Early Childhood Literacy and Numeracy: Evidence to Inform Manitoba Innovation

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Manitoba Open Innovation Challenge
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Human Capital and Economic Growth

- 1% increase in average literacy of the population would yield a permanent 1.5% increase in GDP per capita
- 1.5% of Canada's GDP = $18 billion
- **1.5% of Manitoba's GDP = $577.5 million**
- **ECD** = key to improve overall literacy of the population
- Long-run impact (1960 – 1995) of investment in human capital was 3 times more important than investment in physical capital

"If we closed the education and employment achievement gap between indigenous and other Canadians, we would save more than $115 billion over 15 years while adding more than $401 billion to Canada's GDP" (Jamieson, 2012, p. 49; CSLS, 2010).

Manitoba and Canada’s Hidden Deficit: The Social Cost of Low Literacy Skills

1. **Opportunity costs** (benefits foregone): People unable to reach their full potential

2. **Remedial costs**: both social program costs (e.g., 65% of social assistance and 70% of offenders) and costs due to low literacy (e.g., workplace injury)

3. **Intergenerational costs**: Limits on parents with low literacy in helping their children achieve high literacy

Source: Maxwell and Teploca (2007)
Manitoba and Canada’s Hidden Deficit: The Economic Cost of Low Literacy Skills

1. Limits economy’s ability to generate *wealth*
2. Generates undesirable levels of *social inequality* (including economic, health, educational)
3. Limits *effectiveness and efficiency* of investments in public goods and services (e.g., health, education)

Source: Murray and McCracken (2007)
The Importance of a Lifelong Perspective:
Interprovincial Literacy and Numeracy Differences Grow Wider with Age

NLSCY = National Longitudinal Survey of Children and Youth
TIMSS = Third International Mathematics and Science Study
SAIP = School Achievement Indicators Program
IALS = International Adult Literacy Survey

Healthy Child Manitoba
Putting children and families first
Literacy Skills and Employment in Canada

- Lowest literacy levels had the lowest employment rates
- About 57% (Level 1) vs. 80% (Level 4/5)
- Smallest differences in employment between lowest and highest literacy levels in the Prairies (levelling the playing field)

Youth Literacy and High School Completion

- Lower youth literacy associated with later high school drop-out
- On average, high school dropouts at one full reading proficiency level below high school graduates
- Only 62% of Level 1, 77% of Level 2 graduated, compared to nearly all at Level 3+
- Effect persists after controlling for gender, mother tongue, parental education, family income, location of residence, academic and social engagement
- Not necessarily deterministic: Many at Levels 1-2 graduate, whereas 2-11% at Levels 3+ do not

Youth Literacy and Post-Secondary Education (PSE) Completion

- Lower youth literacy associated with lower PSE pursuit
- On average, PSE participants at one full reading proficiency level below non-PSE participants
- Only 28% of Level 1 and 45% of Level 2 pursued PSE, compared to 65%, 76%, and 88% for Levels 3, 4, 5
- PSE pursuit was related to gender, parental education, family income, and mother tongue, but not location of residence
- PSE pursuit not deterministic or linear (may pursue later)

Youth Literacy in Manitoba: Levelling the Playing Field

- About 40% of differences between provinces due to family background
- About 63% of differences due to family background (e.g., SES) and school context combined
- Example: MB moves from 6th to 2nd place and AB moves from 1st to 9th place

Early Reading Skills in Grade 3 and Literacy at the Transition to Adulthood

- Literacy at age 8/9 years predicted literacy a decade later
- Held true after controlling for sociodemographics, child behaviour, school-related factors, and parental literacy practices
- Low parental education also predicted lower later literacy
- Early hyperactivity also associated, but mediated by school-related factors (repeating elementary school grade; physical, emotional, behavioural limitations that required special help for school work; child disliking/hating school or skipping school at age 12/13 years)

Improving Early Reading Skills and Later Literacy

Positive change in early reading at school linked to higher literacy scores at age 18 or 19

Average literacy score at age 18 or 19

Early Childhood and Later Literacy and Numeracy

• Youth literacy and numeracy scores in PISA are not mainly attributable to the quality of secondary school – they are the cumulative result of children’s opportunities to learn at home and at school from birth to age 15

• Innovating and investing in early childhood development (ECD), from the prenatal period to school entry, is our best chance for improving the overall literacy and numeracy of the population over the long-term

SHHH!
Brain Development in Progress:

By age 3 years, a young child’s brain is apt to be more than TWICE AS ACTIVE as that of his or her PEDIATRICIAN

Sources:
Gopnik, Meltzoff, & Kuhl, 1999; Shore, 1997
Investing in Early Childhood Development: The Economic Imperative

- Leading economists have shown the importance of ECD to our province and country’s economic future. Knowledge is the engine of the 21st century economy. Better brains and innovative ideas fuel economic growth, create jobs, increase wealth, and secure our financial future.

“The real question is how to use the available funds wisely. The best evidence supports the policy prescription:

Invest in the very young.”

James J. Heckman, PhD
2000 Nobel Laureate in Economic Sciences
Shared Destiny: Our Indigenous Children and the Future of Manitoba

"Manitoba cannot prosper if Aboriginal people do not prosper."

-Honourable Oscar Lathlin (1947-2008)
Minister of Aboriginal and Northern Affairs (2002-2008)
Innovation Challenge:
Addressing the Mismatch Between Opportunity and Investment

Adapted from: “How Nurture Becomes Nature: The Influence of Social Structures on Brain Development”
Bruce Perry, Baylor College of Medicine, Houston, Texas.
“A serious trade-off exists between equity and efficiency for adolescent and young adult skill policies. There is no such trade-off for policies targeted toward disadvantaged young children.”

“Early childhood programs are rare among the portfolio of available social programs. What is socially fair is also economically efficient.”

-James J. Heckman, 2000 Nobel Laureate, Economics

Sources:
2 out of every 3 Indigenous babies in Manitoba born into toxic stress (2000 each year
3 in 4 First Nations
1 in 2 Metis, Inuit)

(1 in 4 babies provincewide~5000 per year)

(similar results across Canada)

2003 EDI average language and cognitive development score vs. 1994-98 low birth weight

\[ r = -0.53 \]

SES Differences Begin Early: Vocabulary Growth - First 3 Years

Estimated Cumulative Differences in Language Experiences by 4 Years of Age

Early Childhood Development (ECD): Language Skills Gap Emerges Very Early
(Hart & Risley, 1995; Fernald et al., 2013)

- 30-million word gap at age 3 years between low-SES and high-SES
- **New:** first evidence of **even earlier** differences (age 18 months) in language and vocabulary
- By age 24 months: 6-month gap between low-SES and high-SES

**Developmental Science**
Developmental Science 365 (2013), pp 234-248
DOI: 10.1111/das.12009

**PAPER**
SES differences in language processing skill and vocabulary are evident at 18 months
Anne Fernald, Virginia A. Marchman and Adriana Weisleder
Department of Psychology, Stanford University, USA

(March 2013 issue)
1 in 4 Kindergarteners and 2 in 4 Indigenous Kindergarteners in Manitoba vulnerable (28% or ~5000 not ready for school each year)

(45%)

(similar results across Canada)

Data source: Healthy Child Manitoba Office
Community-Level Early Childhood Literacy and Numeracy: Percent not ready in Language & Cognitive Development (EDI), Manitoba, Kindergarten classrooms >7 students only, 2006-2015

Range: 77%

0%
EARLY READING AND SCHOOL READINESS:
Child’s Age When Reading with Parent Began and
Percentage of MB Children Not Ready to Learn in School
(age 5), 2004

Source: 2004 EDI Parent Survey and 2004 EDI results

Note: Shorter bars are better
COMMUNITY MATTERS: Neighbourhood Safety and Percentage of MB Children Not Ready to Learn in School, 2004

Source: 2004 EDI Parent Survey and 2004 EDI results

Note: Shorter bars are better
FAMILY WELL-BEING MATTERS: Family Functioning and Percentage of MB Children Not Ready to Learn in School, 2004

Source: 2004 EDI Parent Survey and 2004 EDI results

Note: Shorter bars are better
PARENT WELL-BEING MATTERS: Parental Depression and Percentage of MB Children Not Ready to Learn in School, 2004

Source: 2004 EDI Parent Survey and 2004 EDI results

Note: Shorter bars are better
HEALTHY LIVING MATTERS:
Participation in Organized Physical Activities and Percentage of MB Children Not Ready to Learn in School, 2004

![Bar chart showing participation in organized physical activities and percentage of MB children not ready to learn in school, 2004.](image)

- Physical health and well-being: 5% in organized activities, 18% not in organized activities.
- Social competence: 6% in organized activities, 16% not in organized activities.
- Emotional maturity: 8% in organized activities, 18% not in organized activities.
- Language and cognitive development: 4% in organized activities, 17% not in organized activities.
- Communication skills & general knowledge: 4% in organized activities, 14% not in organized activities.
- Scored low in at least one domain: 15% in organized activities, 37% not in organized activities.

Source: 2004 EDI Parent Survey and 2004 EDI results

Note: Shorter bars are better
Predictive Validity of the EDI: “Not Ready” on the EDI (2000-2001) and Grade 4 Foundational Skills Assessments (FSAs) in British Columbia, 2004-2005

![Bar chart showing percentage not passing by number of EDI domains "not ready" in NUMERACY.]

- 0 domains "not ready": 12%
- 1 domain "not ready": 22%
- 2-3 domains "not ready": 34%
- 4-5 domains "not ready": 56%
Predictive Validity of the EDI: “Not Ready” on the EDI (2000-2001) and Grade 4 Foundational Skills Assessments (FSAs) in British Columbia, 2004-2005

**Reading**

<table>
<thead>
<tr>
<th>Number of EDI domains &quot;not ready&quot;</th>
<th>Percentage not passing (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>18%</td>
</tr>
<tr>
<td>1</td>
<td>34%</td>
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<tr>
<td>2-3</td>
<td>43%</td>
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<tr>
<td>4-5</td>
<td>68%</td>
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</tbody>
</table>
Early Childhood Development (ECD) Predicts Grade 3 Reading and Numeracy

5 Early Development Instrument (EDI) domains:
- Physical Health and Well-Being
- Social Competence
- Emotional Maturity
- Language and Cognitive Development (literacy/numeracy)
- Communication Skills and General Knowledge

Data sources: Healthy Child Manitoba Office and Manitoba Education and Training (chart from Manitoba Centre for Health Policy: Brownell et al., 2012)
Early Childhood Development (ECD) Predicts Grade 8 Reading, Math, Science
Early Development Outcomes Predict Grade 8 Outcomes:
2004/05 EDI results (age 5) and 2012/13 PCAP (age 13) results, Manitoba

Note: Children with higher EDI scores at age 5 in Kindergarten (measured in 2004/05) in the Language and Thinking Skills domain (i.e., early literacy and numeracy) were more likely to score higher on the PCAP when they were age 13 in Grade 8 (measured in 2012/13) in the related subjects of Science, Math, and Reading.

Data sources: Healthy Child Manitoba Office and Manitoba Education and Training

Note: EDI = Early Development Instrument, PCAP = Pan-Canadian Assessment Program
Early Development Outcomes Predict Grade 8 Outcomes: 2004/05 EDI results (age 5) and 2012/13 PCAP (age 13) results, Manitoba

Note: For Kindergarten children, the higher the number of their EDI vulnerabilities (“Not Ready” in 1 or more of the 5 EDI Domains, measured in 2004/05), the lower their PCAP scores when they were in Grade 8 (measured in 2012/13) in the related subjects of Science, Math, and Reading. More than the classic “3 Rs” is essential for later success: children also need physical, social, and emotional readiness.

Data sources: Healthy Child Manitoba Office and Manitoba Education and Training

Note: EDI = Early Development Instrument, PCAP = Pan-Canadian Assessment Program
Early Socioeconomic Status Predict Grade 8 Outcomes:
2006 SEFI results (age 7) and 2012/13 PCAP (age 13) results, Manitoba

Note: Higher SEFI scores indicate higher need. As SEFI increases, PCAP scores decrease. Results are statistically significant ($p < .05$) for all PCAP scores, except Earth Science.

Note: PCAP = Pan-Canadian Assessment Program, SEFI = socioeconomic factor index.

Data sources: Manitoba Centre for Health Policy and Manitoba Education and Training.
Early Development + Grade 2 SES Predict Grade 8 Outcomes: 2004/05 EDI (age 5), 2006 SEFI (age 7) and 2012/13 PCAP (age 13), Manitoba

Kindergarteners scoring the highest on EDI Language and Thinking Skills tend to score the highest on PCAP, but this is reduced by greater socioeconomic need (scores decrease as SEFI increases).

Kindergarteners scoring the lowest on EDI Language and Thinking Skills tend to score the lowest on PCAP, but this is further reduced by greater socioeconomic need (scores decrease as SEFI increases).

Note: EDI = Early Development Instrument, PCAP = Pan-Canadian Assessment Program, SEFI = socioeconomic factor index (higher SEFI indicates higher need).

Data sources: Healthy Child Manitoba Office, Manitoba Centre for Health Policy, and Manitoba Education and Training
Early Differences in Readiness at School Entry Persist Through to Grade 10

Canadian Test of Basic Skills
Mean Reading Score by Readiness Group (Assessed in Kindergarten)

Grade 6—Reading Grade 8—Reading Grade 10—Reading Comprehension

High readiness
Variable readiness
Average readiness
Low readiness

1.7 times more likely to graduate high school

4.6 times more likely to graduate college/university (bachelor's degree or higher: 23% vs. 6%)

2.65 times more likely to be employed (full-time for at least 2/3 of past 24 months: 75% vs. 53%)

84% less likely to be on income assistance (over past 89 months: <4% vs >20%); children who did not participate in the program were 6 times more likely to be on income assistance as adults.

Data source: North Carolina study
Innovation Challenge: Addressing the Mismatch Between Opportunity and Investment

Adapted from: “How Nurture Becomes Nature: The Influence of Social Structures on Brain Development”
Bruce Perry, Baylor College of Medicine, Houston, Texas.
Innovation Challenge: Leaping from Red to Green

**HIGH-COST**, lower value (waiting until problems have already occurred):

**Low-cost**, **HIGH VALUE** (save dollars, uplift lives):
5 IMPLICATIONS FOR INNOVATION

1. Close the gap starting at birth (or earlier)
2. Focus on low-SES, low-EDI communities (especially for Indigenous children)
3. Scale-up serve and return
4. Buffer toxic stress
5. Strengthen early physical and mental health for all