Brain-Behaviour and Environmental Match-Mismatch Considerations for Optimal Socio-Emotional Functioning and Intervention In Children and Youth

John D. Strang, Ph.D., C. Psych.
Clinical Neuropsychologist
April 2015

Socio-Emotional (SE) Considerations

- How we feel and how we relate to others are interconnected
- At least 1 in 5 will have problems with their SE functioning and mental health before age 19
- Good SE functioning represents a mental health buffer and facilitator throughout life

DIMENSIONS OF SE PROBLEMS

- For children and adolescents with “social learning disabilities”, SE functioning represents a central problem and these often promote additional mental health problems (e.g., anxiety, depression)

- Other children and youth have SE functioning problems related primarily to environmental influences (e.g., CD, ODD)

- The “cause” of SE problems always has an underlying brain-behaviour influence at the point of expression

Research Domain Criteria (RDoC): Toward Precision Diagnosis for Mental Disorders

NIMH Training Webinar
September 17, 2014

Bruce N. Cuthbert, Ph. D.
Director, Division of Adult Translational Research
National Institute of Mental Health
**RDoC DOMAINS/CONSTRUCTS**

- **Genes**
- **Molecules**
- **Cells**
- **Brain-related Circuits**
- **Physiology**
- **Behaviour**
- **Self Report**
- **Paradigms**
RDoC DOMAINS/CONSTRUCTS

- Negative Valence Systems
- Positive Valence Systems
- Cognitive Systems
- Systems for Social Processes
- Arousal/Modulatory Systems

All RDoC domains/constructs relate to SE development & SE functioning

RDoC Systems for Social Processes

- Affiliation/Attachment
- Social Communication
- Perception/Understanding of Self
- Perception/Understanding of Others

SE functions are multi-facet and person-related
Devereux Student Strengths Assessment (DESSA)

• 72-item standardized, norm-referenced behaviour rating scale
• assesses social-emotional competencies
• can be completed by parents, teachers, or other staff

Self Awareness
Social Awareness
Self Management
Goal Directed Behavior
Personal Responsibility
Decision Making
Optimistic Thinking

Social-Emotional Composite

Devereux Student Strengths Assessment (DESSA)

• 44 students in two Grade 6 classrooms
• high levels of interpersonal conflict, limited coping strategies
• ratings completed by classroom teacher pre- and post-intervention
• intervention consisted of the Friends for Life program delivered by Marylou Cortese, Consultant in Student Mental Health

Self Awareness
Social Awareness
Self Management
Goal Directed Behavior
Relationship Skills*
Personal Responsibility
Decision Making
Optimistic Thinking*

Social-Emotional Composite
Emotional, Cognition & SE Learning

- “Feeling systems” in the brain are connected to our internal (body) sensations, our brain’s information monitoring systems, and our thoughts

- A combination of emotional processing and cognitive processing systems provide the “equipment” for both socio-emotional (SE) development and SE capabilities

- Experience and learning “program” the developing brain through epigenetic expression to shape SE perceptions and skills

EPIGENETIC MECHANISMS

- Courtesey of NIMH Public Access
Accumulating evidence that type, intensity, timing and duration of early life stress (ELS) a major risk factor

ELS causes functional scarring in limbic and prefrontal regions essential for emotional control, learning and memory functions

*Match/mismatch between experience & needs*

NB for outcome: psychopathology or resilience

Shared pleasure (SP) in early mother-infant interaction: predicting lower levels of emotional and behavioral problems in the child and protection against the influence of parental psychopathology

SP 58 2 month-old infants face to face interaction mean time

Longer mean SP showed fewer internalizing and externalizing problems 2 years later.

Reduced SP contributed to internalizing after controlling for other factors related to mother’s interactive behaviour

Father’s mental health problems at follow-up contributed to increased externalizing and internalizing, except for infants protected by high maternal SP

Mantymaa, M. et. al 2015 *Journal of Infant Mental Health*

It’s all about interpersonal connectedness
Early Language and SES
Fernald et. al. 2013

- 18 month yr. old children divided into low and higher SES groups (parent vocation + level of education)
- Mean family income $23K vs. $69K (<$22K USA poverty level)
- All children free of brain threats
- Children’s language evaluated at 18 mons. & 24 mons.

<table>
<thead>
<tr>
<th>Mean Expressive Vocabulary</th>
<th>Low SES</th>
<th>Higher SES</th>
</tr>
</thead>
<tbody>
<tr>
<td>18 Months</td>
<td>107 words</td>
<td>174 words</td>
</tr>
<tr>
<td>24 Months</td>
<td>288 words</td>
<td>442 words</td>
</tr>
</tbody>
</table>
Self-Regulation Brain Systems

Hanson J. et al. (2013) PLoS ONE
/Public Library of Science

- Hearing mothers and their deaf children: the relationship between early, ongoing mode match and subsequent mental health functioning in adolescence
- 15 year longitudinal database - 3 groups: auditory/oral, sign match, sign mismatch
- Results supported the importance of an early and consistent mode match between children and their mothers regardless of communication modality.

Wallis, Musselman & MacKay, 2004 Journal of Deaf Studies and Deaf Education
Neural Circuits for Social Processes

Based on *The Emotional Life of Your Brain* (2012)
Richard Davidson, Ph.D.

**Social Intuition:**
fusiform gyrus $\leftrightarrow$ amygdalae

**Self-Awareness:** insula $\leftrightarrow$ amygdala $\leftrightarrow$ PFC

**Sensitivity to Context:**
hippocampus $\leftrightarrow$ PFC + other cortical association areas

---

**Outlook:**
Nucleus accumbens $\leftrightarrow$ ventral caudate $\leftrightarrow$ OFC $\leftrightarrow$ ACC

**Attention:**
Parietal association $\leftrightarrow$ PFC

**Resilience:**
Left PFC $\leftrightarrow$ amygdala
MBSR (MT) – Boston Study
Pre-Post Stress & Brain Changes
TX Average: 38.3 hrs. over 8 wks.

MINDFULNESS IN EDUCATION

• Rationale – if education professionals have social/emotional skills to manage school demands, classroom climate and student behavior/learning will improve (based on the work of Patricia Jennings, Daniel Siegel, Richard Davidson, Jon Kabat-Zinn and others)

• Purpose – examine response to 6 weeks of mindfulness training/practice (MindfulSchools.org – Mindfulness Fundamentals)

• Measures – BRIEF-A (Behavior Rating Inventory of Executive Function, Adult Version), Five Facet Mindfulness Questionnaire, Perceived Stress Scale, Life Stress Index, Program efficacy and feasibility survey

• Study findings – June 30th

• Results – guide future training and classroom practice

Maryvale Mindfulness Study (2015)

John D. Strang, Ph.D., Janet Glos, MSW, & Paulette A. Strang, M.Ed.
Maryvale Mindfulness Study

Student Participants

- 4 Maryvale classrooms matched for age and academic level
- 2 Mindfulness Training (MT) classrooms (n=10)
- 2 Control (CTR) classrooms (n=11)

Maryvale Mindfulness Study: Staff & Student Training

- Sept. 26 to Oct. 21:
  4 training sessions/procedures (script) for involved staff about MT and reliable data collection procedures.

- Beginning Oct. 22:
  Classroom Mindfulness script & ongoing MT for students, teacher, and CYW, with MT Instructor.
Maryvale Mindfulness Study: MT Protocol

Oct. 22 to Dec 12: 8 weeks MT(Mindful Breathing+)

Maryvale Classroom + MT Instructor Sessions

◇ Classroom start: 1 min. a.m.
◇ Classroom gradual increase over time a.m. and p.m.
◇ Classroom end: 10 min. a.m., 3 min. p.m.
◇ MT instructor start: 6 X 1 min./ 30 min. session
◇ MT progression: 6 X 2, 5 X 3, 3 X 5, to 10 min/30 session
◇ MT instructor end: 2 X 10 min./ 30 min. session

Measures: Social Skills Improvement System Rating Scales

Social Skills: Communication, Cooperation, Assertion, Responsibility, Empathy, Engagement, Self-Control

Problem Behaviors: Externalizing, Bullying, Hyperactivity/Inattention, Internalizing, Autism Spectrum
Maryvale Mindfulness Study: Measures

- Oct. 14 to 17:
  **Pre-study measures**: Social Skills Improvement System – Rating Scales (SSIS–RS)\(^1\) & Resiliency Scales (RS)\(^2\)
  - Completed by students\(^1,2\), parents\(^1\), and teachers\(^1\) with trained staff monitoring.
- Dec. 12-19:
  **Post-study measures**: completed by students\(^1,2\), parents\(^1\), and teachers\(^1\) with trained staff monitoring.

### Student-Rated Communication Level

<table>
<thead>
<tr>
<th>Raw Score</th>
<th>Average Range</th>
<th>Confidence Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.65</td>
<td>3.15</td>
<td>99%</td>
</tr>
</tbody>
</table>

- Mindful Training (MT)
- Control (CTR)

SSIS–RS Student Form: MT Raw Score \(p \leq 0.01\); MT>CTR Raw Score Difference \(p \leq 0.01\)
Student-Rated Cooperation Level

- Mindful Training (MT)
- Control (CTR)

Oct. 14-17 to Dec. 15-19
SSIS -RS Student Form: MT Raw Score Improvement p ≤.01; MT>CTR Level p ≤.08

AVERAGE RANGE

Student-Rated Responsibility Level

- Mindful Training (MT)
- Control (CTR)

Confidence = 97%

Oct. 14-17 to Dec. 15-19
SSIS-RS Student Form: MT Improvement p ≤.03; MT>CTR p ≤.06
Measures: Resiliency Scales for Children and Adolescents

Resiliency Scales for Children and Adolescents™

Sense of Mastery Scale: Optimism, Self-Efficacy, Adaptability.

Sense of Relatedness Scale: Trust, Support, Comfort, Tolerance.


Student-Rated Mastery T-Score

Resiliency Scales: MT Improvement ≤ .07; MT>CTR p ≤ .04
Student-Rated Optimism Score

Mindful Training (MT) = 89% Confidence Level

Control (CTR)

Oct. 14-17 to Dec. 15-19

Resiliency Scales: MT Improvement ≤ .11

Parent-Rated SSIS Standard Score:

Social Skills Summary Score

Mindful Training (MT) = 99.98% Confidence Level

Control (CTR)

Oct. 14-17 to Dec. 15-19

SSIS-RS Parent Form: CTR p ≤ .01; CTR+MT p ≤ .008
Maryvale Mindfulness Study

- Not all students responded to MT: ↑60%, →30%, ↓10%
- Group dynamics influenced MT effectiveness

MARYVALE PLAN & NEXT STEPS

1. Follow the (same) evidence-based treatment protocol.
2. Confirm the characteristics of the students that responded most favorably to the mindfulness training.
3. Select only the students that will fit well within the group (e.g., in terms of their readiness).
4. Increase pre-training regarding mindfulness and its purpose and how it is connected with the beaker program concepts.
Fragile X Syndrome (single gene mutation on X chromosome):
- Boys,
- Cognitive Impairment (ID), Language Disorders,
- Language Disorders,
- Eye aversion,
- Anxiety & Attention problems,
- Behaviour and socio-emotional problems

William’s Syndrome (specific genetic cause):
- Girls=Boys,
- Cognitive Impairment,
- Nonverbal learning problems,
- Social-relating problems (NLD subtype?)

“One DNA molecule (one DNA 'letter' - A, T, G or C) would be represented by one house on a street. A gene would equal a whole street of houses. A chromosome is all the streets in a neighbourhood. A set of chromosomes (for example all of the human chromosomes) would be represented by a city made up of all different neighbourhoods”.

(http://www.genomeatlantic.ca/UserFiles/ChromosomeFundamentals.pdf)
Genes with de novo mutations are shared by four neuropsychiatric disorders discovered from de novo database: Autism spectrum disorder, intellectual disability, epileptic encephalopathy, and schizophrenia.

53 candidate genes are associated with more than one of the above disorders.

Li, J. et. al. April 2015 *Molecular Psychiatry*

---

LIFESPAN NEURODEVELOPMENTAL PRINCIPLES

- Cognition, socio-emotional function and mental health are intertwined across the life course

- Linked through interactional processes of gestational & genetic influences, nurturance, self-regulation, the role of education, socialization, work, leisure and lifestyle


STRESS HORMONES AND EARLY DEVELOPMENT

- Epidemiological evidence links exposure to stress hormones (glucocorticoids) during fetal or early post-natal with increased risk of lifetime cardiac, metabolic, autoimmune, neurological and psychiatric disorders

- These environmental influences exploit epigenetic modification of DNA and/or histones to induce stable modifications of gene expression

Mesquita, A.R. et. al. Seminars Fetal and Neonatal Medicine 2009