Brain Science And Early Learning

Ross A. Thompson, Ph.D.
Department of Psychology
University of California, Davis
rathompson@ucdavis.edu

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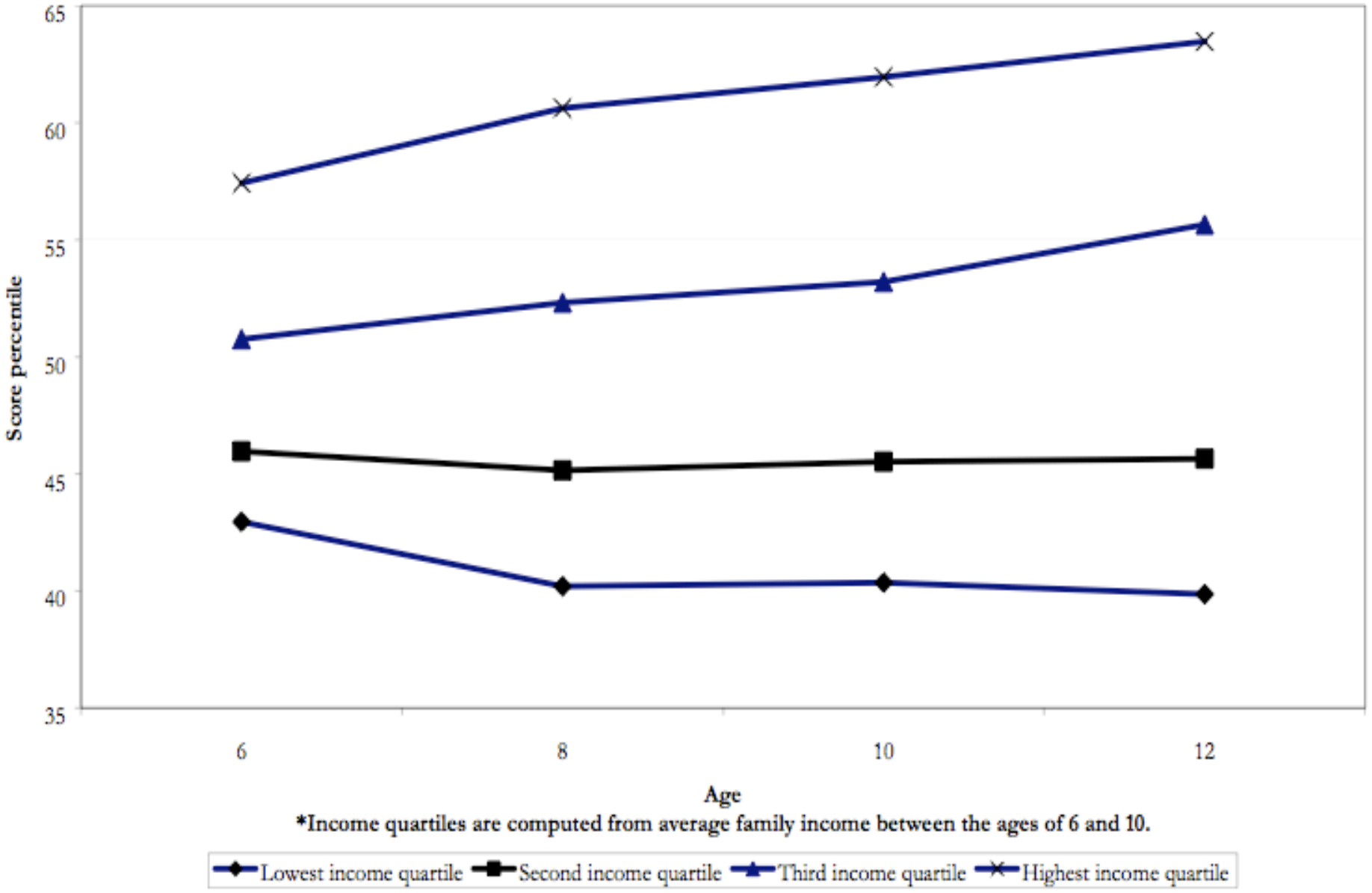
Developmental neuroscience,
developmental psychology,
and the economics of human capital formation
are yielding a common focus on
development in the preschool years

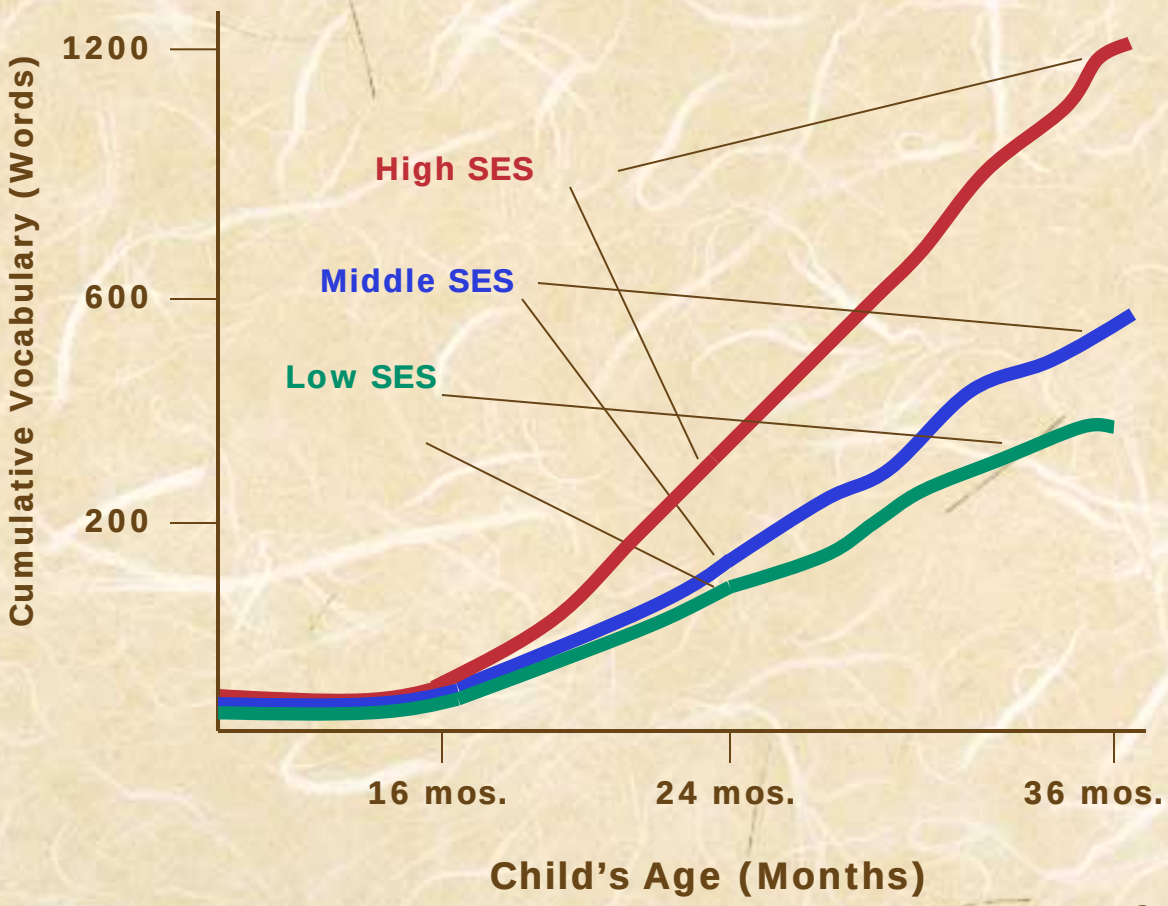
Children of NLSY

Average percentile rank on PIAT Math score, by income quartile*



*Income quartiles are computed from average family income between the ages of 6 and 10.

Differences in Vocabulary Growth Emerge Early



Source: Hart & Risley (1995)

What are the essential elements of early learning?

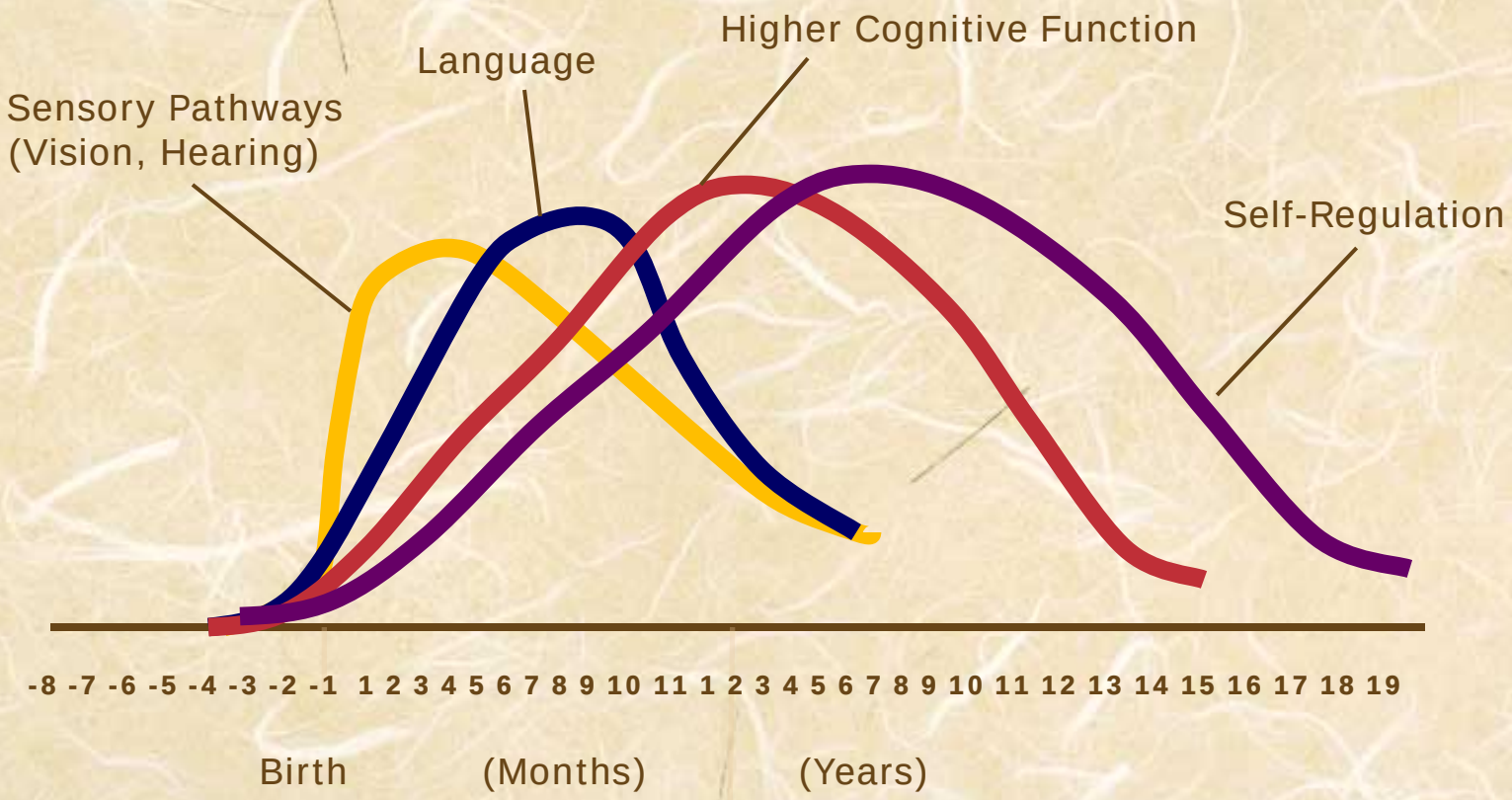
- Cognitive skills (letters, numbers, problem-solving, language)
- Personal skills (motivation, curiosity, persistence, self-confidence, self-regulation of behavior and emotions)
- Social skills (getting along with teachers and peers; social understanding; developing close relationships)
- Teacher perceptions underscore the importance of each skill set
- Because of the nature of early brain development, the quality of an early education program and its teachers is essential to early learning and school readiness

Early brain development is explosive – but that is just the beginning . . .

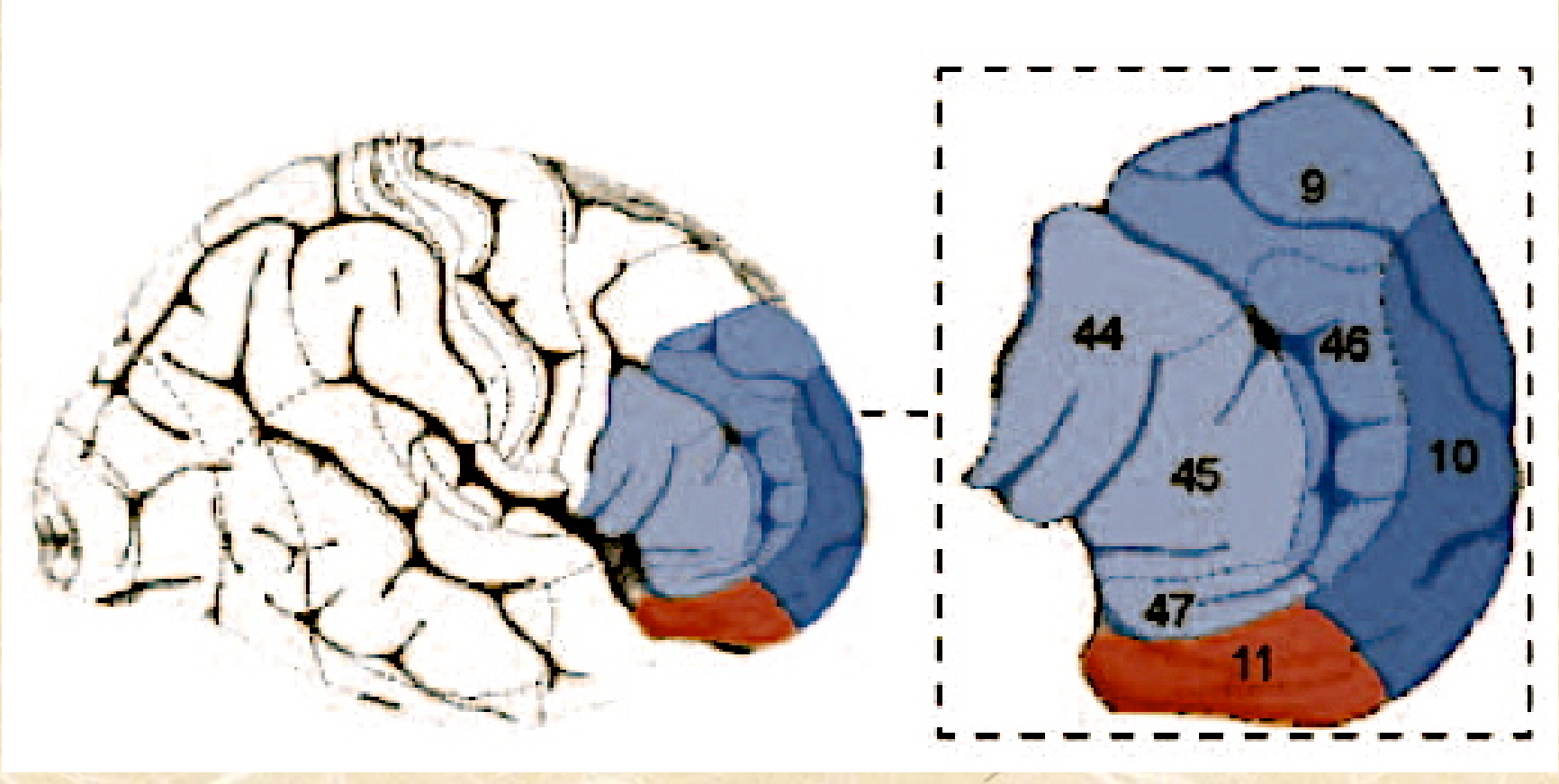
birth

. . . many of the neurobiological foundations for learning and problem-solving develop later

-- on the foundation provided by the early years



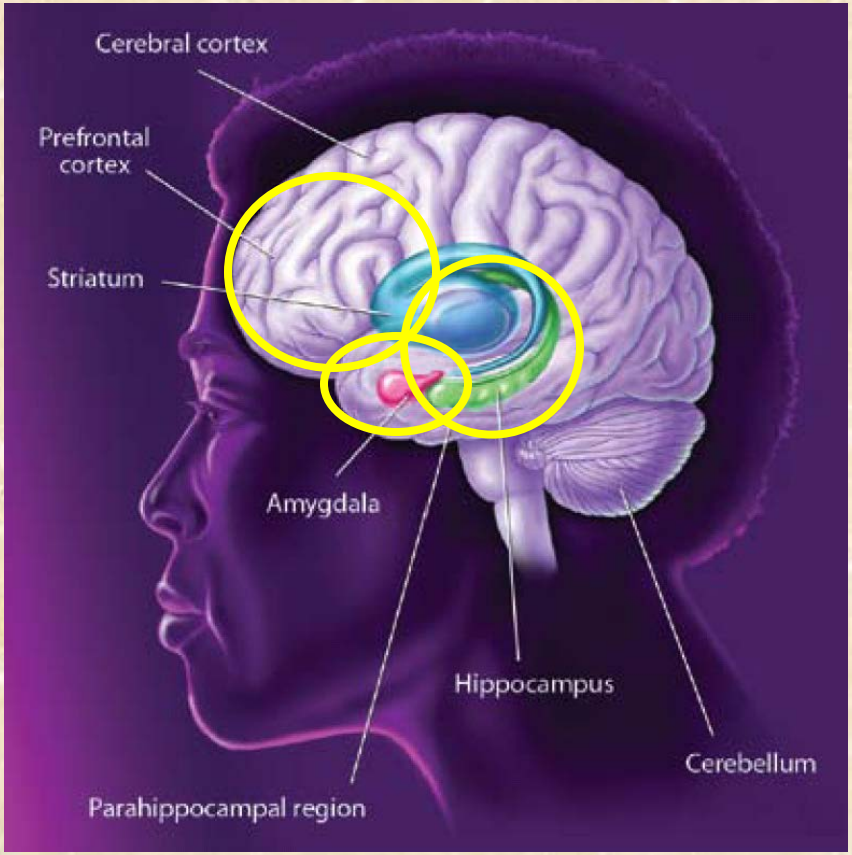
Source: C. Nelson (2000)



PREFRONTAL CORTEX (PFC)

- Orbitofrontal cortex (red; 11): reversal learning; delay of gratification
- Ventrolateral PFC (lt blue; 44, 45, 47): conditional rules (“if . . . then”)
- Dorsolateral PFC (darker blue; 9, 46): rule switching; working memory; selective attention; inhibition
- Rostrolateral PFC (dk blue; 10): creation of higher-order rules

Cognitive, social, and emotional development are deeply interdependent in the early years



Early childhood stress influences developing brain architecture

Many young children experience chronic, severe, and/or uncontrollable stressful experiences (“toxic stress”) that can lead to hyperreactive stress management systems, and may impair learning and memory

Positive Stress

Brief increases in heart rate / blood pressure and mild elevations in stress hormone levels that are moderated by stable, supportive relationships.

Tolerable Stress

Stress responses that *could* disrupt brain architecture, but are buffered by supportive relationships.

Toxic Stress

Prolonged activation of stress response systems in the absence of protective relationships, which can produce physiological changes that lead to lifelong problems in learning, behavior, and health.

A high-quality early childhood education with well-prepared staff are thus important to early learning because they . . .

- support self-regulation skills that are neurobiologically very immature
- guide the growth of reasoning and problem-solving skills as brains develop
- offer individualized learning experiences suited to the child's readiness to learn
- motivate enthusiasm for learning
- instill self-confidence
- buffer stress and assist in emotion regulation
- provide emotional security

Early learning depends more on the support of a quality program and staff until developing brains & minds enable independent, self-regulated learning

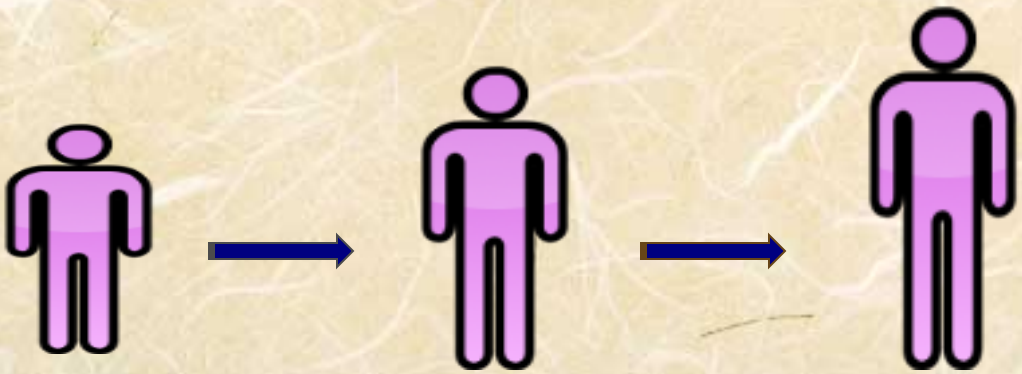
A high-quality early learning environment looks *much* different than a high-quality learning environment for older ages

- language-rich environment
- lots of social interaction with peers & adults
- teachers seek to stimulate and capitalize on children's interests
- small group size and high adult-child ratios
- warm, responsive adult-child interactions

Brain Development

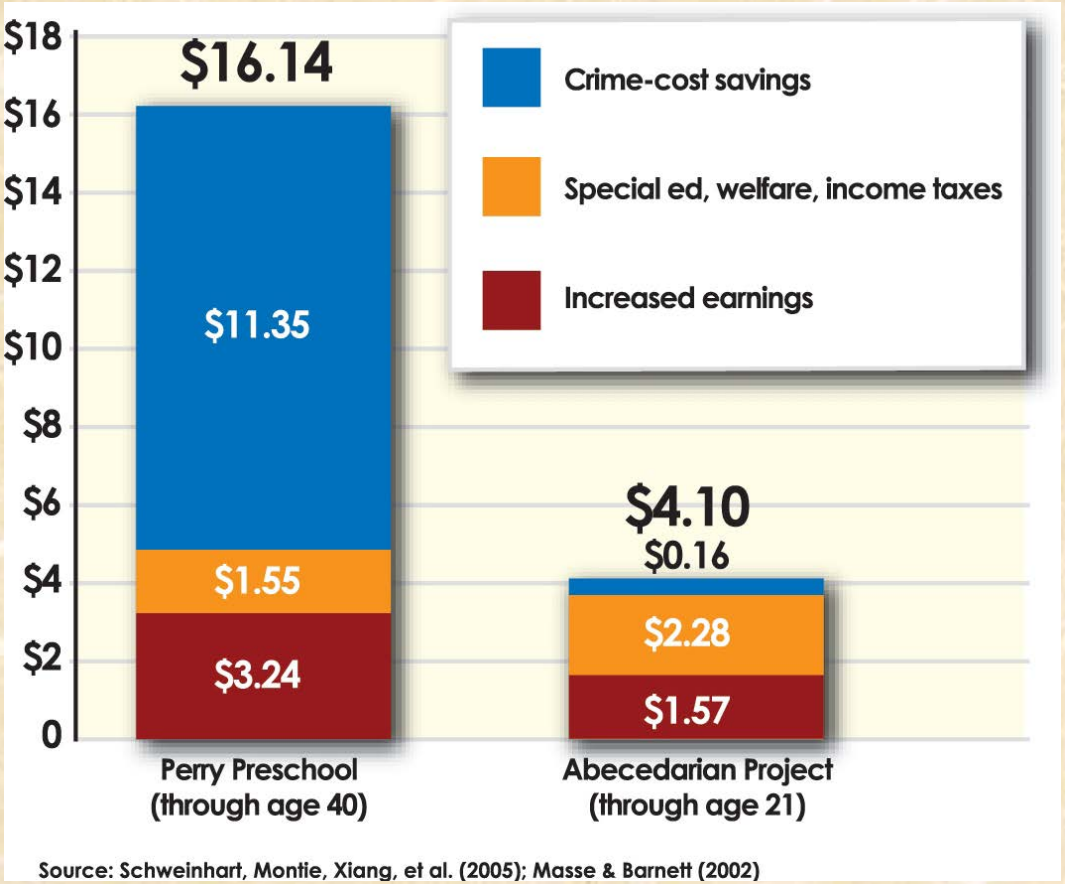
Early Learning & School Readiness

Social & Emotional Functioning



Cost / Benefit for Two Early Childhood Programs

(Dollars returned for each dollar invested)



Source: Schweinhart, Montie, Xiang, et al. (2005); Masse & Barnett (2002)

“On a purely economic basis, it makes a lot of sense to invest in the young. . . . Early learning begets later learning and early success breeds later success.”

-- James J. Heckman, Ph.D.
Nobel Prize laureate and University of Chicago economist

Thanks!

rathompson@ucdavis.edu