The Science of Early Childhood Development: Lessons for Policy and Practice

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The Foundation of a Successful Society is Built in Early Childhood
Experiences Build Brain Architecture
Experience Shapes Brain Architecture by Over-Production Followed by Pruning

(700 synapses formed per second in the early years)
Neural Circuits are Wired in a Bottom-Up Sequence

Sensory Pathways (Vision, Hearing)

Language

Higher Cognitive Function

Birth (Months) (Years)

The Ability to Change Brains Decreases Over Time

Source: Levitt (2009)

Normal Brain Plasticity Influenced by Experience

Physiological “Effort” Required to Enhance Neural Connections

Age (Years)
Interactions Shape Brain Circuitry
Brains and Skills are Shaped by the “Serve and Return” Nature of Human Interaction
Language environment impacts children’s language development

Early Experiences Alter Gene Expression and Shape Development
Genes Carry Instructions that Tell Our Bodies How to Work

- **Nucleus**
- **DNA**
- **Gene**
- **Chromosome**
Early Experiences Leave Lasting Chemical “Signatures” on Genes

External Experience

Gene Regulatory Proteins

Epigenetic “Signature” Turns Gene On or Off
Example 1: Early Experience Affects Differences in Adult Anxiety in Mice

Prenatal development
Mother

High care
Low care

Source: Gross & Hen, 2004
Early Life Experiences Are Built Into Our Bodies (For Better or For Worse)
Toxic
Prolonged activation of stress response systems in the absence of protective relationships.

Three Levels of Stress Response

Positive
Brief increases in heart rate, mild elevations in stress hormone levels.

Tolerable
Serious, temporary stress responses, buffered by supportive relationships.
Severe Neglect Affects Brain Power

Positive Relationships  Extreme Neglect

Significant Adversity Impairs Development in the First Three Years

Source: Barth, et al. (2008)

Number of Risk Factors

Children with Developmental Delays

1-2  3  4  5  6  7
20% 40% 60% 80% 100%

Number of Risk Factors

Source: Barth, et al. (2008)
Example 1:
Risk Factors for Adult Heart Disease are Embedded in Adverse Childhood Experiences

Source: Dong, et al. (2004)
Example 3:
Early Abuse Affects Later Behavior

Source: Pollak & Kistler (2002)
Profound Neglect Impairs Physical Growth

Source: Johnson et al. (2000)
What does this tell of us about early childhood policy and programs?
Children randomly assigned to leave the institution and be placed in high quality foster care environment

- Children placed in foster care before age 2 appear to catch up with typical children on measures of cognitive development
- These children had lower rates of ADHD, disruptive behaviors, and depression when compared to children who stayed in the institution

As a result of this study,

- The Romanian government passed a law forbidding the institutionalization of non-handicapped children under age 2.
- Over 27,000 foster homes have been created.
Long-term effects of Head Start

- Head Start closes one-third of the gap between median and low income family income on a summary of young adult outcomes:
  - High school graduation
  - College attendance
  - Idleness (not in high school, no wages)
  - Crime
  - Teen parenthood
  - Health status

Source: Deming, 2009
Chicago Child-Parent Center (2004)

- Children who did not receive a strong education from PK through 3rd grade were three times more likely to be held back and more likely to be placed in special education than those who had a strong PK-3 foundation.

Preparing to Succeed-Boston (2011)

- Attending preschool erased the Latino/white test score gap and significant reduced the African American/White test score gap.

Source: Reynolds, et al., 2004
The impact of attending high quality early childhood education can be observed nearly four decades later.
Rates of return to human capital investment

Source: Heckman, 2006 p.1902
36 months: Adjusted means for child outcome by quality

Source: NICHD ECCRN, 2000
The best of what we do is still not good enough
The economic impact of attending a high quality early childhood education program

Total Return per $1 Invested

To Individuals
Increased earnings

To Society
Crime costs, special education and welfare savings, increased income taxes paid

The best of what we do, is not yet good enough.

Major Findings: High/Scope Perry Preschool Study at 40

- Arrested 5+ times by 40: Program group 36%, No-program group 55%
- Earned $20K+ at 40: Program group 40%, No-program group 60%
- Graduated regular high school: Program group 45%, No-program group 65%
- Basic achievement at 14: Program group 15%, No-program group 49%
- Homework at 15: Program group 38%, No-program group 61%
- IQ 90+ at 5: Program group 28%, No-program group 67%
Program Evaluation Research Helps Identify Effectiveness Factors

Not all programs are effective. **Effectiveness factors** are key to distinguishing those programs that work from those that do not.

Our goal: to provide clearer guidance than the usual calls for “quality.”

Source: Center on the Developing Child at Harvard University (2007)
Effectiveness Factors for Early Care and Education Programs

- Skilled and well-compensated personnel
- Small group sizes and high adult-child ratios
- Language-rich environment
- Developmentally appropriate “curriculum”
- Safe physical setting
- Warm and responsive adult-child interactions

Source: Center on the Developing Child at Harvard University (2007)
Effectiveness Factors for Parenting Education Programs:
Parenting education with modeling and/or opportunities for practice

Grindal et. al. (under review)
Four Targets for Professional Development

- Institutional/Organizational Practices
- Classroom/Group Setting Quality
- Educator Education, ECE Training, Well-Being
- Practices Related to Specific Child Outcomes

Current Conceptual Framework for Early Childhood Policy and Practice

Sources of Toxic Stress

Healthy Developmental Trajectory

Delayed Development

Supportive Relationships, Stimulating Experiences, and Health-Promoting Environments
Designing an Enhanced Framework that Balances Enrichment and Protection

Sources of Toxic Stress

Protective Interventions

Healthy Developmental Trajectory

Supportive Relationships, Stimulating Experiences, and Health-Promoting Environments
An Integrated, Science-Based Logic Model Could Inform More Effective Early Childhood Policies and Programs

Source: Center on the Developing Child (2010)