

# **The Economic Benefits of Literacy: Evidence and Implications for Public Policy**

**Mike McCracken  
and  
T. Scott Murray**



## Executive Summary

This report provides a non-technical overview of how economists think about literacy and what the available evidence tells us about the economic value of literacy.

The evidence indicates that Canadians should be concerned because:

- too many Canadians are failing to acquire the level of literacy skills required for participation in modern Canadian society
- literacy has a large impact on the ability of an economy to generate wealth
- differences in literacy skills generate undesirable levels of social inequality in valued outcomes, including health and education
- a substantial proportion of the taxes we pay are consumed to provide public goods and services to persons with low literacy levels

Economic theory suggests that human capital – what individuals know and can put to productive use – is an important driver of economic growth and that literacy is a key element of human capital. Human capital is tightly linked with literacy, since reading proficiency determines one’s ability to learn as well as one’s ability to adapt to changes in organizations, and in the labour market.

Literacy ‘demand’ is driven by changes in technology and social organization. Literacy ‘supply’ is determined by learning over the entire life course. Literacy demand and supply are matched in markets that serve as the engines for creating skill-based social inequality. These markets include labour, education, health and the markets that provide access to power and influence in the broader society.

Until recently, empirical research has relied on indirect measures of literacy skill, such as years of schooling and educational attainment, to explore their relationship to individual and national economic success. While literacy skill is a strong predictor of whether an individual will complete high school and/or participate in post-secondary studies, the availability of reliable measures of adult literacy skills provides a means to explore the true economic dimensions of literacy.

The evidence summarized here indicates the following points.

- There are large differences in the level and distribution of literacy skills within and between countries.
- These differences matter to the individual. Higher levels of literacy skill are associated with more stable employment, higher wages, better health, increased educational achievement, and higher levels of social engagement.
- These differences also matter to institutions and to society. The profile of literacy skills in a population influences the performance of schools, firms and communities.

- Literacy also matters at the national level. Differences in average literacy levels explain more than 55% of differences in the long-term growth rate of GDP per capita at both the national and provincial level. The proportion of adults with low literacy levels constrains long-term economic growth rates, and some effects at the national level appear to stem from the increased prevalence of illness and accident suffered by lower skilled adults.

Since literacy challenges begin early in life, and are most effectively addressed at that time, it is thus critically important for Canada to foster literacy from an early age. A National Strategy for Early Literacy is therefore urgent, in order to ensure future social and economic success for Canada as a nation. Inequalities in children's educational outcomes have been shown to appear early, before school begins (Brownell et al., 2004). However, the short, medium, and long-term benefits of quality preschool programs have been shown to far outweigh their costs (Temple, 2007). These costs are economic as well as social, such as reduced need for remedial education services, and reduced crime and dependency on welfare, as well as improved health, employment and educational attainment (Temple, 2007).

The most noted of these longitudinal studies (e.g., the Abecedarian program, the High/Scope Perry Preschool program, the Chicago Longitudinal Study, Head Start) have been conducted in the United States. This discussion can benefit from the analysis of costs and benefits of preschool programs derived from research conducted in the U.S., in light of the absence of any longitudinal Canadian studies of this nature. Indeed, at the Manitoba Centre for Health Policy Analysis, researchers determined that results from one of their studies on predictors and consequences of grade retention were comparable to results from similar research conducted in the U.S. (Guevremont, Roos, & Brownell, 2007). For example, a review of 36 public programs showed that participation in preschool was associated with a 31%, 50%, and 32% improvement in grade retention, special education placement, and high school dropout rates respectively (Barnett, 1995). Cost returns to society for such programs have been estimated at between \$2.00 and \$8.74 per dollar invested, depending mainly on the socio-economic status of the children, the benefits measured, and the discount rate<sup>1</sup> applied (Nores, Belfield, Barnett, & Schweinhart, 2005). Short- and medium-term calculations for the Head Start program estimate that the benefits of the program offset 40 to 60% of the total costs (Nores et al., 2005).

While it is important to invest in early childhood education, interventions which can improve the skills of adults currently facing challenges due to lower literacy levels also need to be considered. In view of the severe economic and social consequences of low adult literacy, including the intergenerational effects on children in families in which adults have poor literacy skills, such initiatives aimed at increasing adult literacy levels would yield significant economic benefits. Improving the literacy skills of adults increases access to higher paying jobs, makes workers more productive, and reduces workplace accidents. At a national level, estimates of the direct costs and benefits of a literacy investment large enough to raise all adults to prose literacy Level 3 imply an initial rate of return of 251%, and an approximate payback period of 4.8 months (Murray, Jones, Willms, Shillington, & Glickman, 2008). In other

---

1. A 'discount rate' is a percentage amount which is used for calculating the future dollar value of an item. Since we do not know what the future value of something is likely to be, the discount rate (percentage) chosen in a calculation is usually a best guess. This is why several different amounts of discount rates are calculated and presented in tables (e.g., one calculation that estimates future value for an item at a 3% discount rate, another column that shows the value of that same item calculated with a 7% discount rate).

words, the large estimated returns to individuals and to society more than justify the required investment provided that the Canadian economy can absorb all of the new literacy skill as it is created.

A total investment of \$6.4 billion<sup>2 3</sup> targeted at all adults who are currently at Level 1 or Level 2 aged 16 to 65 (about 9.1 million people) could raise their literacy skill to Level 3 – the minimum required for full participation in the emerging global knowledge economy and information society (DataAngel, 2009).

- 
2. This estimate is based on a mean investment of \$706.41 per Level 1 and 2 learner. This one-time investment in the current generation could be spread over several years, with modest maintenance costs.
  3. The resulting economic benefits of this investment will vary considerably by province and territory because of differences in industrial, occupational and wage structures. In a few cases, moving adults to Level 3 precipitates a slight drop in earnings. This reinforces the need for government policies to stimulate the level of skill demand in the economy – policies that would ensure that the Canadian economy is able to absorb and apply the newly created skills.

## Table of Contents

<b>Executive Summary</b>	<b>5</b>
<b>Introduction</b>	<b>9</b>
Research Questions	10
Research Findings	10
1. What is the level and distribution of adult and child/youth literacy skill in Canada?	10
2. How does the level and distribution of literacy skill influence individual outcomes?	12
The demand for skill	12
The supply of skill	13
Different types of skills	25
3. How do levels of Canadian literacy skills influence national economic performance, including population health and citizen engagement?	27
Literacy's impact on individual economic outcomes	27
The impact of literacy on individual outcomes related to technological change	28
Literacy's impact on individual outcomes relating to education	29
Literacy's impact on individual outcomes related to health	33
Literacy's impact on individual social outcomes	33
Literacy's impact on the performance of social institutions	34
Firms	35
Schools	37
Communities	37
4. How would quality of life in Canada be improved if literacy skill levels were higher?	38
How the distribution of human capital influences overall economic performance	40
5. What role could or should governments play in encouraging improvement of the literacy skills of children, youth and adults?	41
What the Canadian government can do	45
What firms can do	48
What unions and the labour movement can do	48
What other social institutions can do	48
What adult educators can do	49
What individuals can do	49

## Table of Contents

<b>Conclusions</b>	<b>50</b>
--------------------	-----------

<b>References</b>	<b>51</b>
-------------------	-----------

<b>Further Readings</b>	<b>56</b>
-------------------------	-----------

### List of Figures

Figure 1	The return on investment in education throughout the life course	11
Figure 2	Adjusted rates of child well-being for three program comparisons: Juvenile arrest by age 18	20
Figure 3	Adjusted rates of child well-being for three program comparisons: Special education by age 18	28
Figure 4	Adjusted rates of child well-being for three program comparisons: High school completion by age 21	21
Figure 5	Profiles of skill supply and demand framework	26
Figure 6	Cognitive and technical proficiency matrix	29
Figure 7	Percentage of youth who had completed high school by age 19 by their reading proficiency at age 15	30
Figure 8	Post-secondary participation rates by reading proficiency level at age 15	30
Figure 9	Likelihood of receiving employer support for training	30
Figure 10	Graph comparing mean document literacy scores with annual hours worked in several countries	35

### List of Tables

Table 1	Present value of abecedarian benefits and costs per child (2002 dollars)	14
Table 2	Lifetime cost-benefit analysis of the high/scope Perry preschool program for participants	15
Table 3	Lifetime cost-benefit analysis of the high/scope Perry preschool Program for Society	15
Table 4	Individual benefits	16
Table 5	Individual benefits	17
Table 6	Benefits to society	17
Table 7	Educational attainment between treatment (preschool) and control (no preschool) groups in the Perry preschool program	18
Table 8	Itemized costs in 1998:dollars of the Chicago child-parent center program: Preschool and school-age components	19
Table 9	Early education programs have long-term effects	22
Table 10	Benefit-cost analysis for preschool programs	23
Table 11	The costs and benefits of head start	24
Table 12	Odds-ratios indicating likelihood of participating in post-secondary education, according to literacy level	31

## Table of Contents

---

Table 12	Odds-ratios indicating probability of obtaining post-secondary education (PSE), according to individual and family characteristics, including literacy and numeracy skills	32
Table 14	ICT use index	35
Table 15	The cost of illiteracy to Canada	36
Table 16	Estimated lost economic output because of worker health problems, sick days, and reduced productivity (USA)	41

---



## Introduction

Globally, Canada enjoys one of the highest standards of living in the world due in large part to our comparatively higher literacy levels. Literacy skill is a key driver of economic and social success for individuals and for nations and Canada has benefited from our comparative advantage in this regard for many years. However, change is a defining feature of modern life — technologies change, the organization of work changes, terms of trade change, communities change, and social roles change as individuals negotiate the life course.

Change is unavoidable. It obliges individuals, social institutions and nations to adapt. Individuals and institutions that have the ability to adapt are the ones which will more likely survive and flourish. Technological change, the globalization of trade, and the increasing availability of growing numbers of highly-skilled persons in developing countries are among the challenges facing Canadians today. These challenges will require Canada to commit to increased public investment in programs that improve literacy levels.

Literacy skills are important for several reasons. On an individual level, literacy has been linked to physical health, the ability to access learning opportunities, social and democratic participation, and obtaining higher income employment. At the societal level, employment and reduction in crime rates have positive implications for the local economy in reduced reliance on welfare and reduced expenditure in the criminal justice system. Nationally, the demand for, and the cost of, providing public goods and services including health and education, would be much reduced if literacy levels in Canada were higher overall.

Literacy skills have been associated with an individual's adaptability to change. Higher wages and overall health status, and ability to participate more fully as a citizen in a democratic society are also benefits. Most importantly, it has been demonstrated that children's literacy levels can predict high school completion and post-secondary participation.

Literacy is thus tightly linked with human capital<sup>4</sup>, and the ability of individuals, social institutions and nations to adapt and change along with technological and other developments in the global market, which is key to remaining competitive. Literacy has been recognized as an important economic and social asset for at least 3,200 years (Statistics Canada & HRDC, 1996)<sup>5</sup>. Thus, it is in our collective self-interest to understand how literacy will influence our lives in the future and how we need to respond as parents, learners, citizens and employees.

---

4. Human capital is defined as "the knowledge, qualifications, competencies and other qualities possessed by individuals that can be put to productive use" (OECD, 1998).

5. As evidenced by the papyrus from 1210 BC Thebes that was reproduced in the Foreword of *Reading the Future: A Portrait of Literacy in Canada*.

## Research Questions

This report focuses on answering the following important questions.

1. What is the level and distribution of adult and child/youth literacy skill in Canada?
2. How does the level and distribution of literacy skill influence individual outcomes?
3. How do levels of Canadian literacy skills influence national economic performance, including population health and citizen engagement?
4. How would quality of life in Canada be improved if literacy skill levels were higher?
5. What role could or should governments play in encouraging improvement of the literacy skills of children, youth, and adults?

## Research Findings

### ***1. What is the level and distribution of adult and child/youth literacy skill in Canada?***

The usefulness of any economic theory depends largely on its ability to predict change. A focus on change means that the economic theory will allow public policy-makers to understand a number of things: the rate at which skill profiles are evolving; the social and economic forces that underlie such change; the impact that these changes will have on the overall level of key outcomes; and how these outcomes are distributed socially. Most importantly, they can provide some sense of the ability of public policy to influence the level and distribution of skills.

There are several theories that help economists understand the effect of literacy on individuals, institutions, and society as a whole. To discuss each theory individually is beyond the scope of this paper. However, it is important to note that each theory embodies an economic model of skill that includes elements of skill ‘demand’, skill ‘supply’ and markets for skill. What this means is that different life contexts – work, home and the community – all demand that people have certain skills. The type of skill required, its level of difficulty, and the degree to which it calls for different types of solutions are called ‘demands’.

Individual proficiency can be calculated as the probability that a person will be able to master tasks in any given domain. For adults, relevant literacy skills have been measured through the International Adult Literacy Survey (IALS) and Adult Literacy and Life skills survey (ALL). Skill supply is defined as the percentage of individuals who have a probability of getting tasks correct at a given level of difficulty that is greater than 80% in a particular skill domain.

In children, proficiency at mastering certain skills appears as early as the preschool years. Specifically,

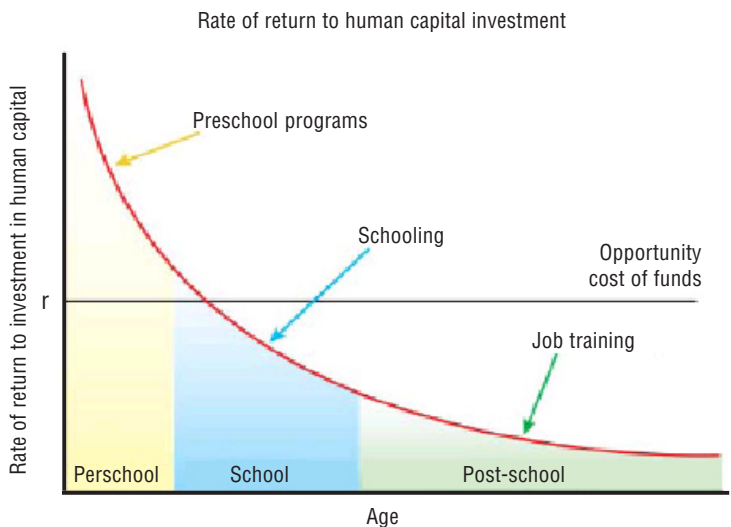
...the formation of cognitive skills, such as intelligence, memory power and reasoning, and self-regulatory skills, such as motivation, delay of gratification and persistence, begins in early childhood. The level of these skills is decisive for becoming a productive member of society. (Pfeiffer & Reuss, 2008, p. 632).

Thus, Pfeiffer and Reuss’ (2008) economic model includes age-dependent cognitive and self-regulatory skill formation, human capital accumulation, and age-

dependent skill depreciation over the life cycle (e.g., 80 years). The model captures biological reasons (i.e., health, nutrition, brain development) as well as social reasons for differences in skill formation. Indeed, Heckman (2006) acknowledges the dynamic and holistic nature of early environments on child, adolescent, and adult skill formation and achievement. Skills are formed through the interaction between genetics and individual experience from the moment of conception throughout the life course, and early family environments are major predictors of skill development. Since skill development follows a hierarchy where early foundations of skill predict future skill attainment, this underscores the importance of resource allocation toward high quality preschool programs (Heckman, 2006). While necessary, programs targeting criminal rehabilitation, job training, and adult literacy have shown poor results (Heckman, 2006). Thus, prevention in terms of early intervention (e.g., preschool programs) can prove more beneficial in the long run. The graph below demonstrates the importance of investing in early childhood education, in terms of the rate of return to investment at different ages of development (Figure 1).

**Figure 1**

**The return on investment in education throughout the life course**



Rate of return to human capital investment in disadvantaged children. The declining figure plots the payout per year per dollar invested in human capital programs at different stages of the life cycle for the marginal participant at current levels of spending. The opportunity cost funds ( $r$ ) is the payout per year if the dollar is invested in financial assets (e.g., passbook savings) instead. An optimal investment program from the point of view of economic efficiency equates returns across all stage of the life cycle to the opportunity cost. The figure shows that, at current levels of funding, we overinvest in most schooling and post-schooling programs and underinvest in preschool programs for disadvantaged persons. Adapted from (3) with permission from Mt Press.

Source: Heckman, 2006.

In terms of policy, Figure 1 makes a convincing case for greater investment in preschool education programs, especially for disadvantaged children (Heckman, 2006). That is, anything above the ‘opportunity cost of funds’ line, should receive priority funding, since it produces the greatest returns on investments made to human capital. Although the emphasis in this graph is on investment in preschool, adults who did not have the opportunity to benefit from such programs, who are in need of skills

training, still require resources to be available. As such, there remains a conflict in the literature between funding of adult literacy interventions, and the redirection of those funds toward preschool, for improving the lives of future generations. In any case, policy-makers may be interested in understanding the link between adult skill level and ‘outcomes’ in terms of people’s value within the workplace and the greater economy. This association allows for the identification of skill deficits and also enhances understanding of how this can influence the country’s overall level of human development (Statistics Canada, 2005). In terms of early interventions for children, many adult economic and social problems can be traced back to lower levels of skill in the population, so the notion of creating stimulating early environments for skill development can predictably decrease economic and social failure when children reach adulthood (Heckman, 2006).

As compelling as the case is for investment in children, an equally strong case can be made for a simultaneous investment in adults. The case for investment in adult literacy depends on a series of arguments as set out below.

- Low fertility rates mean that the flow of literacy leaving the secondary education system is too small to have much of an impact on the overall supply of skill. Thus, the only way to meet rising skill demand is to train adults.
- Canada’s reliance on immigration to meet the economic demand for skill implies a need for investment in language and literacy training. Large numbers of adult immigrants arrive with limited literacy skills in Canada’s official languages, something that prevents them from realizing their full economic potential.
- Recent research has documented significant levels of literacy skill loss in some groups of adults, loss that appears to be the result of low levels of skill use in daily life. Reversing skill loss requires remedial training.
- Many adults with low literacy skills are themselves parents. Research has shown that youth literacy levels are highly conditioned by parental skill levels. Thus, an investment in raising adult skill levels will precipitate improvements in their children’s scores.

The economic prescription is clear. Canadians need to invest simultaneously in raising the literacy skill of both adults and children if we are to realize our full economic and social potential.

## ***2. How does the level and distribution of literacy skill influence individual outcomes?***

### ***The demand for skill***

Forces that change the demand for skills may be external or internal. Externally imposed changes include the diffusion of new technologies, process innovations and the reconfiguration of social institutions. A result of these changes is that the demand for skill tends to rise in all life contexts – work, home and the community. Internally imposed changes in skill demand happen as a result of changes in individual and collective goals and aspirations, as well as changes that happen as a result of the natural consequence of an individual’s passage through different life stages.

## The supply of skill

As the demographic composition of populations evolves, the supply of economically, socially and environmentally relevant skills also changes. Reform of primary and secondary education is the most obvious driver of change in the supply of skill over the long term (Statistics Canada & Organisation for Economic Cooperation and Development; OECD, 2005). The importance of primary (preschool) education is emphasized with regard to the prevention of several social problems (e.g., children's involvement in crime, teenage pregnancy, and level of educational attainment) by fostering the development of cognitive (intellectual) and non-cognitive (socio-emotional) skills when children are most receptive to inputs from their environment (Feeny, 2006; Heckman, 2006; Tremblay, 2006). Specific benefits to schools and teachers is the proven reduction in need for remedial school services, such as grade retention and special education placement. Longer-term benefits to the individual include greater levels of educational attainment, higher adult earnings, and lower rates of juvenile and adult crime (Temple & Reynolds, 2007).

The most conclusive evidence supporting these findings comes from three major longitudinal studies conducted in the United States. These are: the Abecedarian program; the High/Scope Perry Preschool program; and the Chicago Longitudinal Study. The Head Start program is also targeted at disadvantaged children but is a government funded, government run program (as opposed to the three research-driven programs) and does not have any longitudinal data available for comparison.

The Abecedarian program is a randomized trial which began in 1972, serving mostly low-income African American mothers and children from North Carolina with year-round, full-time care for five years, starting from the child's first year of life (Duncan, Ludwig, & Magnuson, 2007). This program was a high-quality, high-cost program run by researchers (not government) and produced marked effects in children's IQ scores by age 5, and by adulthood these participants were 2.5 times more likely to enter college than the control group, and rates of teen parenthood and drug use were reduced by nearly half. Although the control and treatment groups showed about the same rate of employment in adulthood, the participants in the Abecedarian program were more likely to be working in a skilled job - 67% as opposed to 41% in the control group (Duncan et al., 2007).

The High/Scope Perry program began in the 1960s in Michigan, serving low-income, low-IQ African American children between the ages of 3-4 using a randomized controlled trial<sup>6</sup> approach. Similar to the Abecedarian program, the Perry program is also a randomized trial. The Perry program provided one or two years of high-quality part-day programs and home visits, using highly educated teachers. This program produced long-term effects, such that at age 40, participants in the Perry program reported earnings approximately \$5,000<sup>7</sup> per annum higher than the control group (Duncan et al., 2007).

The Chicago Longitudinal Study involved providing educational and family support services to low-income children aged 3-9 years old at the Title I Chicago Child-Parent Centres located in the public schools. The longitudinal study involved

6. A randomized controlled trial separates eligible participants into two groups, one that receives the 'treatment' or program, and a 'control' group which does not receive an intervention. The key to a randomized controlled trial is that participants are *randomly* allocated to one group or another.

7. As measured in the year 2000.

a program and comparison<sup>8</sup> group of children born in 1980, using a quasi-experimental design<sup>9</sup>. Participation in the program showed substantial effects in school achievement, high school completion, lower rates of remedial education service use, juvenile delinquency, and child maltreatment (Reynolds, Temple, Robertson, & Mann, 2002). Key elements of this program involve opportunities for parent involvement, well-trained staff, and a curriculum focus on literacy.

Let us now discuss each program in greater detail. The Abecedarian program involved 112 children, with 104 participants remaining at age 21. Results showed that the program produced much lower levels of grade retention (34% in the program, 65% in the control group), reduced rate of placement in special education classes (31% versus 49%), lower rates of high school drop out (33% versus 49%) and a greater chance of attending college at age 21 (36% versus 13%) (see Barnett & Masse, 2007). Despite these encouraging results, the Abecedarian program did not show any statistically significant reduction in youth crime. The following table provides more detailed information about the costs and benefits of the Abecedarian program, according to three different discount rates (Table 1). Even at a discount rate of 7% (the highest), the benefits still outweigh the costs of the program. This can be seen in increased earnings of future generations, smoking/health, and participation in high school education. The total benefits far outweigh the costs of the program, in each of the three calculations made.

<b>Table 1</b>			
<b>Present value of Abecedarian benefits and costs per child (2002 dollars)</b>			
	<b>Discount rate (%)</b>		
	3	5	7
Program cost (net)	\$ 35,864	\$ 34,599	\$ 33,421
<b>Program benefits</b>			
Part. earnings	37,531	16,460	6,376
Earnings of future generations	5,722	1,586	479
Maternal earnings	68,728	48,496	35,560
K-12 education	8,836	7,375	6,205
Smoking/health	17,781	4,166	1,008
Higher education costs	-8,128	-5,621	-3,920
AFDC	196	129	85
<b>Total benefits</b>	<b>\$ 130,666</b>	<b>\$ 72,591</b>	<b>\$ 45,793</b>
Net present value	\$ 94,802	\$ 37,992	\$ 12,372

Source: Barnett and Masse, 2007.

8. The comparison or control group included children who were enrolled in Head Start and kindergarten programs, since these children were considered to be representative of low-income children in Chicago (Reynolds et al., 2002).
9. A quasi-experimental design is similar to a randomized controlled trial, except children are *not* randomly assigned to one group or another (e.g., treatment/program group or the 'control/no-treatment group'); instead, they are studied as they are. For example, a group of children that happen to be enrolled in a preschool program vs. a group of children who happen to not be enrolled in a preschool program.



The costs and benefits of the Perry program are detailed in the two tables below (see Table 2, Table 3). The tables are divided into costs and benefits for participants in the program (Table 2) and for society (Table 3). There are no program costs to participants, but a great amount of benefit especially in terms of lifetime employment earnings (Table 2). For society, the benefits in terms of lower crime rates, reduced dependence on welfare, and increased earnings, greatly outweigh the cost of the program (Table 3).

Table 2

Lifetime Cost-Benefit Analysis of the High/Scope Perry Preschool Program for Participants

Benefit/cost	Discount rate of 3%			Discount rate of 7%		
	Full sample	Male	Female	Full sample	Male	Female
<b>Program benefits</b>						
Child care <sup>a</sup>	906	906	906	862	862	862
Edinjtition fees <sup>b</sup>	(160)	35	(354)	(64)	(11)	(116)
Earnings	50,449	45,889	55,007	17,712	15,205	20,218
Crime	0	0	0	0	0	0
Welfare receipt <sup>c</sup>	(2,005)	(7,005)	2,995	(1,140)	(2,631)	352
<b>Total</b>	<b>\$49,190</b>	<b>\$39,825</b>	<b>\$58,554</b>	<b>\$17,370</b>	<b>\$13,425</b>	<b>\$21,316</b>
Program costs <sup>d</sup>	0	0	0	0	0	0
Net benefits	\$49,190	\$39,825	\$58,554	\$17,370	\$13,425	\$21,316

a. Barnett (1996, 28).

b. Barnett (1996, Table 13).

c. Barnett (1996, 36–38).

d. Barnett (1996, Table 27).

Note: All money values expressed in 2000 dollars. Program benefits do not include items in Table 3. Discounting begins after first year of program.

Source: Nores et al., 2005.

Table 3

Lifetime Cast-Benefit Analysis of the High/Scope Perry Preschool Program for Society

Benefit/cost	Discount rate of 3%			Discount rate of 7%		
	Full sample	Male	Female	Full sample	Male	Female
<b>Program benefits</b>						
Child care <sup>a</sup>	906	906	906	862	862	862
Education <sup>b</sup>	7,144	12,282	2,006	4,973	7,734	2,215
Earnings	64,526	58,436	70,615	22,739	19,458	26,019
Crinii <sup>c</sup>	171,472	330,474	12,470	69,758	133,867	5,647
Welfarec	763	2,663	(1,138)	433	1,001	(133)
<b>Total</b>	<b>\$244,811</b>	<b>\$404,761</b>	<b>\$84,859</b>	<b>\$98,765</b>	<b>\$162,922</b>	<b>\$34,610</b>
Program costs <sup>c</sup>	\$5,166	\$15,166	\$15,166	\$14,367	\$14,367	\$14,367
Net benefits	\$229,645	\$389,595	\$69,693	\$84,398	\$148,555	\$20,243

a. Barnett (1996, 28).

b. Barnett (1996, Table 13).

c. Barnett (1996, 36–38).

d. Barnett (1996, Table 27).

Notes: All money values expressed in 2000 dollars. Program benefits do not include items in Table 3. Discounting begins after first year of program.

Source: Nores et al., 2005.

A more detailed look at the total lifetime earnings between participants and non-participants in the Perry preschool program are detailed in the tables below (Table 4 and Table 5). Table 4 shows that earnings up to age 27 are approximately \$20,000 to \$50,000 greater for preschool participants than non-preschool participants. The differences compound over the life course: in other words, between preschool and non-preschool participants, individual earnings increase with age of participant. For example, over the life course, the total earnings between ages 18-65 are approximately \$140,000 and \$220,000 greater for those participating in preschool than for those who did not (Table 4).

Table 4				
Individual benefits				
	Total lifetime gross earnings (undiscounted, in 2000 dollars)			
	Preschool		No preschool	
	Males	Females	Males	Females
Lifetime earnings	Dollars		Dollars	
<b>Up to age 27</b>				
Profile A1	201,259	144,099	173,767	91,495
Profile A2	206,235	141,301	184,759	90,607
Profile A3	131,773	97,967	110,535	48,381
<b>Ages 28 to 40</b>				
Profile A1	317,855	244,052	240,405	183,170
Profile A2	380,805	311,158	293,434	248,381
Profile A3	231,496	194,872	160,717	137,095
<b>Ages 41 to 65</b>				
Profile A1	800,753	597,308	754,699	534,686
Profile A2	804,268	626,808	769,855	571,528
Profile A3	511,338	436,035	380,045	351,365
<b>Total, Age 18 to 65</b>				
Profile A1	1,310,868	986,459	1,168,871	809,351
Profile A2	1,391,307	1,080,267	1,248,077	910,516
Profile A3	874,608	728,875	651,296	536,842
<b>Program cliff erentiitis</b>				
Profile A1	+150,997	+177,108		
Profile A2	+143,230	+169,750		
Profile A3	+223,312	+192,033		
N	33	25	38	26

Source: Belfield, Nores, Barnett, and Schweinhart, 2006.

Other indicators of wealth include home ownership, car ownership, savings account, etc. (Table 5). Once again, we can see that adults who participated in preschool as children, show greater financial success on most dimensions than their no-preschool counterparts. The exception is car ownership for females, where females with no preschool surpass females having participated in preschool. On all other dimensions, the results show promising results, in support of the positive economic effects of investment in preschool education (Table 5).



Table 5

## Individual benefits

Wealth measures	Wealth levels and wealth indicators			
	Preschool		No preschool	
	Mates	Females	Mate	Females
	<b>Percent</b>		<b>Percent</b>	
Home ownership	26.7	50.0	23.1	31.8
Car ownership	80.0	65.5	50.0	77.3
Savings account	73.3	79.2	36.1	72.7
Life insurance	60.0	75.0	47.5	63.6
Credit card	46.7	54.2	36.1	50.0
Checking account	40.0	58.3	38.9	50.0
<b>Wealth levels (undiscounted, in 2000 dollars):</b>				
Weighed by education	\$35,970	\$39,960	\$35,100	\$32,140
Weighted by marital status	\$48,530	\$45,010	\$40,620	\$39,430
N	33	25	39	26

Source: Belfield et al., 2006.

Benefits to society include higher tax contributions made by those participating in preschool versus those who did not (Table 6). Regardless of gender, lifetime tax contributions are roughly \$40,000 to \$60,000 greater with preschool education than without (Table 6).

Table 6

## Benefits to society

Age-earnings profile	Tax contributions by age-earnings profile (Undiscounted, in 2000 dollars)			
	Preschool		No preschool	
	Mates	Females	Mate	Females
<b>Lifetime tax contribution</b>				
Profile A1	\$314,740	\$334,949	\$280,817	\$193,456
Profile A2	\$311,653	\$241,640	\$281,507	\$204,449
Profile A3	\$243,377	\$202,550	\$182,528	\$149,711
N	33	25	39	26

Source: Belfield et al., 2006.

There is strong evidence showing that participation in preschool leads to greater educational attainment (see Table 7). There is a noticeable difference in achievement between males and females. Females with no preschool were three times more likely not to finish high school by age 27, whereas participation in preschool did not have noticeable differences for males in this regard (Table 7). By age 40, 18 participants in the preschool group had obtained some kind of degree, compared with 11 in the no-preschool group. It is interesting to note that 8 out of the 11 degrees in the no-preschool group were obtained by females. Overall, the data show that higher educational attainment can be expected from children who participate in preschool programs, than their non-preschool counterparts (Table 4).

<b>Table</b>				
<b>Educational attainment between treatment (preschool) and control (no preschool) groups in the Perry preschool program</b>				
Educational attainment	Educational attainment (Percent)			
	Preschool		No preschool	
	Males	Females	Male	Females
<b>Up to age 27</b>				
Less than high school	32	20	36	63
High school	68	72	64	33
Associate degree	0	4	0	4
College degree	0	4	0	0
Master's degree	0	0	0	0
<b>By age 40</b>				
Less than high school	29	16	31	54
High school	65	72	67	38
Associate degree	3	4	0	8
College degree	3	4	0	0
Master's degree	0	4	3	0
<b>N (Total = 119)</b>	<b>31</b>	<b>25</b>	<b>39</b>	<b>24</b>

Source: Belfield et al., 2006.

The costs for the Chicago Child-Parent Center (CPC) program are detailed in Table 8. As with most literacy intervention programs, the instructional staff comprise the greatest portion of the budget, followed by administration and maintenance costs. Additional costs are incurred for provision of a parent participation component of the program.

Table 8

**Itemized costs in 1998:dollars of the Chicago child-parent center program:  
Preschool and school-age components**

Budget category	Preschool program	School-age program
Instructional staff	7,864,225	7,849,856
Family and school-coin unity staff/parent program	1,744,945	25,634
Administration	2,288,153	1,481,416
Operations and maintenance	1,905,311	—
Instructional materials	140,772	117,621
Capital outlay's and equipment	76,075	118,864
Transportation, food, and community services	85,364	42,796
School-wide services	779,901	—
School district support	141,632	140,744
Parent program participation	1,421,695	897,300
Capital depreciation and interest	1,652,121	—
Total cost in 1998 dollars	18,100,194	10,674,231
Number of children in 25 centers/schools	4,114	6,757
Average cost per child for one year	4,400	1,580
Present value of weighted average cost per child	6,692	2,981
Present value of weighted average cost per child for 4 to 6 years of CPC participation	—	10,000
Amount above and beyond participation fix 1 to 4 years intervention	—	4,057

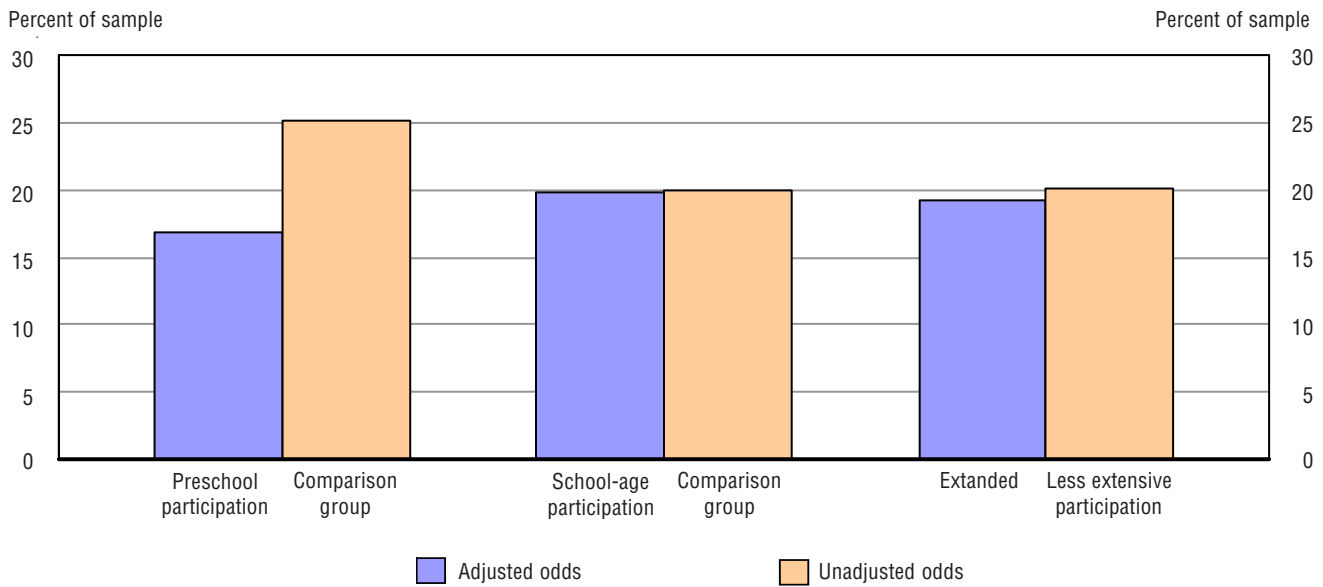
**Note:** Original program costs, (nominal dollars) for the preschool program were from 1985-1986 and for the school-age program from 1986-1987. They were converted to 1998 dollars using the Consumer Price Index (CPI-U). The 1986, 1987, and 1998 CPI-U values were, respectively, 109.6, 113.6, and 168.0. The present value was evaluated at age 3 using an annual discount rate of 3%. Parent program Cost is based on 10 hour; of participation per month at the minimum wage of \$5.35. The present value of the weighted average cost of 1 to 4 year of intervention (less-extensive participation) was \$5,943.

**Source:** Reynolds et al., 2002.

The following three figures visually demonstrate the long-term effectiveness of preschool programs for several domains: involvement in juvenile crime (Figure 2), need for special education (Figure 4), and high school completion. Again, we can see that enrolment in literacy programs earlier rather than later, results in markedly noticeable reduction in youth criminal involvement and greater rates of high school completion (Reynolds et al., 2002). In relation to the comparison group, a noticeable reduction on special education programs was observed even when literacy interventions took place later (see Figure 3).

**Figure 2**

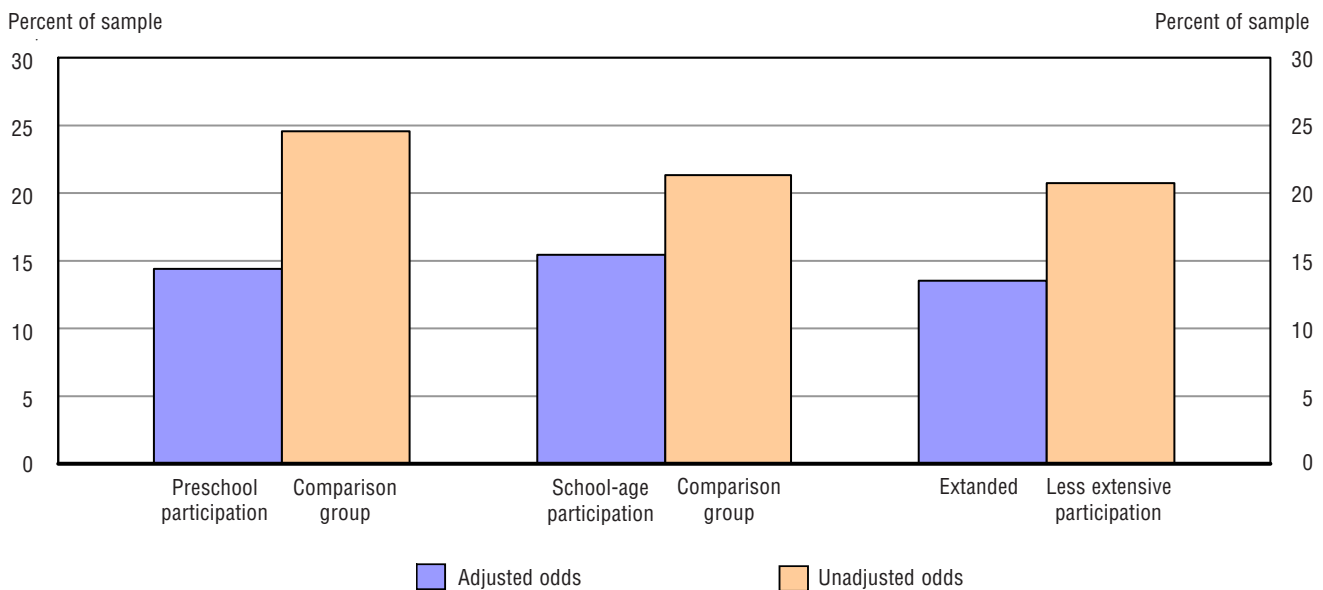
**Adjusted rates of child well-being for three program comparisons: Juvenile arrest by age 18**



Source: Reynolds et al., 2002.

**Figure 3**

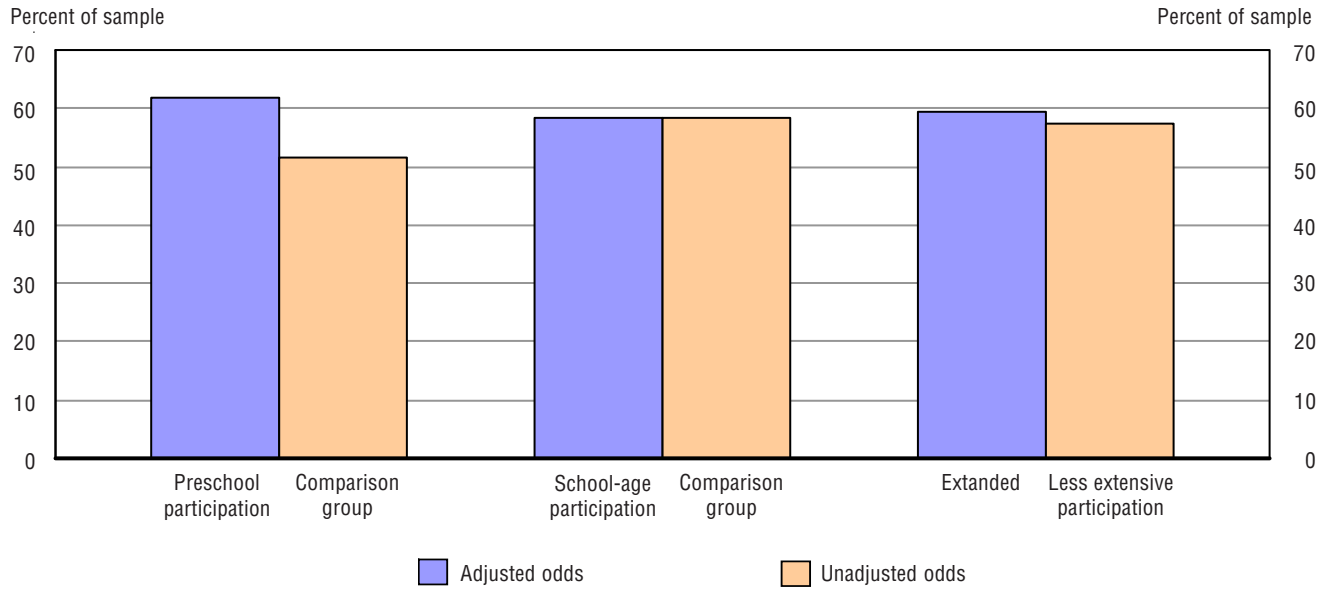
**Adjusted rates of child well-being for three program comparisons: Special education by age 18**



Source: Reynolds et al., 2002.

Figure 4

Adjusted rates of child well-being for three program comparisons: High school completion by age 21



Source: Reynolds et al., 2002.

In terms of policy, the main question is whether effects of preschool intervention are long-lasting (Duncan et al., 2007). The following table provides a visual comparison of the three longitudinal studies: Abecedarian, Chicago CPC, and Perry Preschool (Table 9). Overall, each program demonstrates improvements in IQ, educational achievement, and employment in skilled jobs into adulthood. Reliance on special education services was reduced, as well as grade retention and criminal convictions and arrests. In addition, a greater proportion of students went on to complete high school after participating in preschool education programs than students who did not (Committee for Economic Development; CED, 2006).

**Table 9**

**Early education programs have long-term effects**

	Carolina abecedarian <sup>1,3</sup>	Chicago child- parent centers <sup>2</sup>	High/scope <sup>1</sup> Perry preschool
	Treatment vs. control group		
<b>Cognitive outcomes</b>			
IQ	94 vs. 88* at age 12	95 vs. 83* at age 6	91 vs. 88* at age 7
Achievement	93 vs. 82* Math achievement age 15	147 vs. 142* Reading achievement at age 14	6.0 vs. 5.2* Problem solving at age 27
<b>Educational out comes</b>			
Special education placements	24% vs. 48%*	14% vs. 28%*	15% vs. 35%*
Grade retention	31% vs. 66%*	23% vs. 38%*	35% vs. 40%
High school completion	70% vs. 67%	62% vs. 51%*	65% vs. 45%*
<b>Crime outcomes</b>			
Arrests/convections	8% vs. 12% at age 21 <sup>4</sup>	17% us. 25%* at age 18	33% vs. 48% at age 40 <sup>5</sup>
Child abuse anti neglect	n/a	5% vs. 10%*at age 18	n/a
<b>Employment and earnings</b>			
Employed	64% vs. 50% at age 21	n/a	76% vs. 62%* at age 40*
Employed in skilled Jobs	67% vs. 41%* at age 21	n/a	n/a
Monthly earnings	n/a	n/a	\$1,856 vs. \$1,308* at age 40

1. Model program, randomized treatment and control groups.
2. Large-scale program, matched treatment and control groups.
3. Program began while children were in infancy.
4. Convicted of a felony.
5. Arrested for a violent crime.

\* Difference between treatment and control groups is statistically significant at the .05 level.

Sources: Frances A. Campbell, Craig T. Ramey, Elizabeth Pungello, Joseph Sparling, and Shari Miller-Johnson, "Early Childhood Education: Young Adult Outcomes From the Abecedarian Project," *Applied Developmental Science*, vol. 6, no. 1 (2002); Leonard Masse and W. Steven Barnett, "A Benefit-Cost Analysis of the Abecedarian Early Childhood Intervention" (New Brunswick, NJ: NIEER, 2002); Arthur J. Reynolds, Judy A. Temple, Dylan L. Robertson, and Emily A. Mann, "Age 21 Cost-Benefit Analysis of the Title I Chicago Child-Parent Centers," *Educational Evaluation and Policy Analysis*, vol. 24, no. 4 (Winter 2002); Lynn A. Karoly and James H. Bigelow, *The Economics of Investing in Universal. Preschool Education in California* (Santa Monica, CA: RAND Corporation, 2005); Lawrence Schweinhart, *Lifetime Effects: The High/Scope Perry Preschool Study Through Age 40* (Ypsilanti, MI: High/Scope Educational Research Foundation, 2004).  
CED, 2006.

While these results are interesting, policy-makers also need to know whether the program is cost-effective. The table below compares the three programs based on total benefit, total cost, benefit/cost ratio, and internal rate of return. The distribution of benefits is calculated for both taxpayers (society) and individuals participating in the program. The results demonstrate that the total benefits for all programs far outweigh the initial investment made (Table 10).

Table 10

## Benefit-cost analysis for preschool programs

	Per child discounted at 3%			Benefit/ ratio cost	Distribution tobenefits among...		Internal rate of return
	Total benefit	Total cost	Net benefit		Taxpayers	Participants	
Carolina, abecedarian (2002 dollars)	\$135,546	\$35,864	\$99,682	3.78	14%	86%	7%
Chicago CPC (1998 dollars)	\$47,759	\$6,682	\$41,067	7.14	64%	46%	10%
Perry preschool age 40 follow-up (2000 dollars)	\$244,811	\$15,166	\$229,646	16.14	80%	20%	18%
Mata-analysis (2003 dollars)	\$17,202	\$7,301	\$9,901	2.36	62%	31%	n/a

**Sources:** Milagros Nores, Clive R. Belfield, W. Steven Barnett, and Lawrence Schweinhart, "Updating the Economic Impacts of the High/Scope Perry Preschool Program" *Educational Evaluation and Policy Analysis*, vol. 27, no. 3 (Fall, 2005); Clive R. Belfield, Milagros Nores, Steve Barnett, and Lawrence Schweinhart, "The High/Scope Perry Preschool Program: Cost-Benefit Analysis Using Data from the Age-40 Follow-Up," *Journal of Human Resources*, vol. 41, issue 1 (2006); Leonard Masse and W. Steven Barnett, "A Benefit-Cost Analysis of the Abecedarian Early Childhood Intervention" (New Brunswick, NJ: NIEER, 2002); Lynn A. Karoly and James H. Bigelow, *The Economics of Investing in Universal Preschool Education in California* (Santa Monica, CA: RAND Corporation, 2005); Steve Aos, Roxanne Lieb, Jim Mayfield, Marna Miller, and Annie Pennucci, *Benefits and Costs of Prevention and Early Intervention Programs for Youth* (Olympia, WA: Washington State Institute for Public Policy, 2004); Arthur J. Reynolds, Judy A. Temple, Dylan L. Robertson, and Emily A. Mann, "Age 21 Cost-Benefit Analysis of the Title I Chicago Child-Parent Centers," *Educational Evaluation and Policy Analysis*, vol. 24, no. 4 (Winter 2002). CED, 2006.

The Head Start program is a preschool program implemented by the United States government, which provides services to over 900,000 low-income children. The program began in 1965 as part of the 'war on poverty' program launched by President Lyndon B. Johnson. It was designed as a comprehensive program, aimed at addressing health issues (e.g., nutrition, immunization), as well as development of cognitive skills, through involvement of parents and families. Many parents participated in the program as teacher aides, which facilitated continued learning at home through their understanding of what was being taught in school. There are no long-term results available; however, short- and medium-term benefits have been observed, and an overview is provided in the table below (see Table 11). Short-term effects include improvements in physical and emotional health, as well as indirect benefits to parents and siblings. Similar to other preschool programs, medium-term benefits include reduced need for special education placement and grade retention.

Table 11

The costs and benefits of head start

Cost of sending 1,000 children to regular part-day, part-year head start for two years:	
Federal cost	\$10,152,381 (5,200,000 + 5,200,000/1.05).
Local cost	\$2,030,476 (assumes 20% local matching. Much local matching is in-kind. so the proper valuation of It may be unclear).
<b>Short-term benefit</b>	
Improved health and nutrition, prevention of abuse and neglect, benefits to other members of family including parents and siblings	
Child care I: (part-day, part-year valued at cost of "mediocre" child care)	\$1,435 per child per year (\$2.11 X 20 hours per week X 34 weeks per year). Total benefit \$2,801,667.
Child care II: (full-year valued at mean of what employed mothers actually pay)	Between \$2,240 and \$4,029 per child per year (The average employed mother spends \$80.57 per week conditional on spending anything, but only 55.6% of employed mothers of preschool children report making payments for child care). <sup>b</sup> Total benefit between \$4,373,033 and \$7,866,143.
<b>Medium-term benefits<sup>c</sup></b>	
Preventing grade repetition.	Assumptions rate of special education is approximately 12%, and is reduced by a similar amount as grade repetition. Thus 28 fewer children are placed in special education. Special education costs approximately \$8,000 per year more than regular education and once placed in this track, children have unlikely to rejoin the mainstream. Children are assumed to leave school after 11 years. Discount rate of 5%. Total cost saving = \$1,855,245 = (28 X [8,000/ (1.05) <sup>3</sup> + ...8,000/ (1.05) <sup>14</sup> ].
Preventing grade repetition.	Assumptions: rate of grade repetition is approximately 20% and is reduced by 20%. Thus, 541 fewer children (out of the 1,000) repeat a grade. Cost of a year of elementary education \$6,000 Most children who repeat, repeat kindergarten or first grade. Discount rate is 5%, 40% of children do not receive benefits in terms of prevention of grade repetition. Total cost saving \$174,149 = [.6*(56 X 6000/(1.05) <sup>3</sup> ].
Any other continuing benefits to children and families of getting off to a good start.	
<b>Long Term benefit</b>	
Possible improvements in schooling attainment and wages, and reductions in crime, teen pregnancy, etc.	

b. See Blau (2000).

c. Estimates of effects of Head Start on grade repetition are based on Currie and Thomas (1995). Currie and Thomas do not examine the probability of special education placement, but many of the studies listed in Table 2 do. Estimates of the costs of special education and grade repetition, and of the number of children in special education are thanks to Caroline Minter Hoxby and Julie Berry Cullen.

Note: All costs and benefits discounted to when the child was age 3, and presented in 1999 dollars.

Source: Currie, 2001.

When assessing adult skill level, some factors such as literacy at age 15, completion of high school, and participation in post-secondary education are important considerations. Analysis of IALS and ALL data suggests, however, that other factors also play a significant role in adult skill acquisition and maintenance (OECD & Human Resources Development Canada, 1997), such as the quality of post-secondary education and other forms of adult education and training, as well as level of socio-economic development. These factors all appear to have a noticeable positive impact on the supply of skill and on the average quality of those skills (Statistics Canada & OECD, 2005).



These findings contrast with other empirical evidence, which suggests that some skill gains made over time are offset by skill loss in adulthood (Willms & Murray, 2007). This skill loss may be related to the reduced use of these skills in light of the social and economic demand for them. Culture also seems to play a role in that countries differ greatly in their participation in lifelong learning and in their levels of skill use outside of paid employment. The presence of skill loss raises the issue of the cost of educational opportunity, which can be addressed by balancing ‘supply-side’ interventions that can increase the overall demand for skill in terms of adjustments made to public policy. Because skill loss is a widespread issue, assessments such as the Organisation for Economic Cooperation and Development (OECD) Programme for International Student Assessment (PISA) can assist in providing a starting point for conducting repeated measurements of adult skill level throughout the life course. The available research suggests that markets for skill recognize and reward literacy, however, the degree to which skill influences outcomes varies considerably from country to country.

Public policy in Canada can address this by adopting policies that increase demand for these specialized skills. For example, by increasing the labour market’s requirement for skill-intense technologies, policies can influence the supply of skill by financing education and can increase the efficiency of the markets that select upon skill. The balance struck by government among these elements can have a profound impact upon the real and observed effects of literacy and other skills upon economic outcomes.

### ***Different types of skills***

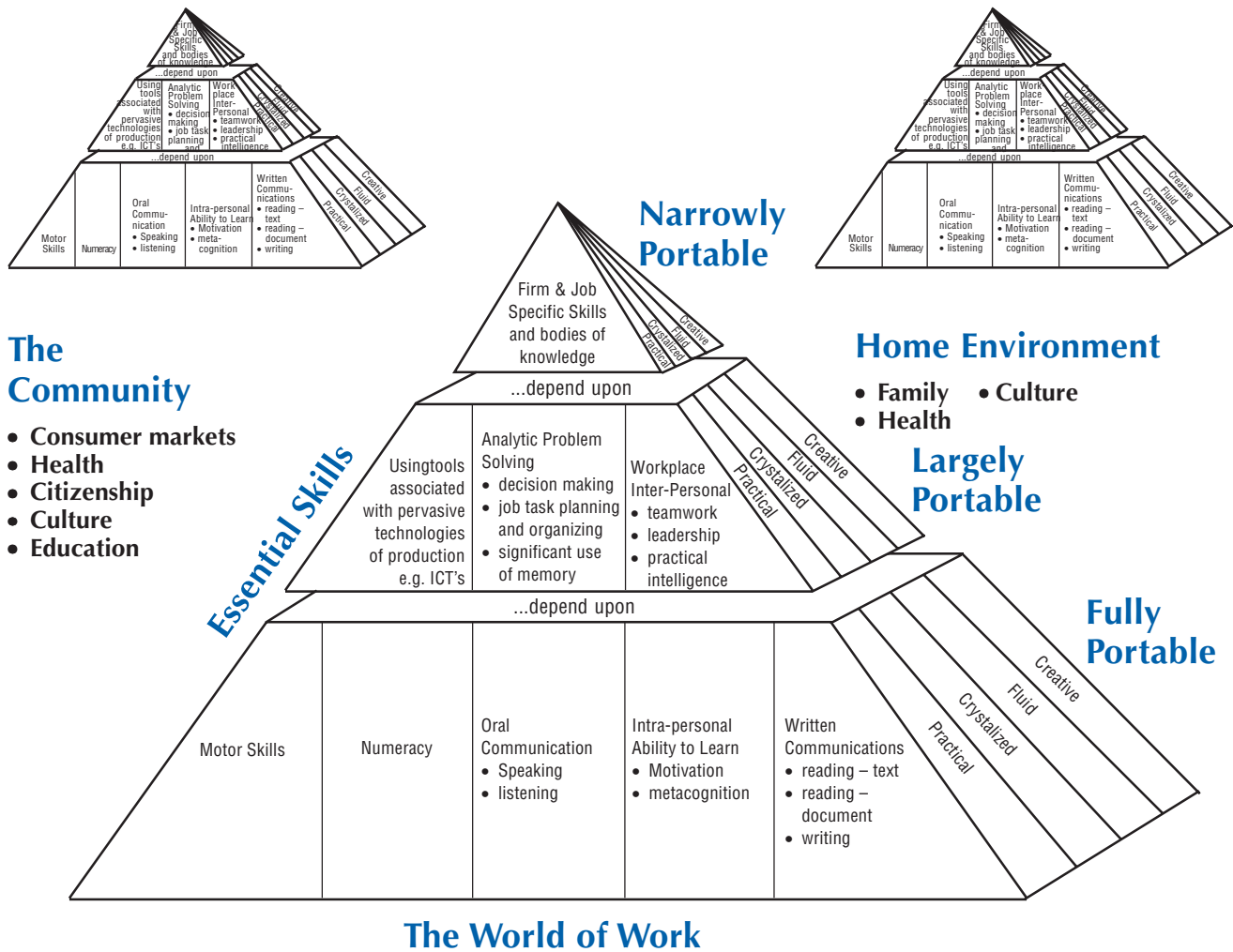
Each skill domain has its own economic, social and educational value. These skill domains are based upon a combination of the academic literature on human cognition and intelligence, the job and task analyses that underlie occupational skill standards, the literature on the expected outputs of education and the skills that are thought to be associated with full and equitable social and economic participation.

Higher levels depend upon skills acquired at lower levels (such as literacy, in particular). One of the key objectives of the ALL study was to establish the strength of these dependencies through research. Understanding these dependencies is critically important for both policy and instructional design, because lower level skills such as literacy are essential for higher-level skills to be acquired, and to reduce social inequities in outcomes that are attributable to distribution of skill. Such a policy emphasis contrasts with pressure from employers and others for governments to invest in higher order skills that may be in short supply, such as team work or critical thinking.

Also important is the ‘portability’ of skills – the degree to which skills can be put to productive use in multiple contexts (see Figure 5).

Figure 5

Profiles of skill supply and demand framework



Source: International Adult Literacy Survey: Measuring Adult Literacy and Life Skills: New Frameworks for Assessment (Murray, Clermont, & Binkley, 2005).

Each of the skills measured by the ALL study is believed to be portable across a broad range of contexts. In terms of policy, the more portable a skill is, the stronger the case can be made that remedial intervention should be financed by government, the less portable a skill is the stronger the case for private finance.

There are four levels of performance that are identified in the research literature on human cognition. Practical and crystallized abilities are those which enable individuals to cope with most everyday skill demands, and which most individuals possess (Statistics Canada, 2005). The approach to assessment applied in the ALL study concentrates on identifying skills that are associated with fluid and creative intelligence – the levels that are associated with efficient adaptation to anticipated change in skill demand.

### 3. *How do levels of Canadian literacy skills influence national economic performance, including population health and citizen engagement?*

Literacy exerts a profound influence over a range of important social and economic outcomes experienced by individuals, including:

- their labour market outcomes, such as employment, wages, incomes and reliance on social transfers
- their education outcomes, e.g., the amount of benefit received from participation in the formal education system, rates for completion of secondary education, participation and persistence in completion of post-secondary education, and access to adult learning systems
- their health outcomes, as reflected by their overall quality of life, their levels of mortality and morbidity, and the cost of treatment
- their social outcomes, e.g., their levels of engagement in the community and in the broader democratic process

The following sections highlight what is known about the impact of literacy in each of these areas.

#### *Literacy's impact on individual economic outcomes*

Current organizations and technologies of production impose a set of skill demands, and employers recruit and reward employees based on their skill levels. In labour markets where large differences in skill among individuals can be seen between different population sub-groups, workers with high skill are the ones who obtain stable, well-paid employment while workers with lower skill are excluded from employment or relegated to intermittent employment and lower wages.

Economists consider the costs incurred and benefits enjoyed by individuals and their households in obtaining more education (or literacy) to be different than that of society as a whole. Measuring the positive benefits that the education of one individual may have for the economic situation of others is challenging. When an individual attains higher levels of education or literacy, the benefit to society is the total benefit resulting from having a more educated (literate) individual in the population. Literacy can boost national economic growth by improving the livelihoods of individuals, families and communities through various channels.

Without direct measures of human capital, most of the available research is constrained by the assumption that those with a specified level of education possess similar knowledge, skills and other attributes. However, the observed variation in wages within occupations is much larger than can be explained by differences in educational attainment. Such variation is undoubtedly the product of underlying variation in the degree to which firms employ and reward skill and in the actual skill levels of workers.

Neither the design of the IALS study nor that of the ALL study offers insight into inter-firm heterogeneity with respect to skill utilization and reward. These studies do, however, provide direct measures that allow for specific skills to be valued separately from the many characteristics that education is supposed to measure indirectly. It also allows an improved understanding of the correspondence between the inputs and outputs of the human capital formation process. For example, educational attainment might actually act as a proxy measure for characteristics of other skills, if there is a particular job skill that is valued independently from schooling.

Green and Riddell (2001) determined that literacy and numeracy skills greatly determine the level of wages received by those who possess skills and those who do not. They have also recently extended and refined these analyses using data from the 2003 ALL study (Green & Riddell, 2007). They confirmed that employment and wages are affected by literacy and numeracy skills in the labour market as a whole, as well as for Aboriginals and immigrants. This is an important finding because it means that people get paid for what they know and can do. More specifically there is no evidence for systemic skill-based discrimination in the Canadian labour market.

Similarly, Osberg (2000) found that literacy proficiency is responsible for 40 to 45% of the economic return from obtaining education. Boothby (2002) suggests that literacy skills result in higher wages, and that literacy contributes directly to productivity. Finally, Shalla and Schellenberg (1998) cite research conducted by the National Anti-Poverty Organization (NAPO; 1992), showing that working-age women and men who are economically disadvantaged and who possess weak literacy skills are doubly disadvantaged, and face a high risk of marginalization. The effects of low income and limited literacy could result in high social and economic costs to individuals and to society, especially given the current economic restructuring and associated increases in the demand for labour and skill in Canada's labour markets.

Literacy and numeracy skills play a significant role in determining employment and wages in labour markets. People who increase their level of literacy by 10 points on the 500 point proficiency scale, whether initially at a level which is relatively lower or higher, typically gain the same amount of benefit in terms of wages earned (Maré & Chapple, 2000; Denny, Harmon, & O'Sullivan, 2004). Thus, investments in improving literacy overall can have great benefits for many individuals, across the spectrum of different skill levels.

### ***The impact of literacy on individual outcomes related to technological change***

Technological change in the labour market means that newer technologies and forms of organization favour more skilled workers over less skilled workers (Katz & Autor, 1999). Typically, these skills are referred to as cognitive: the type of skills that are useful for interacting with new information and communication technologies (ICT). However, some research argues that non-cognitive traits affect the amount of wages earned more than cognitive skills (Bowles, Gintis, & Osborne, 2001).

The measures of ICT skill embodied in the ALL study are based upon work by Irwin Kirsch and his colleagues at the Educational Testing Service (ETS). The ETS framework defines ICT skill as a combination of cognitive skills – literacy, numeracy and problem solving skill – and the technical skill associated with using a particular technology – its syntax, user interface, etc. Although proficiency depends on the application of both sets of skills, the relative difficulty of the task at hand determines the level of ICT skills required. The ETS framework defines five ascending levels of application – access, manage, integrate, evaluate and create (ETS, 2003).

This theory allows individuals to be classified into the following four categories, each of which carries different implications for remedial education required to use technology in the workplace. From an employer point of view, workers classified in Group B are considered ICT literate, in the sense that they have the ICT skills demanded by the job and are thus job ready, whereas workers in Group A require technical training in the use of ICTs. Workers in Group C require extensive literacy and ICT training. Very small numbers of workers are found in Group D – workers in this group are repetitive users of ICTs that require little cognitive input.

Figure 6

**Cognitive and technical proficiency matrix**

	Low technical proficiency	High technical proficiency
High cognitive proficiency	A	B
Low cognitive proficiency	D	D

Source: Statistics Canada and OECD, 2005.

Analysis of the ALL data has revealed that having high literacy and being an intense user of ICT greatly increases the probability of holding a high wage, stable job (Statistics Canada & OECD, 2005).

***Literacy's impact on individual outcomes relating to education***

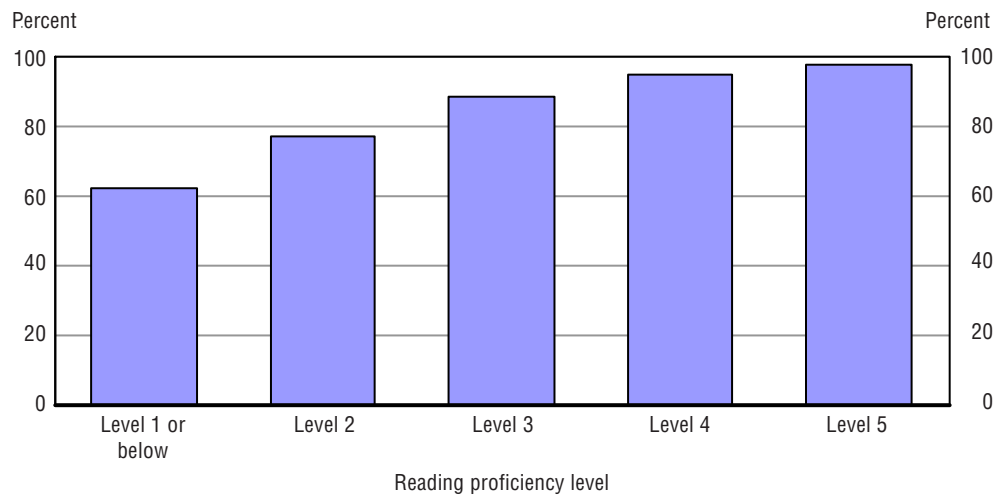
Literacy has a profound impact on educational access and persistence. This should come as no surprise as literacy is one of the prized outputs of early education and is one of the keys to efficient and independent learning in adulthood. Knighton and Bussière (2006), using the PISA2000/Youth in Transition Longitudinal Survey, found that high school completion and also participation in post-secondary education is highly dependent on literacy level. Similarly, Willms (2003) has shown that literacy and numeracy have a marked effect on initial post-secondary participation.

Given the relationship that high school completion and post-secondary participation have on various markers of labour market success, including employability and wage rates, these findings suggest that adults with low literacy skills face large lifetime consequences.

Let us now turn to some tables from the Youth in Transition Longitudinal Study by Knighton and Bussiere (2006) that will explain the relationship between high school completion and literacy levels of youth. Figure 7 shows that youth whose reading proficiency is at Level 4 or 5, are the most likely to finish high school (almost 100%), compared with students who scored at Level 2 or 3. Students with a literacy Level of 1 were the least likely to complete high school, with drop-out rates approximating 40%.

**Figure 7**

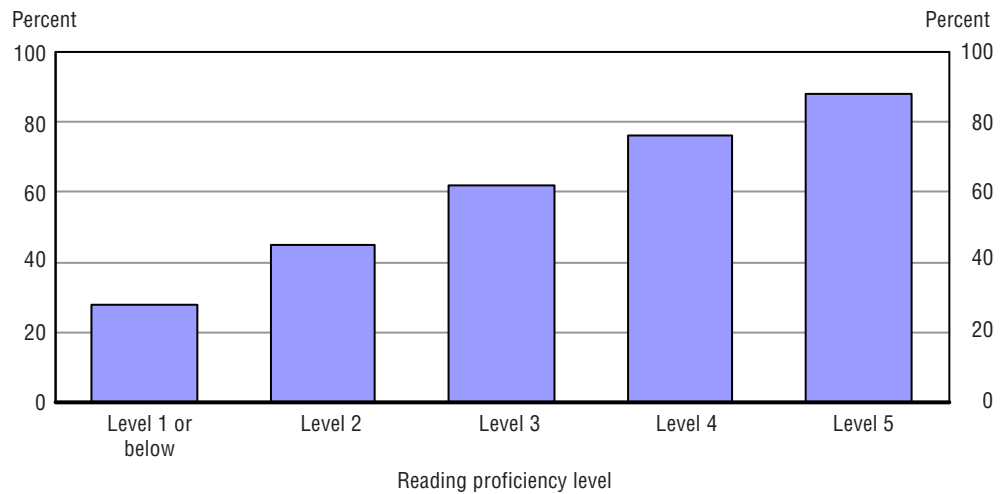
**Percentage of youth who had completed high school by age 19 by their reading proficiency at age 15**



Source: Knighton and Bussiere, 2006.

**Figure 8**

**Post-secondary participation rates by reading proficiency level at age 15**



Source: Knighton and Bussiere, 2006.

Findings from the same study also reveal that post-secondary participation is also highly conditioned on literacy level. For example, Figure 8 shows that youth with a reading proficiency score of 1 or less participate in post-secondary education levels at a rate of less than 30%. However, if a child scores a Level 4 or 5 in reading proficiency, they are almost three times more likely to engage in post-secondary education, participating at a rate of approximately 80%.

Cook and Willms (2002) have shown that these equalities in secondary completion and post-secondary access can be traced back to aspects of early childhood experience, including how much parents read to their children before the age of six.

The following tables use ‘odds-ratios’ as a way to compare the probabilities<sup>10</sup> between groups. This approach reveals that post-secondary participation rates increase progressively with reading proficiency level and that significant differences in participation rates exist among all reading proficiency levels.

**Table 12**

**Odds-ratios indicating likelihood of participating in post-secondary education, according to literacy level**

	<b>G</b>	<b>G</b>	<b>G</b>
Reading proficiency level 1			
Reading proficiency level 2	0.69	0.375	2.16
Reading proficiency level 3	1.29	0.353	4.14*
Reading proficiency level 4	1.92	0.362	8.04*
Reading proficiency level 5	2.65	0.416	16.77*

G reference group

\* significant at P <=.05

Source: Cook and Willms, 2002.

For example, children at reading proficiency Level 2, were four times more likely to remain in school than were those at Level 1; those at Level 3 were eight times more likely, and those at Level 5 were almost 17 times more likely to remain in high school than the reference group, which was comprised of youth with reading skills at Level 1 who were 15 years of age in 2000.

Willms (2003) has also shown that literacy and numeracy have a marked effect on participation in post-secondary education (PSE). In the following table, we can see that if a student is female, has a reading proficiency of Level 5, and has one parent who completed university, her chances of participating in post-secondary education are approximately double. As reading proficiency decreases, so do the chances of the individual pursuing post-secondary education; these results reflect the findings reported above, by Knighton and Bussiere (2006). Note also that students who score much higher on numeracy skills than on literacy skills are almost 1.5 times more likely to pursue post-secondary education.

10. A probability is the chance that something will happen, usually expressed as a percentage or a decimal. For example, a probability of 80% is equal to a probability expressed as 0.8 (Kallenberg, 2002).



Table 12

**Odds-ratios indicating probability of obtaining post-secondary education (PSE), according to individual and family characteristics, including literacy and numeracy skills**

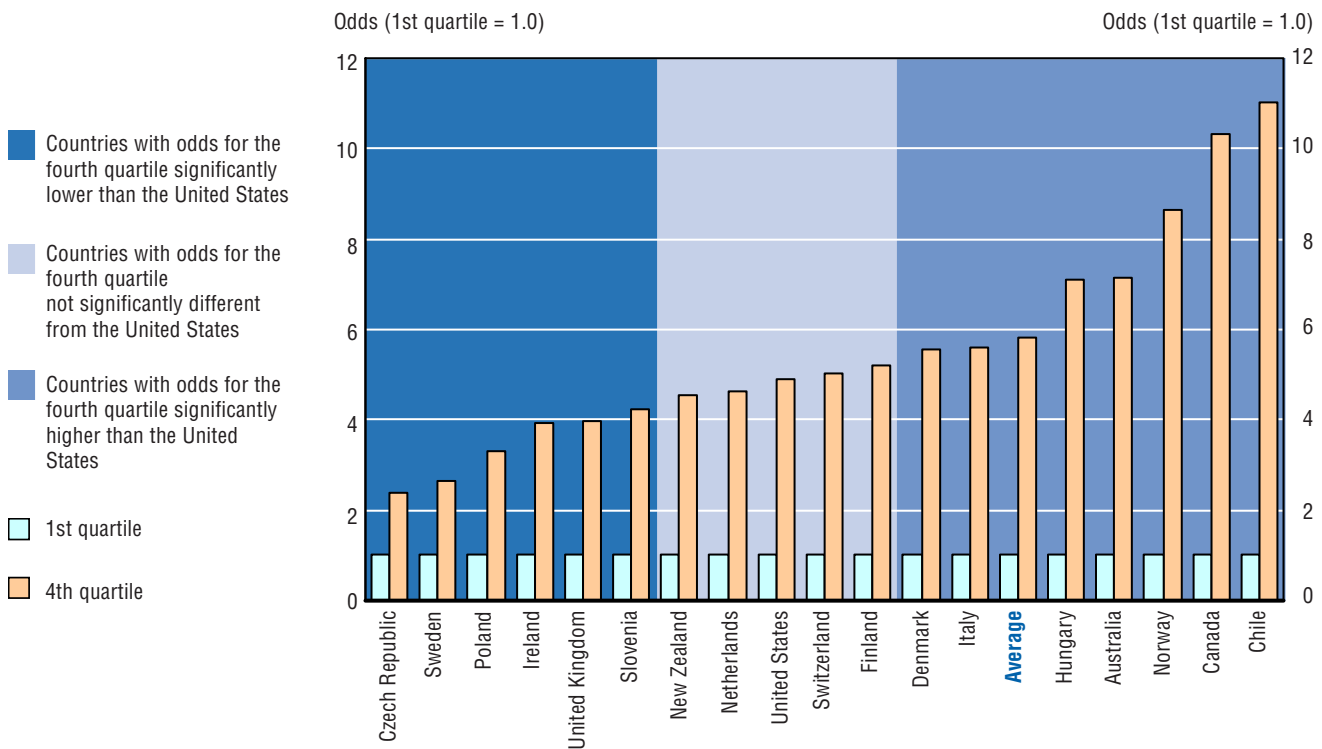
	Odds Ratio
Effects on post-secondary education attendance associated with youth's age, sex, parental education, and literacy scores: International Adult Literacy Study, 1994	
Age of respondent (years)	1.46
Respondent is female	1.81
At least one parent completed university	1.81
Prose Literacy Score at Levels 1 or 2	0.09
Prose literacy Score at Level 3	0.45
Prose literacy Score at Level 5	2.2
Respondent's quantitative literacy score is high relative to his or her prose literacy score	1.45

Source: J. D. Willms, UNB.

Analyses by Tuijnman and Belanger (1997), Belanger and Valdivielso (1997), Tuijnman and Boudard (2001) and Rubensson and Desjardins (2007) established a relationship between large social inequities regarding access to adult education and training systems according to literacy level of the individual. This was particularly true for education supported by employers. Figure 9 below shows that low-skilled workers in Canada are over 10 times less likely to receive employer support for training than their more literate peers (Tuijnman & Boudard, 2001).

Figure 9

**Likelihood of receiving employer support for training**



Source: Tuijnman and Boudard, 2001.



Many countries are investing public resources to support higher levels of formal, non-formal and informal adult learning. These investments are motivated by a perceived need to compensate for low educational participation and educational quality in earlier periods, for skill loss and to meet rising skill demands. A large body of evidence has established the impact that literacy and numeracy skills have on the human capital formation of adults through their participation in these types of learning.

Reder and Strawn (2001) expected to find that individuals with higher skill levels are more likely to engage in self-study, but their study showed the opposite was true. Individuals with higher skill levels are less likely to have engaged in self-study efforts to improve their skills or prepare for the General Educational Development (GED). Individuals at the lowest levels of skill are the most likely to engage in such self-study efforts; about half of the Longitudinal Study of Adult Learning (LSAL) population functioning at the lowest proficiency level (Level 1) has previously engaged in such self-study activities. This finding belies a commonly held assumption that adults with low literacy skills are neither motivated to nor capable of managing their own learning.

### ***Literacy's impact on individual outcomes related to health***

Population health outcomes, in general, depend upon individual choices concerning diet and lifestyle. However, skill can also play a significant role by enabling access to information that is health promoting. Analysis of data from the ALL study reveals a strong relationship between general health status, physical health status, mental health status and literacy (Statistics Canada & OECD, 2005).

The relationship between skill level and health status, however, runs deeper than access to information. Ironically, Canada's labour markets systematically select workers with lower literacy skill levels into occupations that expose them to higher levels of risk for illness and accident – hence placing higher health literacy demands on these workers (CCL, 2008a). The weight of empirical evidence also suggests that increased levels of skill can help to reduce stress levels, by helping individuals adapt to change and exert some control over this process. This is important, because stress can impair the human immune system in ways that lead to higher levels of morbidity and mortality from a range of diseases.

Secombe, Lockwood, and Reder (2007), using data from LSAL, report that adults with lower levels of literacy are less likely to have a regular health care provider and health insurance. These adults are also more likely to have trouble understanding written medical directions, have difficulty getting needed care, and as a result, have poorer health. They also use physician services, overnight hospital stays, and emergency rooms more frequently. These results are true when one controls for education, access, health, and socio-demographic characteristics.

### ***Literacy's impact on individual social outcomes***

Skills are integral to achieving universally accepted objectives with respect to human rights and democratic values. Globally, the right to education set forth in the 1948 Universal Declaration of Human Rights, the Jomtien Declaration on Education for All (UNESCO, 1990), the Hamburg Declaration on Adult Learning (UNESCO Institute of Education, 1997), and the United Nations Millennium Development Goals (UN, 2000) reinforce the role of skill in redressing imbalances that lead to social inequities in economic and social outcomes. As noted above, public policy can

have a profound impact on the level and social distribution of skill, a fact that obliges those in power to understand the processes of skill acquisition, maintenance and loss, and its influences on health, economic, social and educational outcomes at all levels. This understanding can help policy-makers see what needs to be done to improve the situation.

Skill plays a role in sustaining the democratic process. Paulo Freire highlights skill as central to the process of “conscientisation” in which citizens question the way things are and undertake to change them for the better (Freire, 1970). As such, skill enables politically active participation in social and economic transformation (UNESCO, 1975).

In addition, skill plays a role in defining our collective ability to deal with issues of the environment and sustainable development. Human kind is at a crossroads – either we learn how to live in harmony with the natural environment or we suffer the consequences of ecological collapse and degradation. Throughout the millennia, human societies have learned the hard way how to coexist with our environment. The rate of growth of human populations, the development of human societies and the global economy represent an enormous challenge to our long-term survival as a species. Skill, as denominated above, has the potential to transcend our parochial interests, to enlighten and to lead to environmentally sustainable lifestyles. The alternative is not a desirable option. Understanding skill and its distribution and relationship to individual and societal outcomes is part of the solution.

Findings from the IALS study (OECD & HRDC, 1997) confirm a strong link between literacy and social engagement evidenced by the proportion of adults who participated in voluntary community activities at least once a month.

Coleman (1988) identified the fact that information is an important dimension of social capital, one that contributes to trust and norm-building by extending the reputation of an individual beyond his/her immediate contacts. Information is often the medium of exchange that creates social cohesion and solidarity, through informal or “back-fence” conversation. Information exchange through social networks can also facilitate individual actions, such as finding a job.

Schuller and Field’s (1998) study in Northern Ireland showed that social capital resulting from informal adult education provides a buffer for a lack of formal human capital certification (e.g., a high school diploma or GED). Strawn (2003), using data from the LSAL study, confirmed that adults use social networks to compensate for limited human capital, including literacy.

### ***Literacy’s impact on the performance of social institutions***

Skill plays a role in determining the efficiency and effectiveness of social institutions. This includes the subset of institutions that produce public goods and services. Governments in the OECD area remain concerned with finding ways to reduce the cost of producing and delivering public services such as education, health and social welfare. A skilled population makes fewer demands on the system, since they are able to make use of more efficient and less costly delivery modes when they do need service. For example, ICT-literate citizens are able to access health information via the internet and to manage health-related tasks themselves with less assistance from scarce and expensive health professionals.

**Firms**

The ALL data have been used to create a combined literacy and ICT use index. The following analysis models the effects of various socio-economic characteristics, as well as literacy skill and computer use profiles, on personal income. The combined profiles consist of four groups (see Table 15).

**Table 14**

**ICT use index**

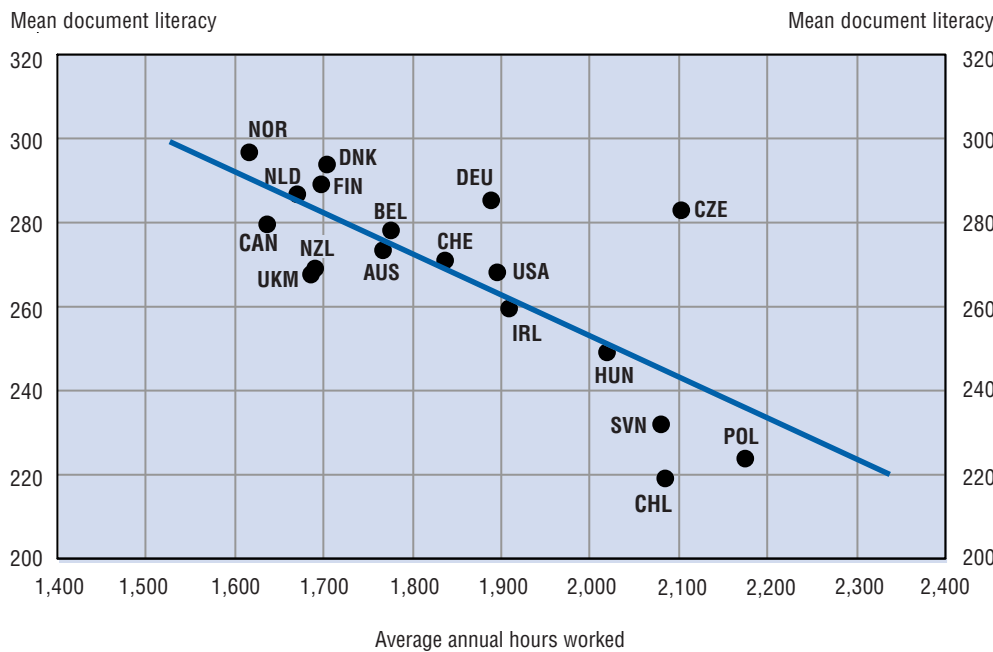
Profile	Literacy level-	Use of computers for task-oriented purposes
Group 1	Low (Levels 1 and 2)	Low-intensity (less than top quartile of computer users)
Group 2	Medium/high (Levels 3 and 4/5)	Low-intensity (less than top quartile of computer users)
Group 3	Low (Levels 1 and 2)	High-intensity (top quartile of computer users)
Group 4	Medium/high (Levels 3 and 4/5)	High-intensity (top quartile of computer users)

**Note:** From “Learning a Living: First Results of the Adult Literacy and Life Skills,” by Statistics Canada and OECD, 2005. Copyright 2005 by OECD Publishing.

The research linking wage, hours and employability to literacy levels suggests that literacy is a valuable economic asset, leading to higher levels of employee output per hour worked and hence to higher wage rates. The following chart shows that another benefit of having higher literacy skills is reduced hours of work.

**Figure 10**

**Graph comparing mean document literacy scores with annual hours worked in several countries**



**Note:** From “Literacy skills for the information age: Final results of the International Adult Literacy Survey,” by Statistics Canada and OECD, 2000. Copyright 2000 by OECD Publishing.

**Source:** International Adult Literacy Survey, 1994-1998.

Some of the benefits of increased literacy might, however, be retained by firms (or passed along to shareholders) rather than being distributed to workers. Thus, a 10% increase in worker productivity attributable to higher worker literacy might be rewarded by a 5% wage increase, with the rest of the benefit accruing to the firm in the form of higher retained earnings and to their customers in the form of lower prices or higher quality goods and services or distributed to shareholders.

The Canadian Trucking Human Resources Council (2004) has undertaken research that provides an interesting example of how literacy skills might influence the bottom line of firms in the heavy trucking industry. They report that a large percentage of drivers do not meet the industry standards set for prose literacy, document literacy and numeracy skills, and that low literacy skills influence the bottom line of their member firms. Drivers with lower levels of skill are much more likely to experience an accident or a spill and hence influence insurance costs in an industry where insurance is a major component of the cost base. For example, CPPI-certified Petroleum Professional Drivers, who did not meet or exceed the upper end of the standard established by the CPPI-WDTF for:

Reading Text (e.g., Skill Level 3) were 1.58 times more likely to have had an incident than those who did meet the standard;

Document Use (e.g., Skill Level 4) were 1.69 times more likely to have had an incident than those who did meet the standard;

Numeracy (e.g., Skill Level 3) had about the same chance (odds ratio of 1.004) of having an incident than those who did meet the standard.

Bloom, Burrows, Lafleur, and Squires (1997) surveyed 41 Canadian firms which offered literacy training to their employees. Twenty-one of these companies provided qualitative feedback on the benefits of literacy training to their organizations, which included better team performance, improved labour-management relations, a reduced error rate and increased output of products and services.

In 1988, the Canadian Business Task Force on Literacy attempted to estimate the cost of illiteracy to Canada. Using Grade 9 graduation as a proxy for the number of low-skilled workers, the Task Force generated the following rough approximations.

**Table 15**

**The cost of illiteracy to Canada**

Industrial accidents	\$1.6 billion
Lost productivity	\$2.5 billion
Direct training	\$0.05 billion
Lost earnings	\$8.8 billion
Unemployment insurance	\$0.17 billion
Federal prisons	\$0.08 billion
Direct costs to business (first three items) costs to society (rest of items)	\$4.2 billion \$10.7 billion
<b>Total costs</b>	<b>\$14.9 billion</b>
Percent of GDP in 1988	2.4 %

Source: Canadian Business Task Force on Literacy, 1988.

Johnston (2004) provides a summary of what little evidence is available internationally. He reports that the National Skills Task Force (2000), for example, refers to a number of studies comparing matched samples of manufacturing firms in different countries, where differences in productivity are related to differences in skills. However, the focus was on intermediate and higher level skills rather than literacy skills; in fact, there does not appear to be any research that compares firms according to their levels of basic literacy skills. Few studies have looked at whether firms with more skilled employees are more productive or more profitable than firms with less skilled employees. Even less attention has been given to isolating the effects of higher literacy skills, however, the effects of particular training programs on firm productivity is described in Ananiadou, Jenkins, and Wolf (2003). The surveyed firms report a number of benefits including a decrease in error rates, improved levels of participation in team meetings, growth in employees' confidence, and an improved ability to work more flexibly (Johnston, 2004).

## Schools

Although there is little conclusive evidence in support of the hypothesis, it is reasonable to assume that the average level of student literacy has an impact on the efficiency and effectiveness of the educational process, and hence upon what students learn. The proportion of GDP that Canada invests in education, and participation rates in post-secondary education are approaching 80% in recent cohorts of Canadian youth. A large portion of special education services are directed at children with poor reading skills; this investment could be substantially reduced by more effective teaching and early identification of poor reading skills. The number of children relying on special education services could be reduced by approximately 70% if prevention programs were implemented at an early stage (Lyon et al., 2001). In addition, children who fall behind in reading rarely catch up, making a stronger case for prevention of poor reading skills rather than treating later through special education programs (Lyon et al., 2001; Heckman, 2006). In addition, participation in preschool literacy programs resulted in fewer incidents of grade retention and placements in special education by age 15 (Rolnick & Grunewald, 2003).

The progression of literacy skill throughout the life course is evident; the earlier the intervention, the more efficient and effective the program is (KPMG, 2006). In a recent report on children's literacy interventions, benefits to individuals and society were measured along similar economic and social dimensions as other studies on this topic (KPMG, 2006). Specifically, while they found that earlier interventions resulted in greater observed benefits, a 79% reduction in literacy failure for children at the age of six years old was observed by those enrolled in the 'Reading Recovery' program. The estimated savings for a sample of 40,000 children participating in this program, calculated up until the age of 37 was approximately £1.5 billion compared with children who leave primary school with low literacy skills (KPMG, 2006). Therefore, it is certain that the efficiency and effectiveness of Canada's educational investments are limited by the literacy skills of children at entry to kindergarten, high school, through post-secondary school. In other words, post-secondary investments in Canada are limited by the number of low-skilled students leaving the secondary system.

## Communities

Research has also identified a link between literacy and health at the community level. Literacy is a key determinant of socio-economic status because of its influence on wages, employment and education. Despite Canada's universal health insurance

and more comprehensive social security system, the association between lower socioeconomic status and the incidence of many common cancers is as strong in Ontario as it is in the U.S — a fact implicating literacy since, as mentioned previously, literacy challenges are linked with the attainment of lower wages (Mackillop, Zhang-Salomons, Boyd, & Gromme, 2000). This, in turn, affects the type of neighbourhood that these individuals can afford to reside in; usually lower-quality standard of housing, located in less-desirable areas, typically higher in crime, etc.

#### **4. *How would quality of life in Canada be improved if literacy skill levels were higher?***

The direct assessment of adult literacy skills is a relatively recent phenomenon in research, so most of the work on this subject has been done using proxy variables, such as years of schooling and level of educational attainment. These analyses assume that these variables can be reliable indicators of differences in literacy within countries, between countries and over time – an assumption that we shall see later is mistaken.

The available research on the role of human capital<sup>11</sup> accumulation in cross-country growth<sup>12</sup> confirms that schooling has had a positive and significant effect on transitory growth. Human capital also affects the long-run level of labour productivity otherwise referred to as ‘per capita income’. This is true when the sample of countries includes both developed and developing countries (Barro, 2001).

In their background paper for the 2006 UNESCO Education for All Global Monitoring Report, Cameron and Cameron (2006) provided a summary review of the available research. They concluded that the nation-wide effects of literacy are not necessarily associated with years of schooling. This raises concerns about the dependence on traditional types of data for analysis in economic research (see Levine & Renelt, 1992; Hoover & Perez, 2004; Temple, 2000).

In contrast, several recent analyses based upon robust measures of literacy skill show that it is important to distinguish actual skill levels from mere years of schooling. Thus, Hanushek and Kimko (2000) criticize the failure of earlier cross-country studies to account for differences in the quality of schooling. To correct for this, they use international tests of student achievement in mathematics and science as their indicators of labour force quality. They found the relationship between these indicators and economic growth to be consistently strong across the 31 countries for which data were available.

Coulombe, Tremblay and Marchand (2004), using data from the International Adult Literacy Survey (IALS) for 14 comparable economies, found that literacy scores had a positive and significant effect on both short-run growth and long-run levels of GDP per capita, and on labour productivity. In another study, Coulombe and Tremblay (2006a) used data from the ALL study to show that literacy levels and distributions have had a marked impact on long-term rates of provincial GDP and labour productivity growth. They found that the proportion of low skilled adults reduced long-term growth rates, and that literacy impacted economic growth independently of one’s participation in attaining post-secondary education. This result supports the need for policies aimed at raising average literacy levels by reducing the

---

11. Human capital is defined as “the knowledge, qualifications, competencies and other qualities possessed by individuals that can be put to productive use” (OECD, 1998).

12. For a survey of empirical studies dealing with the growth effects of human capital and social capital across OECD countries, refer to Temple (2000). Also, refer to Krueger and Lindahl (2001) for a broader discussion of empirical studies dealing with human capital and education.



proportion of low-skilled adults in order to improve economic growth in the country. Because immigrants to Canada do not possess official language literacy skills commensurate with their education levels, literacy skill limits the potential for these individuals to participate as a source of net labour force growth (Coulombe & Tremblay, 2006b).

The Coulombe analyses provide the basis for a rough calculation about the economic value that might flow from an investment that resulted in moving the Canadian average literacy level up 10 points on the 500 point proficiency scale or 2%. An increase of this magnitude is not large when judged from an educational perspective – the equivalent of the gain in literacy observed with approximately 4.8 months of additional schooling on average (Willms, 2003). Yet the economic return would be enormous – a 3% increase in GDP. (In 2006, this would be over \$42 billion and would continue in future years.)

Simple arithmetic suggests that the additional tax revenue on such an increase would pay whatever the cost was in order to achieve these gains. It is possible to derive a rough estimate of what it would cost to raise scores by this amount using what it costs to educate students at the secondary level. For example, in Ontario, at a cost of \$6,913 per student in 2000<sup>13</sup>, this translates into an additional cost of \$2,765 per adult learner for 4.8 months of schooling. Of Canada's 21,960,683 adults aged 16 to 65, 41.9% were at a literacy Level of 1-2, suggesting that an investment of \$25.4 billion would be required to raise these adults' skill to an appropriate level using the technology employed in elementary schools. While this may be viewed as a very inefficient method for improvement in literacy, this amount could be spread over several years with only modest maintenance required in later years.

A more realistic estimate of the cost of raising all adults to Level 3 has been developed (McCracken & Murray, 2008). Assuming a "best practice" response to the specific learning needs and characteristics of adults at Levels 1 and 2, this would yield a total cost of \$6.4 billion. In economic terms, the national estimates of costs and benefits of a literacy investment large enough to raise all adults to literacy Level 3 would mean a rate of return of roughly 251% per year, with an approximate pay back period of 4.8 months (Murray et al., 2008). The estimated benefit is high enough to warrant investment in literacy. To make the case even stronger, these numbers likely represent underestimates of the true economic returns because they exclude a range of indirect economic benefits associated with lower health, social and educational costs and increases in consumption taxes.

The estimated economic benefits for investment in adult literacy in Canada vary considerably by province and territory as a result of differences in industrial, occupational and wage structures. In a few cases, moving adults to Level 3 precipitates a slight drop in earnings. This reinforces the need for government policies to stimulate the level of skill demand in the economy, policies that would ensure that the Canadian economy is able to absorb and apply the newly created skills.

Despite the above calculations, the analysis does not include estimates of rates of return by province and territory because the sample sizes available in the ISRS study were not large enough to provide reliable estimates of the size of the market segments at this level.

13. In 1992 constant dollars

### ***How the distribution of human capital influences overall economic performance***

The previous section reviewed the evidence of literacy's impact on overall rates of economic growth. The *distribution* of literacy in a population might also have an impact on economic performance but there is little or no research to support this claim. Jenson (2004) reports that persistent inequalities in terms of outcomes impose economic and social costs both at the individual and societal levels. Specifically, these costs manifest in terms of lost productivity, foregone tax revenue, reduced consumer spending and higher expenditures on income assistance, social services, health care and security. Said in economic terms, literacy's role in creating social inequality in individual labour market outcomes means that literacy may have a distributional effect upon economic growth.

This distributional effect can be seen where areas with higher percentages of low skilled adults constrain economic performance over the long term (Coulombe et al., 2004). This effect is attributed to the relationship between variable worker quality on employer's choices of technology and work organization (Murray, 2005). Specifically, they found that countries that had a high proportion of adults with low prose skills had lower GDP per capita.

It is possible that the measure of a worker's efficiency reported in the research might be affected by external factors such as the relationship between literate workers and their decreased likelihood of becoming prone to health problems that impair their productivity. Under the assumption that the relationships are the same in Canada and the U.S., this translates into a 0.6 % loss of Canadian GDP or an equivalent annual loss in 2006 of almost \$8.5 billion. Given literacy's influence on income, employment occupational segregation and health, it can be hypothesized that this effect can be explained by lower literacy skill levels due to failure to complete high school.

Davis and her colleagues have explored the relationship between lost economic output due to worker health problems, sick days and reduced productivity (Davis, Collins, Doty, Ho, & Holmgren, 2005). As shown in the following table, their analyses reveal that health problems and sick days impose a huge economic cost on the American economy, one that amounts to roughly 2.4% of U.S. Gross Domestic Product.



Table 16

**Estimated lost economic output because of worker health problems, sick days, and reduced productivity (USA)**

	Base: Adults ages 19 to 64 <sup>a</sup>		
	Number of adults (in millions)	Lost days of work (in millions)	Lost economic output (in billions)
Nonworking adults report disability, handicap, or chronic disease or nonworking because of health reasons	18	4,487	185
Workers with any sick days	69	407	48
Workers with reduced productivity days	55	478	27
<b>Total sick days or reduce-productivity days</b>	<b>103<sup>b</sup></b>	<b>5,372</b>	<b>\$260</b>

a The total number of adults age 19 to 64 was 148 million, excluding among working, adult those who are self-employed and those who do not report a wage rate. The number of adults not working for non-health-related reasons (31.5 million) is not shown.

b Total number of adult show is sum of those not working because of disability or other who reported missing work because of sickness-and/or reduced productivity.

**Note:** Those not working because of disability or other health reasons were estimated to lose 250 day of work per year at minimum wage. Workers who reported being unable to concentrate at work because they were not feeling well or were worried about sick family members, were assumed to work at 50 percent lower productivity.

**Source:** The Commonwealth Fund Biennial Health Insurance Survey (2003).

No one yet knows what percentage of these losses is attributable to literacy – we are working on a couple of linkages to try to establish an estimate – but even if it is only 25% or 0.6%, it is still a large loss.

### 5. *What role could or should governments play in encouraging improvement of the literacy skills of children, youth and adults?*

The work of early economists drove governments in the OECD area to make massive public investments in education. These investments have translated into rapid increases in participation and completion rates at the elementary, secondary and post-secondary level. With the demographics of the post-war baby boom on their side, these investments were sufficient to balance increases in the demand for skill that were evident in most OECD economies.

By the early 1980s, however, policy-makers were becoming increasingly concerned about skill shortages at all levels in OECD labour markets. Gaps in wage inequality continued to grow, suggesting that something else other than education was affecting wage earnings. However, most labour market and macro-economists continued to use educational attainment and years of schooling as a way to explain differences in labour market outcomes at the individual and economy level. By the late 1980s, technological innovation was discovered to be the ‘something else’, and human capital would become increasingly important in terms of ‘skill-biased technical change’. The basic hypothesis underlying skill-biased technical change is that new technologies are not only more productive but also demand higher skill levels to employ them. Therefore, new technologies offer the possibility of both higher economic growth and higher wages to workers who possess these skills. As a result, public policy started to take into consideration how skill influenced productivity growth, particularly through its impact on the rate of technical, process and organizational innovation within firms.

It followed that economically successful nations would have to have post-secondary education systems capable of sustaining high rates of knowledge generation and skilled, flexible and highly adaptable labour forces. This new model implied the need for two complementary sets of skills:

- Advanced technical skills and awareness of scientific bodies of knowledge sufficient to support the generation of new knowledge and its application in the production process; and
- A set of key competencies that transcend occupations; competencies that are needed to master modern modes of production and organization, and which enable efficient learning in adulthood.

In most cases, the adoption of these technologies has precipitated a sharp, short-term increase in the demand for technical training and a long-term increase in the level of skill required of most workers, a classical example of skill-biased technical change at work. This created strong incentives for firms to adapt at a rapid pace.

Massive investments in education by several developing economies have greatly increased the pool of skilled labour available to multi-national firms. Workers in these countries are fully capable of adopting the efficient technologies of production and work organization enabled by ICTs, and are willing to work for lower wages than those prevailing in OECD countries. This situation creates huge incentives for firms to move production to lower cost labour markets. In a world where capital, goods and services, technology and highly skilled labour flow freely, policy-makers were forced to look to the skills of the average worker, as it is their skills that will allow nations to compete successfully in the global economy. Therefore, the response of governments throughout the OECD area has been to invest heavily in education, in the first instance in the quality of early childhood education and health, then in raising participation levels in primary and secondary education systems. The caution here, is toward policy-makers, who may focus on creating policies and programs based on the assumption that 'success' is observed if an intervention improves test scores (Clement, 2005). In reality, this paper has demonstrated that early preschool education programs have proven benefits that are both cognitive (e.g., measurable by a test score) and non-cognitive (e.g., more difficult to measure, but have tangible and intangible social benefits such as reduction in crime, improved health, etc). Indeed, many participants in preschool programs who grew into adulthood, and attained the same level of IQ as their non-preschool peers, achieved greater success in terms of employment and skill level due to development of non-cognitive in addition to cognitive skills (Duncan et al., 2007).

More recently, the focus has shifted to reducing high school dropout rates, in raising rates of post-secondary participation and, to a lesser extent, in raising the quantity and quality of adult learning. The initial response to this concern involved assessing the performance of students in school. Policy-makers were interested in the relative quantity and quality of skill being generated in initial education, and on the social and economic consequences that were associated with social inequity in the distribution of outcomes related to educational attainment.

In studies about the effectiveness of preschool programs, the quality of the program (e.g., strong supervision, well-designed curriculum, well-compensated staff, on-going evaluation, opportunities for intensive parent involvement, small classes, and an instructional focus on literacy) was emphasized as most important (Reynolds et al., 2002; Barnett & Masse, 2007; Duncan et al., 2007). In fact, it was found that a quality preschool program of a duration of one year, was more effective than a lesser quality program that was extended to two years. The cliché 'an ounce of

prevention is worth a pound of cure' is true; investments in efforts to improve abilities of low-skilled workers have been demonstrated to be somewhat ineffective and generate small returns in comparison to the effects of prevention via early childhood interventions (Currie, 2001; Keller, 2006).

For the most part, public policy interests in the economic dimensions of human capital and its role in fostering economic growth and competitiveness in a global knowledge economy have concentrated on the 'elite'. This includes the institutions that generate such knowledge, including universities and research institutions. For example, policy-makers have focused on rates of participation in tertiary education systems and on the relative quality of tertiary programs and institutions, particularly in the hard sciences at the Master's and Ph.D. levels. Public policy has also explored the role of research and development in the innovation process, including a focus on the efficiency and effectiveness of knowledge creation, transmission and management systems. Finally, policy-makers have spent time looking at individual and firm characteristics that are associated with achieving high rates of innovation. This includes technological, process, product and organizational innovation that are felt to be needed in order to realize the productivity gains that will keep OECD economies competitive in the emerging global knowledge economy and information society.

Over the past 15 years, however, international research efforts have focused increasingly on the middle and bottom end of the skill distribution, including workers' literacy and numeracy skills. This research has concentrated on profiling the level and distribution of a range of skills believed to be tightly linked to the productivity of workers and their ability to absorb technological, process and organizational innovation. Murray (2005) has provided data on the supply of four skills that are known to be tightly linked to job performance in a broad range of occupations (prose literacy, document literacy, numeracy and, more recently, critical thinking such as problem solving).

These analyses have challenged the prevailing policy assumptions in several ways. They have confirmed that:

- large differences in literacy exist within and between countries
- these differences matter to individuals because of the way they influence valued outcomes
- these differences also matter to the performance of social institutions, including firms, schools and communities
- at the national level, both the average level and the distribution of literacy skill are important influences for economic outcomes and for health

Interventions that have focused resources on higher education have experienced the lowest returns. The literature on early childhood education thus emphasizes the importance of investment in 1) preschool programs as opposed to waiting until students are older or adults and 2) targeting lower income or otherwise disadvantaged children (Keller, 2006; Campbell & Ramey, 1994, 1995). However, there are disadvantages to targeting lower-income children exclusively. First, there may be children who are not economically disadvantaged but may benefit from the program, such as children with limited English language proficiency, children of high school dropouts, and children at risk of abuse or neglect (Currie, 2001). Also, by singling out low-income children as 'needy' this may have repercussions for children in terms of stigma among their peers. Therefore, although targeting only disadvantaged children may be attractive since this approach can produce the most visible benefits and can be more popular in terms of public support, it may unfairly exclude some

children who may benefit from the program (Currie, 2001). The other solution is to introduce a ‘universal’ preschool program. The opponents of this option cite difficulties in being able to append a preschool program to their educational mandates, due to time and budgetary constraints (Olsen, 1999). However, as emphasized throughout this paper, investments in early education can produce short, medium, and long-term benefits. Perhaps the greatest of these is the promise of highly skilled, well-adjusted, motivated workers for our future workforce. As noted by Dickens, Sawhill, and Tebbs (2006):

Skills beget more skills and new ways of doing business, workers learn from each other, and firms adapt their technology and their use of capital to the skills of the available workforce. The benefits of having a more educated workforce accrue to everyone...effects for the firm or the economy as a whole may be especially important in an increasingly competitive global marketplace (p. 2).

From an economic perspective, the global supply of literacy skills is rising exponentially, so countries like Canada will inevitably lose jobs to lower wage but equally skilled competitors.<sup>14</sup> To remain competitive, Canada must move up the knowledge and skill ladder ensuring that Canada’s workers have the advanced skills required to attract and retain higher wage, fulfilling and stable jobs. This economic imperative alone explains why our competitors have chosen to invest significant public resources in raising literacy levels. This situation presents some difficulties with what are essentially tough political and social choices.

The choice of where Canada should invest will depend on the goal chosen — whether it is to raise the average level of literacy skill, to reduce the proportion of adults who have low levels of skill or to reduce the level of social inequality in literacy. Investment will also depend upon what it would cost to increase the literacy skills of different groups. Little is currently known about what it would take to move different groups of learners up to Level 3 on the IALS/ALL scales, a fact that complicates the crafting of effective literacy policy. Notwithstanding these uncertainties, the existing evidence provides some indication of where investment might pay significant dividends.

First, it is clear that Canada’s educators must find a way to reduce the proportion of students who fail to meet what educators themselves have defined as the minimum level of skill required to participate and contribute fully in society. For example, between 20% and 40% of Canada’s 15-year-olds fail to meet the Province of British Columbia’s graduation standard when it was applied across all provinces (Statistics Canada, 2003).

Second, it is clear that improving the outgoing quality of the primary and secondary education systems will not be enough. Because the birth rate in Canada is at an all-time low, there are simply too few students in Canada to have a major impact on the overall literacy level of the Canadian workforce, regardless of their literacy level (Nault, 2005).

---

14. See: Beiling, Y. (2005, October). *Demand for Skills in Canada: The Role of Foreign Outsourcing and Information Communication Technology* (Cat No. 11F0027MIE No. 035). Ottawa, ON: Statistics Canada.

Thus, if literacy skill levels are to be raised, Canada must also invest in improving literacy skills in four target groups:

- Canadian-born workers who failed to acquire, or no longer have, Level 3 skills
- Immigrant workers whose literacy skill levels are not commensurate with their education levels
- Those not working whose literacy skill poses a barrier to finding and keeping a job
- Aboriginal adults

Canada's literacy challenges will not be met without the active involvement of all sectors of society. While governments can provide leadership and resources, they cannot solve these problems on their own. The commitment and efforts of families and individuals, and of the private and non-governmental sectors are also required.

Detailed estimates have been made for the costs of raising literacy among various groups, based on data from effective, structured, adult literacy programs. The greatest return on such investment is achieved by focusing on helping those who are at Level 1 and 2 to acquire Level 3 skills.<sup>15</sup> These estimates suggest that an investment of \$6.4 billion would provide sufficient literacy training to permit 9.1 million people at Levels 1 and 2 to raise their literacy skill to the average level (Level 3; 275 points). This total reflects investment of an average of \$855 per Level 2 learner and of \$2,500 upwards to \$5,000 per Level 1 learner, though many (such as those who are currently employed) may require less.

The evidence is strong that this amount of investment would have a high payoff in improved productivity and other benefits. The challenge is orchestrating the various groups in society to accomplish this task.

### ***What the Canadian government can do***

All levels of government have to accept a portion of the responsibility for one or another aspect of Canada's literacy challenge. Since the provinces and territories have the mandate for education and training, they obviously have a role to play. So do individual cities or municipalities, since they have control over community resources such as libraries and schools. The federal government also has an economic and social development mandate, and literacy has an impact on quality and performance in both of those domains, nation-wide. However, sorting out who should do what, for whom, and with which resources, is a question yet to be clearly answered in Canada. In fact, one of the major conclusions of a Parliamentary Standing Committee Report was to call on the federal government to work with the provinces and territories to create a "comprehensive Pan-Canadian literacy strategy".<sup>16</sup>

Governments in Canada can have a significant impact on three separate aspects of literacy. The first and most obvious role for governments is on the supply side of the literacy equation. They can finance, build and run schools that have the quality provision of literacy skills as a key goal. In general, supply side investments focus on

15. McCracken, M. C., & Murray, T. S. (2008). *Benefits and costs of improving literacy*. Ottawa, ON: Informetrica Limited.

16.. Standing Committee on Human Resources Development and the Status of Persons with Disabilities. (2003). *Raising Adult Literacy Skills: The Need for A Pan-Canadian Response*. Ottawa, ON: Communication Canada Publishing.



increasing the quantity, quality, efficiency or equity of teaching and learning. They can include things like developing curriculum or teacher training to increase the effectiveness and efficiency of the educational process.

This effort needs to be informed to be effective. Government therefore has an important role to play in ensuring that parents, teachers, community workers and others who influence the supply of literacy skills are appropriately informed about the special importance of these skills, and about how to facilitate their acquisition. A key component will therefore be support for efforts to find and communicate solid, research-supported knowledge in this domain. Another key responsibility for government will be to address gaps in our knowledge about what works and for whom, with respect to fostering good literacy skills in adults and children, by ensuring that the needed applied literacy research is undertaken (e.g., longitudinal studies in a Canadian context, paralleling preschool program evaluations conducted in the United States), and the results are taken up and used for the benefit of Canadians. Without proper attention to the knowledge base required for effective practice and good policy, governments risk wasting their investments directed to increasing literacy skills in an inefficient manner.

Governments can also intervene on the demand side by instituting policies and programs that serve to increase the economic and social demand for literacy skill. Demand-side interventions range from social marketing that encourages individuals to use their skills, to accelerated tax write offs for firms to purchase skill-rich technology. Demand-side interventions can also include strategies that reduce literacy demand or compensate for low skill levels. For example, plain language programs try to make reading materials accessible to a broader range of readers. The verbal advice provided by publicly financed doctors and nurses can also be thought of as a high-cost way to compensate for the low literacy skills of adults who, if they had higher literacy skills, would have been able to access health information and advice themselves.

Another way that governments can intervene is to improve markets for literacy skills that match the available literacy supply with literacy demand. The most familiar market for literacy skill is the labour market. One of the defining features of Canadian labour markets is the degree to which they reward literacy skill. This is evidenced by the fact that stable, high paying employment goes to higher skilled individuals, while lower skilled individuals are limited to intermittent low paying jobs. Governments can improve the efficiency of labour markets in a number of ways, such as supporting test- and credentials-based selection systems to identify those with literacy issues. Governments can also invest in systems that help employers, governments and unions identify and fill their human resource development needs.

Canada's education systems can alternatively be thought of as 'marketplaces' that favour and reward literacy skills. Governments can improve the efficiency and equity of educational systems by testing for literacy when learners are admitted to programs, to ensure that they get the developmental assistance they require at an early stage, and by assessing the system to determine if it is reaching its literacy goals.

Similarly, Canada's health and social systems can be thought of as a 'marketplace', one that offers open access to adults with high literacy skills and reduced access to those with lower skills. Governments can improve the efficiency of health markets by, for example, investing in improving the flow of health information between the healthcare provider and the patient, and offering telehealth services.

While it can be argued that it is beneficial that Canada's various markets reward skill so highly, those benefits will be eroded by the negative consequences of inequality. Although they are not often thought of as such, government programs that serve to create temporary employment and to provide passive income support may well soften the negative impact that low literacy has on individual's fortunes while doing nothing to help them to gain the literacy skills they need. Such programs could easily reduce incentives for individuals to seek literacy training unless there is a clear signal from government about the employment and wage benefits associated with acquiring higher literacy skills. Canadian governments should also provide people with reliable means to diagnose their literacy requirements and provide them with access to high quality literacy training.

Canada can also employ plain language principles and various text formats (large print or Braille, for example) when communicating with the public. Similarly, investments in libraries might be thought of as simultaneously increasing the demand for reading, improving the supply of literacy skills and reducing social inequalities by increasing access to reading materials for the disadvantaged (Statistics Canada and HRDC, 1995).

Canada can show leadership in dealing with these issues. The money to solve Canada's literacy challenge is already in the system in the form of passive income support, remedial and special educational services, and employment creation programs, as well as in the provision of higher-cost health services needed by those with lower literacy skills. Moreover, even if these resources were not already part of the system, the importance of literacy for economic growth would imply that any new investment would be repaid quickly through increased tax revenues and enhanced productivity.

A key issue for working people is access to funding to support literacy activities, and in particular, access to literacy programs. "La loi 90" in Quebec is an example of what one jurisdiction has done. The objective of this law is to improve the quality of the labour force to promote employment, adaptability in the workplace and the increased mobility of workers. Any firm with a salary base of over \$1 million must invest a minimum of 1% of that base in the training of its personnel. These firms are required to declare this investment amount to Quebec's Ministry of Revenue. Any funds not invested during a calendar year must be transferred to the National Fund for Manpower Training. Companies that do not have a salary base of \$1 million are able to get annual grants for projects related to the training of their workers from this National Fund. The Fund's priorities are basic training in literacy, numeracy and essential skills, Francisation, the acquisition of skills necessary for new workplace requirements, and instruction in the management of training.

Many employers across Canada voluntarily invest much more than the 1% mandated under the Quebec law. For example, the manufacturing sector invests on average 2.5% in workplace training. The federal government could encourage employers in all provinces to invest a minimum of 1% of payroll on workplace training using appropriate means. Other options are "Training Insurance" using EI Part 1 funding and "work-share while learning" programs. Another option would be the introduction of literacy and essential skills training as an element of employee benefit and support measures for EI recipients. Training-leave entitlements under the Canada Labour Code should also be considered.

Some government investments can serve multiple goals simultaneously. For example, a supply-side investment in raising adult literacy levels through the provision of training can accomplish several things, including:

- improving labour productivity directly by allowing workers to apply more skill-intensive production technologies
- improving labour productivity indirectly by reducing the number of days lost to workplace illness and accident
- reducing the cost of treating workplace injuries
- reducing the cost of income replacement for workplace illness and accident
- reducing the level of human suffering associated with work-related injury and disease
- reducing the level of demand on health services

### ***What firms can do***

Firms can play several roles to advance literacy skills in the workplace. Employers can influence the demand for literacy skill by selecting technologies of production, work organization and work processes that require workers to use their literacy skills. This would also influence the supply of skill since it would reduce the level of skill loss associated with low levels of use.

Firms can also increase the supply of literacy skill by providing a work environment that is generally conducive to learning, that offers a means for workers to assess their learning needs (including literacy) and that supports literacy education. Firms can also influence the efficiency and equity of markets for literacy skill by adopting selection processes that test for literacy and that offer less skilled workers access to training programs to improve their skill levels.

### ***What unions and the labour movement can do***

Unions can help to create the conditions that will allow Canadian workers to reach their full potential as literate, informed and active citizens by advocating for a worker-centred approach to the acquisition of literacy and essential skills. This means promoting the literacy and learning needs of the worker as a whole person responsible for fulfilling various roles at work, at home, in the union and in the community. One effective technique that has been used in the United Kingdom, Germany and Sweden is to have a designated person (in the U.K. the practice is to identify a union representative) act as a “Learning Advocate” for employees to ensure that their training needs are identified and met. Unions can also use clear language in all aspects of their communications and programming to help union members participate more fully in the life of the union.

### ***What other social institutions can do***

Other social institutions, including advocates and non-governmental organizations, can take the literacy levels of their clients into account when engaging with citizens through their organization. For example, poverty advocates must argue that governments should treat the disease rather than the symptoms. Poverty is the result of not being able to find and keep employment at a reasonable wage. These things depend critically upon literacy.



What schools, communities, and teachers can do to promote early childhood education

Although the studies cited in this review have reported large budgets and costs-per-child for administration of preschool programs, efforts toward making a long-term difference in a child's life need not be expensive. Two examples of small budget small programs in an article by Fransoo, Ward, Wilson, Brownell and Roos (2005) illustrate this point. Although the article acknowledges that staff are already overwhelmed by existing responsibilities, starting small and combining expertise and resources from a variety of sources is the key. One such program called "Little Ones Learning at Arbogate" (LOLA) began with three children and grew to almost 40, after evolving from a once-a-month guest reader and lending library from a local school to a program serving young families three times a week, offering story time, computer activities, library books, circle time with songs, science experiments and crafts, gym time and a nutritious snack. The program grew with increased demand by parents, coupled with a willingness of community stakeholders to donate resources so that the program could operate with no cost to the families. The total operating budget for the program was \$12,000.

The benefits of the program discussed above included noticeable differences in the children that participated in the program, in terms of social skills and grasping concepts, as well as an increase in the number of children reading at the appropriate level by the end of Kindergarten, and 4/5 children reading at or above their level by Grade 3.

### ***What adult educators can do***

The most obvious thing that educators can do is to ensure that all children graduate from our educational systems with the literacy skills that they will need to participate fully economically and socially. Educators must also find ways to ensure that literacy programs attract and retain adult learners.

It is important, too, that educators accept the fact that people learn in places outside of the classroom. As educators, they can play an important role by contributing to people's capacity to create literacy- and learning-rich environments in the home, in the community and in the workplace. Creating these environments is essential if we are to achieve the goal of graduating students who are learners for life, able to maintain or even enhance their literacy skills throughout adulthood.

### ***What individuals can do***

Individuals can influence the supply and demand for skills by participating in literacy instruction and by adopting a lifestyle that values and uses reading skills regularly so that, at the very least, they can retain the level of skill they acquired in school. Individuals can also increase the efficiency of markets for skill by reflecting on their own and their family's learning needs and by acting to meet those needs. They can also help to create literacy and learning-rich environments in the home, workplace and community. Individuals can also press governments to invest in literacy so that they can continue to live in a country that is rich, that offers equal opportunity, and that provides access to learning and literacy, as well as a wide range of other valued public goods and services to its citizens.

## Conclusions

This paper has summarized what is known regarding the importance of literacy skills for the economic security of individual Canadians and the economic prosperity of Canada as a nation. Simply put, adequate literacy skill is a key driver of economic success and therefore critical for the health and prosperity of present and future generations of Canadians.

The personal and national importance of literacy is seen at many levels. Different types and levels of skills are related to different wage categories and job types. There are inequalities both in initial levels of literacy and in opportunities for learning. Difficulties and inequalities can be identified as early as the age of 3, and interventions such as preschool are most effective at this age at a ‘critical period’ for brain growth and learning. The positive effects of preschool educational interventions can be seen throughout the life course. By adolescence, children who score higher on literacy assessments at age 15, are most likely to finish high school and attend post-secondary education in adulthood. An early focus on literacy is key to ensuring that children are able to have stable, higher-wage, fulfilling employment when they become adults. Their less literate counterparts will be less likely to be supported by their employer in furthering their education, despite the fact that improvements in literacy reduce workplace errors and accidents, improve productivity, and improve teamwork and labour relations. While it is recognized that skill training is important and necessary for low-skilled adults, literacy interventions later in life have been shown to be less effective than ‘prevention’ through investing in skill formation in early years. Literacy skill affects many aspects of individual, societal, and national well-being. This includes health status, crime reduction, motivation, reliance on welfare, job satisfaction, employment, and the country’s overall economic performance and competitiveness in the global market. Overall, government policies need to recognize the key role of literacy as an economic driver, and to shift toward encouraging a balance between the supply and demand for skills.

## References

- Ananiadou, K., Jenkins, A., & Wolf, A. (2003). *The benefits to employers of raising workforce basic skills levels: A review of the literature*. London, UK: National Research and Development Centre for Adult Literacy and Numeracy.
- Barnett, W.S., & Masse, L.N. (2007). Comparative benefit-cost analysis of the abecedarian program and its policy implications. *Economics of Education Review*, 26(1), 113-125.
- Barnett, W.S. (1995). Long-term effects of early childhood programs on cognitive and school outcomes. *Future of Children*, 5(3), 25-50.
- Barro, R.J. (2001). Education and economic growth. In J.F. Helliwell (Ed.), *The contribution of human and social capital to sustained economic growth and well-being*. Paris: OECD/HRDC.
- Beiling, Y. (2005, October). *Demand for Skills in Canada: The Role of Foreign Outsourcing and Information Communication Technology* (Cat No. 11F0027MIE No. 035). Ottawa, ON: Statistics Canada.
- Belanger, P., & Valdivielso, S. (Eds.), (1997). *The emergence of learning societies: Who participates in adult learning?* Oxford, NY: Pergamon.
- Belfield, C.R., Nores, M., Barnett, S., & Schweinhart, L. (Win 2006). The High/Scope perry preschool program: Cost-benefit analysis using data from the age-40 follow-up. *Journal of Human Resources*, 41(1), 162-190.
- Bloom, M., Burrows, M., Lafleur, B., & Squires, R. (1997). *The economic benefits of improving literacy skills in the workplace*. Ottawa, ON: The Conference Board of Canada.
- Boothby, D. (2002). *Literacy skills, the knowledge content of occupations and occupational mismatch* (Working Paper 99-3E). Hull, ON: Applied Research Branch, Human Resource Development Canada.
- Boissiere, M., Knight, J.B., & Sabot, R. H. (1985). Earnings, schooling, ability, and cognitive skills. *American Economic Review*, 75(5), 1016-1030.
- Bowles, S., Gintis, H., & Osborne, M. (2001). The determinants of earnings: A behavioral approach. *Journal of Economic Literature*, 39(4), 1137-1176.
- Brownell, M., Roos, N., Fransoo, R., Guevremont, A., MacWilliam, L., Derksen, S., et al. (2004). How do educational outcomes vary with socioeconomic status? Key findings from the Manitoba child health atlas 2004.
- Campbell, F.A., & Ramey, C. T. (1994). Effects of early intervention on intellectual and academic achievement: A follow-up study of children from low-income families. *Child Development*, 65, 684-698.
- Campbell, F.A., & Ramey, C. T. (1995). Cognitive and school outcomes for high-risk African-American students at middle adolescence: Positive effects of early intervention. *American Educational Research Journal*, 32(4), 743-772.
- Canadian Business Task Force on Literacy (1988). Measuring the costs of illiteracy in Canada. In: *Literacy and Health: A Forum for Collaboration*. Calgary, AB: Calgary Adult Literacy Awareness Project.
- Canadian Council on Learning (CCLa). (2008). *Health Literacy in Canada: Healthy Understanding*. Ottawa, ON: Author.

- Canadian Council on Learning (CCLb). (2008). *Reading the Future: Planning for Canada's Future Literacy Needs*. Ottawa, ON: Author.
- Canadian Trucking Human Resources Council (2004). Essential skills as a predictor of safety performance among CPPI-certified petroleum professional drivers in Alberta. Ottawa, ON: Author.
- Coleman, J. S. (1988). Social capital in the creation of human capital. *American Journal of Sociology*, 94 (Supplement), S95–120.
- Committee for Economic Development (CED). (2006). *The economic promise of investing in high-quality preschool: Using early education to improve economic growth and the fiscal sustainability of states and the nation*. Washington, D.C.: Author.
- Cook, C., & Willms, J.D. (2002). Balancing work and family life. In J.D. Willms (ed.), *Vulnerable children: Findings from Canada's National Longitudinal Survey of Children and Youth* (pp. 183-197), Edmonton, Alberta, The University of Alberta Press.
- Cameron, J., & Cameron, S. (2006). *The economic benefits of increased literacy*. Background paper prepared for the Education For All Global Monitoring Report. Paris, France: UNESCO Publishing.
- Clement, D. (2005). *Interview with James J. Heckman*. Federal Reserve Bank of Minneapolis: The Region.
- Coulombe, S., Tremblay, J. F., & Marchand, S. (2004). *Literacy scores, human capital and growth across fourteen OECD countries* (Cat. no. 89-552-MIE, no. 11). Ottawa, ON: Statistics Canada.
- Coulombe, S., & Tremblay, J. F. (2006a). *Human capital and Canadian provincial standards of living*. Ottawa, ON: Statistics Canada.
- Coulombe, S., & Tremblay, J. F. (2006b). *Migration, human capital, and skills redistribution across the Canadian provinces* (Working Paper, D-07). Ottawa, ON: Industry Canada.
- Currie, J. (2001). Early childhood education programs. *The Journal of Economic Perspectives*, 15(2), 213-238.
- DataAngel (2009) Addressing Canada's Literacy Challenge: A Cost/Benefit Analysis, Ottawa
- Davis, K., Collins, S., Doty, M., Ho, H., & Holmgren, A. (2005). *Health and productivity among U.S. workers*. New York, NY: The Commonwealth Fund.
- Denny, K., Harmon, C., & O'Sullivan, V. (2004). *Education, earnings and skills: A multi-country comparison* (Working Paper 04/08). London, UK: Institute for Fiscal Studies.
- Dickens, W.T., Sawhill, I., & Tebbs, J. (2006). *The effects of investing in early education on economic growth*. Washington, DC: Brookings Institution.
- Duncan, G.J., Ludwig, J., & Magnuson, K.A. (2007). Reducing poverty through preschool interventions. *The Future of Children*, 17(2), 143-160.
- Educational Testing Service (ETS). (2003). *Digital transformation: A framework for ICT literacy*. A report of the International ICT Literacy Panel. Princeton, NJ: Center for Global Assessment.
- Feeny, S. (2006, September). Which way should we go from here? Some thoughts about early childhood curriculum. Beyond the Journal, Moving Forward: The Early Childhood Field Responds to Change. Retrieved June 11, 2009, from <http://journal.naeyc.org/btj/200609/FeenyBTJ.asp>
- Fransoo, R., Ward, T., Wilson, E., Brownell, M., & Roos, N.P. (2005). The whole truth: Socioeconomic status and educational outcomes. *Education Canada*, 45(3), 6-10.
- Freire, P. (1970). *Pedagogy of the oppressed*. New York: Continuum.
- Green, D.A., & Riddell, W. C. (2001). *Literacy, numeracy and labour market outcomes in Canada*. Ottawa, ON: Statistics Canada and HRDC.
- Green, D.A., & Riddell, C. (2007). *Literacy and the labour market: The generation of literacy and its impact on earnings*. Ottawa, ON: Statistics Canada and HRSDC.

- Guevremont, A., Roos, N. P., & Brownell, M. (2007). Predictors and consequences of grade retention: Examining data from manitoba, canada. *Canadian Journal of School Psychology*, 22(1), 50-67.
- Hanushek, E., & Kimko, D. (2000). Schooling, labor-force quality, and the growth of nations. *American Economic Review*, 90(5), 1184-1208.
- Heckman, J.J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science*, 312, 1900-1902.
- Hoover, K.D., & Perez, S. J. (2004). Truth and robustness in cross-country growth regressions. *Oxford Bulletin of Economics and Statistics*, 66, 765-798.
- Jenson, J. (2004). *Canada's new social risks: Directions for a new social architecture*. CPRN Social Architecture Papers (Research Report F43). Ottawa, ON: Canadian Policy Research Networks.
- Johnston, G. (2004). *Adult literacy and economic growth* (Working Paper 04/24). Wellington, NZ: New Zealand Treasury.
- Kallenberg, O. (2002). *Foundations of modern probability* (2nd ed). New York, NY: Springer Publishing.
- Katz, L. F., & Autor, D. (1999, May). *Technological change, computerization and wage structure*. Paper presented at the Understanding the Digital Economy: Data, tools, and Research conference. Washington, DC.
- Keller, K.R.I. (2006). Investment in primary, secondary, and higher education and the effects on economic growth. *Contemporary Economic Policy*, 24(1), 18-34.
- Knighton, T., & Bussière, P. (2006). *Educational outcomes at age 19 associated with reading ability at age 15*. Ottawa, ON: Statistics Canada and HRSDC.
- KPMG. (2006). The long term costs of literacy difficulties. Report commissioned by the KPMG foundation.
- Krueger, A.B., & Lindahl, M. (2000). Education for growth: Why and for whom? *Journal of Economic Literature*, 39, 1101-1136.
- Levine, R. & Renelt, D. (1992). A Sensitivity Analysis of Cross-Country Growth Regressions. *The American Economic Review*, 82(4), 942-963.
- Lyon, G. R., Fletcher, J. M., Shaywitz, S. E., Shaywitz, B. A., Torgesen, J. K., Wood, F. B., et al. (2001). Rethinking learning disabilities. In C. E. Finn, A. J. Rotherham, & C. R. Hokanson (Eds.), *Rethinking Special Education for a New Century* (pp. 259-287). Washington, DC: Progressive Policy Institute, Thomas B. Fordham Foundation.
- Maré, D., & Chapple, S. (2000). *Literacy formation and its influence on earnings and jobs*. Wellington, New Zealand: Department of Labour. Unpublished manuscript.
- Mackillop, W.J., Zhang-Salomons, J., Boyd, C., & Gromme, P. (2000). Associations between community income and cancer incidence in Canada and the United States. *Cancer*, 89, 901-912.
- McCracken, M. C., & Murray, T. S. (2008). *Benefits and costs of improving literacy*. Ottawa, ON: Informetrica Limited.
- Murray, T. S. (2005). *Aspects of human capital and the knowledge economy: Challenges for measurement in conference on knowledge economy*. Luxembourg: Eurostat.
- Murray, T. S., Clermont, Y., & Binkley, M. (Eds.). (2005). *International Adult Literacy Survey: Measuring adult literacy life skills: New frameworks for assessment* (Cat. no. 89-552-MIE, no. 13). Ottawa, ON: Statistics Canada.
- Murray, T. S., Jones, S., Willms, D., Shillington, R., & Glickman, V. (2008). *Addressing Canada's literacy problem: A market segmentation analysis*. Ottawa, ON: Canadian Council on Learning.
- National Anti-Poverty Organization (1992). *Literacy and poverty: A view from the inside*. Ottawa, ON: NAPO.



- Nault, F. (2005). *Key Results from the International Adult Literacy and Skills Survey 2003*. Presentation to the Strategic Management Group. Ottawa, ON: Canadian Education Statistics Council.
- Nores, M., Belfield, C. R., Barnett, W. S., & Schweinhart, L. (2005). Updating the economic impacts of the High/Scope perry preschool program. *Educational Evaluation and Policy Analysis, 27*(3), 245-261.
- Olsen, D. A. (1999). *Universal preschool is no golden ticket*. Washington, D.C.: The Cato Institute.
- Organisation for Economic Cooperation and Development (OECD), & Human Resources Development Canada. (1997). *Literacy skills for the knowledge society: Further results of the International Adult Literacy Survey*. Ottawa, ON: OECD Publishing.
- Organisation for Economic Cooperation and Development. (1998). *Human capital investment: An international comparison*. Paris, France: OECD Publishing.
- Osberg, L. (2000). *Schooling, literacy and individual earnings*. Ottawa, ON: Statistics Canada and Human Resource Development Canada.
- Pfeiffer, F., & Reuss, K. (2008). Age-dependent skill formation and returns to education. *Labour Economics, 15*, 631-646.
- Reder, S., & Strawn, C. (2001). Program participation and self-directed learning to improve basic skills. *Focus on Basics, 4*(D).
- Reynolds, A. J., Temple, J. A., Robertson, D. L., & Mann, E. A. (2002). Age 21 cost-benefit analysis of the title I Chicago child-parent centers. *Educational Evaluation and Policy Analysis, 24*(4), 267-303.
- Rolnick, A., & Grunewald, R. (2003, March). Early childhood development: Economic development with a high public return. FedGazette. Retrieved June 11, 2009, from <http://minneapolisfed.org/pubs/fedgaz/03-03/opinion.cfm>
- Rubensson, K., Desjardins, R., & Yoon, E-S. (2007). *Adult learning in Canada: A comparative perspective*. Ottawa, ON: Statistics Canada and HRSDC.
- Shalla, V., & Schellenberg, G. (1998). *The value of words: Literacy and economic security in Canada*. Ottawa, ON: Statistics Canada and HRDC.
- Schuller, T., & Field, J. (1998). Social capital, human capital and the learning society. *International Journal for Lifelong Education, 17*, 226-235.
- Secombe, K., Lockwood, R., & Reder, S. (2007). *Literacy: Influence on access and use of the health care system*. Portland, OR: Macmillan.
- Standing Committee on Human Resources Development and the Status of Persons with Disabilities. (2003). *Raising Adult Literacy Skills: The Need for A Pan-Canadian Response*. Ottawa, ON: Communication Canada Publishing.
- Statistics Canada (2003). *The Canadian labour market at a glance*. Retrieved on March 3, 2008, from <http://www.statcan.ca/bsolc/english/bsolc?catno=71-222-X>
- Statistics Canada, & HRDC. (1996). *Reading the future: A portrait of literacy in Canada*. Ottawa, ON: Statistics Canada.
- Statistics Canada, & OECD. (1995). *Literacy, economy and society: First results of the International Adult Literacy Survey*. Ottawa, ON: OECD Publishing.
- Statistics Canada, & OECD. (2000). *Literacy skills for the information age: Final results of the International Adult Literacy Survey*. Ottawa, ON: OECD Publishing.
- Statistics Canada, & OECD. (2005). *Learning a living: First results of the adult literacy and life skills survey*. Ottawa and Paris: OECD Publishing.
- Statistics Canada. (2005) *The Adult Literacy and Life Skills Survey: New Frameworks for Assessment*, Ottawa, ON: Author.
- Strawn, C. (2003, May). *The influences of social capital on lifelong learning among adults who did not finish high school* (NCSALL Occasional Paper). Portland, OR: Portland State University.

- Temple, J. (2000). *Growth effects of education and social capital in the OECD countries*. (Economics Department Working Papers No. 263). Paris, France: OECD.
- Temple, J. A., & Reynolds, A. J. (2007). Benefits and costs of investments in preschool education: Evidence from the child-parent centers and related programs. *Economics of Education Review*, 26(1), 126-144.
- Tremblay, R. (2006). *Developmental origins of aggression*. Keynote address at the (National Investment for Early Years (NIFTEY) conference. University of New South Wales, Sydney.
- Tuijnman, A., & Belanger, P. (Eds). (1997). *New patterns of adult learning: A six country comparative study*. Oxford, UK: Pergamon.
- Tuijnman, A., & Boudard, E. (2001). *Adult education participation in North America: International perspectives* (Cat. no. 89-574-XIE). Ottawa, ON: Statistics Canada and HRDC.
- United Nations (UN). (2000). *Millennium development goals*. Retrieved on March 3, 2008, from <http://www.un.org/millenniumgoals/>
- UNESCO. (1975). *Final report for international symposium for literacy*. Persepolis, Iran: Author.
- UNESCO. (1990). *World declaration on education for all*. Retrieved on March 3, 2008, from <http://www.cies.us/PaperDocuments/PDF/WorldDeclarationonEducationForAll.pdf>
- UNESCO Institute for Education. (1997). *Hamburg declaration on adult learning*. Retrieved on March 3, 2008, from <http://www.unesco.org/education/uie/confintea/declaeng.htm>
- Willms, D. (2003). Literacy proficiency of youth: evidence of converging socioeconomic gradients. *International Journal of Educational Research*, 39, 247-252.
- Willms, D., & Murray, T. S. (2007). *The missing flow: Gaining and losing skills over the life course*. Ottawa, ON: Statistics Canada.

## Further Readings

- Alliance for Excellent Education. (2006, November). *Healthier and wealthier: Decreasing health care costs by increasing educational attainment*. Washington, D.C.: Author.
- Appleton, S., & Teal, F. (1998). *Human capital and economic development. Background paper prepared for the African Development Report*. African Development Bank.
- Arrow, K.J. (1973). Higher education as a filter. *Journal of Public Economics*, 2, 193-216.
- Barro, R.J., & Lee, J. W. (2000). *International data on educational attainment: Updates and implications* (Working paper no. 7911). Cambridge, MA: National Bureau of Economic Research.
- Barro, R.J., Mankiw, G., & Sala-i-Martin, X. (1995). Capital mobility in neoclassical models of growth. *American Economic Review*, 85(1), 103-115.
- Barro, R.J., & Sala-i-Martin, X. (1992). Convergence. *Journal of Political Economy*, 100, 223-51.
- Barro, R.J., & Sala-i-Martin, X. (1995). *Economic growth*. New York, NY: McGraw-Hill.
- Basic Skills Agency & The Institute for Welsh Affairs. (2002). *Tools for the learning country*. London, UK: Author.
- Baumol, W. J. (1986). Productivity growth convergence and welfare: What do the long-run data show? *American Economic Review*, 76, 1072-85.
- Beck, N., & Katz, J. N. (1995). What to do (and not to do) with time-series cross-section data. *American Political Science Review*, 89, 634-47.
- Becker, G. S. (1962). Investment in human capital: A theoretical analysis. *Journal of Political Economy*, 70(5-2), S9-S49.
- Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis with special references to education*. Chicago, IL: University of Chicago Press.
- Bennell, P. (1996). Using and abusing rates of return: a critique of the World Bank's 1995 education sector review. *International Journal of Educational Development*, 16, 235-248.
- Black, S.E., & Lynch, L. M. (1996). Human capital investments and productivity, *American Economic Review*, 86(2), 263-267.
- Blau, F.D., & Kahn, L. M. (2001). *Do cognitive test scores explain higher US wage inequality?* (Working Paper no. 8210). Cambridge, MA: National Bureau of Economic Research.
- Blaug, M. (1976). The empirical status of human capital theory: A slightly jaundiced survey, *Journal of Economic Literature*, 14(3), 827-855.
- Cartwright, F., Lalancette, D., Mussio, J., & Xing, D. (2003). *Linking provincial student assessments with national and international assessments* (Cat. No. 81-595-MIE, no. 005). Ottawa, ON: Statistics Canada.
- Charette, M.F., & Meng, R. (1998). The determinants of literacy and numeracy, and the effect of literacy and numeracy on labour market outcomes. *Canadian Journal of Economics* 31(3), 495-517.
- De la Fuente, A., & Doménech, R. (2002). *Human capital in growth regressions: How much difference does data quality make? An update and further results*. Manuscript. Instituto de Análisis Económico (CSIC)/Universidad de Valencia.



- Department for International Development. (2002, March). *Improving livelihoods for the poor: The role of literacy*. London, UK: Author.
- Desjardins, R. (2004). *Learning for well being: Studies using the International Adult Literacy Survey*. Stockholm: Stockholm University.
- Devroye, D., & Freeman, R. (2001). *Does inequality in skill explain inequality of earnings across advanced countries?* (Working Paper no. 8140). Cambridge, MA: National Bureau of Economic Research.
- Doeringer, P., & Piore, M. (1971). *Internal labour markets and manpower analysis*. Lexington, MA: Lexington Books.
- Dowrick, S. (2003). *Ideas and education: Level or growth effects?* (Working Paper no. 9709) Cambridge MA: National Bureau of Economic Research.
- Duncan, G.J., & Hoffman, S. (1979). On-the-job training and earnings differences by race and sex. *Review of Economics and Statistics*, 61(4), 594-603.
- Gasper, D., & Cameron, J. (2000). Introduction: Assessing and extending the work of Amartya Sen. *Journal of International Development*, 12(7), 985-88.
- Glazer, E., La Porta, R. Lopes-de-Silanes, F., & Shleifer, A (2004). Do institutions cause growth? *Journal of Economic Growth*, 9, 271-303.
- Green, D.A., & Riddell, W.C. (2003). Literacy and earnings: An investigation of the interaction of cognitive and unobserved skills in earnings generation. *Labour Economics*, 10(2), 165-184.
- Hall, R., & Jones, C. (1999). Why do some countries produce so much more output per worker than others? *The Quarterly Journal of Economics*, 114, 83-116.
- Hanushek, E.A., & Zhang, L. (2006). *Quality-consistent estimates of international returns to skill* (Working Paper no. W12664). Cambridge, MA: National Bureau of Economic Research.
- Harmon, C., Oosterbeek, H., & Walker, I. (2003). The returns to education: Microeconomics. *Journal of Economic Surveys*, 17(2), 115-156.
- Heckman, J., & Tremblay, R. (2006). *The case for investing in early childhood*. Sydney, NSW: The Smith Family Research & Development.
- Human Resources and Social Development Canada. (2006). *Essential Skills research program*. Retrieved on March 3, 2008 at [http://srv108.services.gc.ca/english/general/home\\_e.shtml](http://srv108.services.gc.ca/english/general/home_e.shtml)
- Islam, N. (1995). Growth empirics: A panel data approach. *Quarterly Journal of Economics*, 110(4), 1127-70.
- Kaldor, N. (1963). Capital accumulation and economic growth. In F. Lutz & D. Hague (Eds.), *Proceedings of a conference held by the International Economics Association*. London, UK: Macmillan.
- Lange, F., & Topel, R. (2004). *The social value of education and human capital*. New Haven, CT: Yale University.
- Lee, Y. L., & Miller, P. (2000). *Literacy, numeracy and labour market success* (Report no. 00/9). Canberra, Australia: Department of Education, Evaluations and Investigations Programme.
- Leuven, E., Oosterbeek, H., & van Ophem, H. (1999). *Explaining international differences in male wage inequality by differences in demand and supply of skill* (Working Paper no. 06-99). Amsterdam: Universiteit van Amsterdam.
- Leuven, E. (2000). *Studies in the economics of training*. Amsterdam: Universiteit van Amsterdam.
- Lucas, R.E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1), 3-42.
- Mankiw, N.G., Romer, D., & Weil, D.N. (1992). A contribution to the empirics of economic growth. *Quarterly Journal of Economics*, 107(2), 407-37.
- Maynard, J. (2005). *Annual measure of the volume of work consistent with the SNA: The Canadian experience* (Cat. no.11F0026MIE). Ottawa, ON: Statistics Canada.

- McIntosh, S., & Vignoles, A. (2001). Measuring and assessing the impact of basic skills on labour market outcomes. *Oxford Economic Papers*, 3, 453-481.
- Mincer, J. (1974). *Schooling, experience, and earnings*. New York, NY: Columbia University Press.
- Murnane, R.J., Willet, J.B., & Levy, F. (1995). The growing importance of cognitive skills in wage determination. *Review of Economics and Statistics*, 77(2), 251-266.
- Murnane, R.J., Willet, J.B., Braatz, M.J., & Duhaldeborde, Y. (2001). Do different dimensions of male high school students' skills predict labour market success a decade later? Evidence from the NLSY. *Economics of Education Review*, 20, 311-320.
- Murray, T.S., Rudd, R., Kirsch, I., Yamamoto, K., & Grenier, S. (2007). *Health literacy in Canada*. Ottawa, ON: Canadian Council on Learning.
- Osberg, L. (1989). Paying information workers. In L. Osberg, E.N. Wolff, & W.J. Baumol (Eds.), *The information economy: The implications of unbalanced growth* (pp. 47-86). Halifax, NS: Institute for Research on Public Policy.
- Pearson, G. (1996). *More than money can say: The impact of ESL and literacy training in the Australian workplace*. Canberra, Australia: Department of Employment, Education, Training and Youth Affairs.
- Pryor, F.L., & Schaffer, D. (1999). *Who's not working and why: Employment, cognitive skills, wages, and the changing U.S. labor market*. New York, NY: Cambridge University Press.
- Psacharopoulos, G., & Patrinos, H. A. (2002). *Returns to investment in education: A further update* (Policy Research Working Paper No. 2881). Washington, DC: World Bank. Retrieved on March 3, 2008, from [http://econ.worldbank.org/files/18081\\_wps2881.pdf](http://econ.worldbank.org/files/18081_wps2881.pdf)
- Raudenbush, S.W., & Kasim, R. M. (2002). *Adult literacy, social inequality, and the information economy: Findings from the National Adult Literacy Survey*. Ottawa, ON: Statistics Canada and Human Resource Development Canada.
- Riley, J.G. (1976). Information, screening and human capital. *American Economic Review*, 66(2), 254-260.
- Rivera-Batiz, F. L. (1992). Quantitative literacy and the likelihood of employment among young adults in the United States. *Journal of Human Resources*, 27, 313-328.
- Romer, P.M. (1986). Increasing returns and long-run growth. *Journal of Political Economy* 94(5), 1002-1037.
- Romer, P.M. (1989). Capital accumulation in the theory of long-run growth. In R. J. Barro (Ed.), *Modern business cycle theory*. Cambridge, MA: Harvard University Press.
- Rudd, R., Kirsh, I., & Yamamoto, K. (2004). *Literacy and health in America* (policy information report). Princeton, NJ: Policy Information Center.
- Schultz, T.W. (1961). Investment in human capital. *American Economic Review*, 51(1), 1-17.
- Schultz, T.W. (1963). *The economic value of education*. New York, NY: Columbia University Press.
- Sen, A. (1980). *Poverty and famine: An essay on entitlement and deprivation*. New York, NY: Clarendon Press.
- Smith, A. (1776). An inquiry into the nature and causes of the wealth of nations. In E. Cannon (Ed.), *Wealth of Nations* (5th ed). London, UK: Methuen & Co., Ltd.
- Solow, R.M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65-94.
- Spence, A.M. (1973). Job market signaling. *Quarterly Journal of Economics*, 87(3), 355-374.
- Summers, R., & Heston, A. (1988). A new set of international comparisons of real product and price levels estimates for 130 countries: 1950-85. *Review of Income and Wealth*, 34, 1-26.
- Topel, R. (1999). Labor markets and economic growth. In O. Ashenfelter & D. Card (Eds.), *Handbook of labor economics* (pp. 2943-2984). Amsterdam: Elsevier Science.

- Tuijnman, A. (2000). *Education, literacy and wages in Poland in comparative perspective Yellow Paper Series*. Stockholm: Institute of International Education.
- Velloso, J. (1995). Income distribution and education. In M. Carnoy (Ed.), *International encyclopedia of economics of education* (2nd ed., pp. 230-234). Oxford, UK: Pergamon Press.
- Weiss, A. (1995). Human capital vs. signalling explanations of wages. *Journal of Economic Perspectives*, 9(4), 133-154.
- Willms, D. (2006) *Learning divides: Ten policy questions about the performance and equity of schools and schooling systems*. Montreal, QC: UNESCO Institute for Statistics.
- Workbase. (2002). *Voices from management*. Auckland, NZ: The New Zealand Centre for Workplace Literacy and Language.