-------</td>
<td>----------------</td>
<td>-------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The workshop pace was appropriate for my understanding of the workshop content delivered.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>3.63</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The real world examples provided facilitated my understanding of workshop content.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4.27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The presenters answered questions in a way that facilitated my learning of workshop content.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4.07</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The presenter-attendee relationship was positive and appropriate.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4.41</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This workshop improved my understanding of brain-behaviour relationships in schools.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4.47</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This workshop was relevant for identification of children’s learning needs.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4.27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>This workshop was relevant for intervention of children’s learning needs.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4.24</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would like to learn more about educational neuroscience/school neuropsychology.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4.46</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The overall workshop content and delivery was appropriate for my learning.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>4.14</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Developing Brain Literacy: An Interdisciplinary, International Research Effort

Goals

1. Administate Peer-Reviewed Small Grants Program in Educational Neuroscience
2. Form Editorial Board for the *Translating Educational Neuroscience Journal*
3. Knowledge sharing In *Educational Neuroscience in Practice* Newsletter
4. Knowledge sharing in presentations and workshops at the *Annual Meeting of the International Society for Educational Neuroscience*
University of Calgary-Alberta Children’s Hospital Study

Teaching to the Brain: A Neuropsychological Approach to Differentiated Instruction for Children with Reading Disabilities

Catherine Lebel, PhD, Principle Investigator, James B. Hale, Co-Investigator

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Cognitive Hypothesis Testing Approach to Assessment and Intervention

1. Presenting Problem
2. Intellectual/Cognitive Problem
3. Administer/Score Intelligence Test
4. Interpret Global Scores or Demands Analysis
5. Cognitive Strengths/Weaknesses
6. Choose Related Construct Test
7. Administer/Score Related Construct Test
8. Interpret Constructs/Compare
9. Intervention Consultation
10. Choose Plausible Intervention
11. Collect Objective Intervention Data
12. Determine Intervention Efficacy
13. Continue/Terminate/Modify


©James B. Hale, PhD, MEd, ABPdN, ABSNP
### Bonnie's CHT Processing Strengths and Weaknesses

<table>
<thead>
<tr>
<th>Subtests</th>
<th>Composite</th>
<th>%ile</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WISC-IV</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal Comprehension</td>
<td>102</td>
<td>55</td>
<td>Average</td>
</tr>
<tr>
<td>Perceptual Reasoning</td>
<td>122</td>
<td>93</td>
<td>Superior</td>
</tr>
<tr>
<td>Working Memory</td>
<td>88</td>
<td>21</td>
<td>Low Average</td>
</tr>
<tr>
<td>Processing Speed</td>
<td>106</td>
<td>66</td>
<td>Average</td>
</tr>
<tr>
<td><strong>NEPSY-II</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phonological Processing Total</td>
<td>9</td>
<td>37</td>
<td></td>
</tr>
<tr>
<td>Comprehension of Instructions</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speeded Naming</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Speeded Naming Combined</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>List Memory (List Memory + Delay)</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>List Memory Immediate Recall</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>List Memory Delayed Recall</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>List Memory Learning Effect</td>
<td>58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>List Memory Interference</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>List Memory Delay</td>
<td>25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>List Memory Repetitions</td>
<td>20-58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Narrative Memory Free Recall</td>
<td>11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Narrative Memory Free and Cue</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory for Designs Content</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory for Designs Spatial</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memory for Designs Total</td>
<td>14</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NEPSY-II

<table>
<thead>
<tr>
<th>Subtests</th>
<th>Composite</th>
<th>%ile</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>NEPSY-II</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design Copying Process Total Score</td>
<td>9</td>
<td>37</td>
</tr>
<tr>
<td>Design Copying Process Motor</td>
<td>8</td>
<td>25</td>
</tr>
<tr>
<td>Design Copying Process Global</td>
<td>9</td>
<td>37</td>
</tr>
<tr>
<td>Design Copying Process Local Score</td>
<td>10</td>
<td>50</td>
</tr>
</tbody>
</table>

### WJ III ACH

<table>
<thead>
<tr>
<th>Subtests</th>
<th>Composite</th>
<th>%ile</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WJ III ACH</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broad Reading</td>
<td>83</td>
<td>13</td>
</tr>
<tr>
<td>Letter-Word Identification</td>
<td>90</td>
<td>26</td>
</tr>
<tr>
<td>Reading Fluency</td>
<td>72</td>
<td>3</td>
</tr>
<tr>
<td>Passage Comprehension</td>
<td>84</td>
<td>15</td>
</tr>
<tr>
<td>Word Attack</td>
<td>91</td>
<td>28</td>
</tr>
<tr>
<td>Reading Vocabulary</td>
<td>92</td>
<td>29</td>
</tr>
</tbody>
</table>
Bonnie’s Response to Sight Word Intervention

<table>
<thead>
<tr>
<th>Trials</th>
<th>Trials 1-3</th>
<th>Trials 4-6</th>
<th>Trials 7-9</th>
<th>Trials 10-12</th>
<th>Final Trial</th>
</tr>
</thead>
<tbody>
<tr>
<td>LEARNED Words</td>
<td>27/33</td>
<td>26/37</td>
<td>24/36</td>
<td>33/40</td>
<td>110/146</td>
</tr>
<tr>
<td>Final Percent</td>
<td>82%</td>
<td>70%</td>
<td>67%</td>
<td>83%</td>
<td>75%</td>
</tr>
</tbody>
</table>

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Structural Imaging Response to Intervention: Diffusion Tensor Imaging (DTI) Results

- ↑ Right superior longitudinal fasciculus (BETTER RETRIEVAL)
- ↓ Left arcuate fasciculus (LESS COMPENSATION)
- ↑ Left and right inferior longitudinal fasciculi and left inferior frontal-occipital (BETTER SIGHT WORD AUTOMATICITY)
University of Calgary-Alberta Children’s Hospital

ADHD Biphentin Study

James B. Hale, PhD, ABPdN, Principle Investigator
Jean-Francois Lemay, MD, Frank McMaster, PhD, Signe Brey, PhD, Catherine Lebel, PhD, (Co-Investigators)

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Childhood’s Greatest “Behaviour Problem”: Persistent Academic Achievement Deficits

- ADHD is a neurodevelopmental disorder defined by behavioural criteria, leading to neuropsychological heterogeneity and attenuated treatment efficacy
- Are academic deficits the common pathway? Poorer grades, grade retention, special education likely in ADHD (especially if executive deficits)

WHAT CAUSES ADHD ACADEMIC DEFICITS?

Or

Poor Availability For Learning?

Executive Deficits Impair Learning?

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Contrasting Lisa’s Neuropsychological and Behavioural Response to Stimulant Medication

Note. Lower Ranks = Better performance and behaviour; Order of conditions = Baseline, Low Dose, Placebo, High Dose

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Using Medication to Optimize Learning and Behaviour
Neuropsychological Medication Response and Glutamate

Left Striatum

Cognitive Titration

Behavioural Titration

Right Prefrontal

Cognitive Titration

Behavioural Titration

Glx

Glx

©James B. Hale, PhD, MEd, ABPdN, ABSNP
University of Calgary

A Multi-Tiered Instructional Approach That Meets All Learner Needs

James B. Hale, Principle Investigator
The background and reason for the White Paper became apparent when the Individuals with Disabilities Education Act (IDEA) Statute was published in 2004. Members of the LDA Board of Directors were pleased that the definition of Specific Learning Disabilities (SLD) remained intact. But when the Regulations were published in 2006, it was surprising to find that the SLD evaluation criteria and identification criteria were no longer aligned with the SLD definition in IDEA. Both of these criteria changed from taking the cognitive nature of SLD into consideration, to instead aligning IDEA with the regulations in the Elementary and Secondary Education Act (ESEA/NCLB) and putting the emphasis on identifying students who are not achieving adequate for the child’s age or the attainment of State-approved grade-level standards, not abilities. In effect, the new criteria virtually eliminated a great many students with SLD, including some who have high academic achievement in some areas but markedly low achievement in other areas.

In 2008 LDA partnered with a group of professionals who were also concerned that the cognitive nature of SLD was not given much, or in some cases, no consideration but rather was looked upon as a condition that is educational in nature. The idea for the White Paper grew out of this partnership of professionals and members of LDA and was presented at a Symposium held at the LDA International Conference held in Baltimore, February 2010.

**“The SLD [processing deficit] definition should be maintained”**

**“Neither ability-achievement discrepancy or failure to respond to intervention alone is sufficient for SLD”**

**“[For SLD], Identifying a pattern of processing strengths and weaknesses, and achievement deficits associated with the processing weaknesses, makes the most empirical and clinical sense.”**

**“Assessment of cognitive and neuropsychological processes should be used for both SLD identification and intervention purposes.”**

---


©James B. Hale, PhD, MEd, ABpD, ABSNP

Multi-Tier Model of Service Delivery

Tier 1: 85% Served

Standard Protocol Instruction RTI Approach

Tier 2: 10% Served

Problem-Solving RTI Approach

Tier 3: 5% Served

Comprehensive Cognitive Hypothesis Testing Evaluation

Individualized Special Education

Individualized Measurement Single Subject Designs

Curriculum-Based Measurement Ongoing Progress Monitoring


©James B. Hale, PhD, MEd, ABPdN, ABSNP
Tier 1
Standardized RTI Approach

Responder?

YES Continue General Education and Progress Monitoring

NO Begin Tier 2 Problem-Solving Model Intervention

Tier 2
Problem Solving Model RTI Approach

Responder?

YES Return to Tier 1 General Education and Progress Monitoring

NO, Consider Comprehensive Evaluation and Cognitive Hypothesis Testing Model
Does RTI Work?

Percent of Children Meeting Reading Benchmarks

©James B. Hale, PhD, MEd, ABPdN, ABSNP
Does RTI Work?
Percent of Children Meeting Math Benchmarks

- Fall: Below Basic (40%), Basic (55%), Proficient (2%), Advanced (3%)
- Winter: Below Basic (30%), Basic (50%), Proficient (15%), Advanced (5%)
- Spring: Below Basic (20%), Basic (30%), Proficient (35%), Advanced (15%)
This could suggest that nonresponse is SLD, but CHT results revealed ADHD, Tourette’s, Generalized Anxiety, Bipolar, ODD, and several reading, math, and writing SLD subtypes.
Developing Brain Literacy: Educational Neuroscience Software Development

Goals

1. Refine *Concordance-Discordance Model* software program for identification of learning disabilities.
2. Create *In-Class Live* software for training teachers in real-time interactions with students using actors and/or programmed characters.
3. Create *Diagnostic Practice Live* software program to develop clinical skills in differential diagnosis
4. Create/disseminate computer software for improving instruction and child learning
Processing Strengths and Weaknesses Operationalized: 
*The Concordance-Discordance Model of SLD Identification*

Center for Teaching Brain Literacy
James B. Hale, PhD, MEd, ABPdN, ABSNP, Director

Concordance-Discordance Model (C-DM) Software
James B. Hale and Nils Lahr

User ID: 
Password: 
New User? Create account here.

CONFIDENTIAL

Data entered into this software program contains confidential information about a child for the purposes of learning disabilities identification by a licensed and/or credentialed professional within the jurisdiction the data were gathered. Nothing contained herein is to be shared, transmitted, or revealed without the expressed written consent of the child’s parent/guardian and the credentialed professional who conducted the evaluation.
Processing Strengths and Weaknesses Operationalized: 
*The Concordance-Discordance Model of SLD Identification*

Not Just Content, Teachers Need Skills

In-Class Brain Live Interactive Virtual Reality Software
Developing Brain Literacy: International Society for Educational Neuroscience Clearinghouse

Goals

1. Create quarterly *Educational Neuroscience in Practice* Newsletter
2. Create *Translating Educational Neuroscience* Peer-reviewed scholarly journal
3. Use web searching support/database to facilitate researchers
4. Yearly *Society for Educational Neuroscience* conference
THANK YOU!
QUESTIONS? COMMENTS?

Find us online: www.educ.ucalgary.ca/braingain
Follow us on Twitter: @braingainlab
Like us on Facebook: www.facebook.com/braingainlab

©James B. Hale, PhD, MEd, ABPdN, ABSNP